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Index to the Electrical Review,
July 2nd, 1915.

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THE

ELECTRICAL REVIEW.

Vol. LXXVI.

JANUARY 1 — JUNE 25, 1915.

137030
26/10/15

LONDON:
H. ALABASTER, GATEHOUSE & CO.,
4, LUDGATE HILL, E.C.

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v.76

London:
Published by the Proprietors,
at 4, Ludgate Hill, E.C.

INDEX.

List of sub-headings:—AUTHORS, BANKRUPTCY PROCEEDINGS, CITY NOTES, CONTRACTS CLOSED AND OPEN, CORRESPONDENCE, INSTITUTION AND LECTURE NOTES, LEGAL, LIGHTING AND POWER NOTES, LIQUIDATIONS, NEW COMPANIES, NEW ELECTRICAL DEVICES, FITTINGS AND PLANT, OBITUARY, OFFICIAL RETURNS, PARLIAMENTARY, PROCEEDINGS OF SOCIETIES AND INSTITUTIONS, PROSPECTUSES, RAILWAY NOTES, REVIEWS, TELEGRAPH NOTES, TELEPHONE NOTES, TRAMWAY NOTES, WAR ITEMS.

ACCIDENT, 895
Accident, Lift, 836
Accident, Singular electric blasting, 116
Accident, The Cardiff, 502
Accident, The Ilford railway, 439, 461
Accidents, Automatic-lift, by F. Broadbent, 681
Accidents, South African winding, 67
Acetylene corrosion, 794
Advertisement and character, On, 4
Aerial wire ropeway for automatic disposal of ashes, 502
Ahmedabad, India, Electricity supply at, 695
Aircraft appliances, Anti-, 802
Air raids and fire prevention, 765
Air raids, Fires due to, 728
Alien enemies and legal rights, 167
Alien enemies, Patents and, 29, 126, 185, 222, 255, 288, 321, 363, 402, 438, 552, 662, 861
Alien partners, 831
Allgemeine Elektrizitäts Gesellschaft on the war, The, 3
Alternating-current systems, Buffer batteries for, 591
Aluminium industry, The International, 203
Aluminium industry, The Norwegian, 17
Aluminium, Nickel-plating, 712
Aluminium oxide, Hungarian, 362
Aluminium production in France, 394
Aluminium, Soldering, 337, 831, 876
Ambulance for Durban, Carter electric, 799
American Carbon Co., An, 403
American electrical development, 222
American foreign trade, 652
American wiring rules and regulations, English and, 129
American trade development, 388, 498
Anchor Boards for coal pile, 87
Anchor hospital and distress fund, 282
Anglo-Belgian electrical co-operation in Belgium, 784
Antennæ, Single and multiple ground-wire, 773
Appointments vacant, 18, 53, 86, 117, 154, 186, 223, 255, 288, 323, 363, 402, 439, 478, 516, 552, 592, 625, 662, 728, 766, 802, 831, 863, 895
Arbitration in municipal contracts: Architect *v.* Engineer, 750
Argentina, Improved outlook in, 214
Argentina, Trade openings in, 283
Armature winders, Rate of pay for, 185
Army contracts department, 394
Artistic lighting fixtures, 463
Ashes, Aerial wire ropeway for automatic disposal of, 502
Ashton-under-Lyne, Three-phase plant at, 147
Assistants' Association, The Chief Technical, 361, 772
Atmospheric nitrogen, The fixation of, 876
Australia, 111
Australia, An American proposal to, 154
Australia and preference, 764
Australian Association of British Manufacturers, 624
Australian contract, An, 724
Australian exhibition, An, 546
Australian imports, 890
Australian railway scheme, 632
Australian tariffs, 76
Australia, Our trade with, 547
Australia, Rail manufacture in, 72
Australia, Trade statistics of, 29

AUTHORS—
Acfield, W. C., on Main-line signalling on railways, 565, 599
Ackermann, A. S. E., on Utilisation of solar energy, 675
Ayton, F., on The use of electric vehicles in municipal services, 904
Baker, C. A., on Load factor output and cost, 775, 808, 841
Ball, A. E., on Wireless control of public clocks, 539, 624, 712
Beaver, C. J., on Cables, 230
Begg, R. S., Prof. M. Maclean and D. J. Mackellar, on Distribution and rise of temperature in field coils, 279
Bennett, E. P., on Publicity—The soul of business, 674
Blackman, A. S., and T. Roles, on The practical result of the Point Five tariff, 853, 903
Boothman, L., on Potentiometer rheostats, and rheostats with protective resistance, 427; on The rheostatic control of separately excited generators, 673

AUTHORS—*continued.*
Boulding, R. S. H., and Dr. S. P. Smith on The shape of the pressure wave in electrical machinery, 195
Broadbent, F., on Battery-charging for electric vehicles, 467; on The National electrical code and British wiring rules compared, 121, 134; on The National electrical code revised, 643
Carter, T., on Some notes on shunt regulating resistances, 716, 752, 800
"Commercial," on Workers' earnings and the war, 306; on The fight in the factory, 609
Cooper, W. R., on Electric cooking, 417, 528, 567
Crowley, J. F., on Electrical driving in the woollen trade, 6
Denny, C. W., on Searchlight projectors, 348, 413
Dickinson, A., on Bombay hydro-electric scheme, 657, 707, 780
Digby, W. P., on Scientific and technical commissioners, 819
Dykes, A. H., on Private generating plant, 531
Farr, A. V., on The lubrication of ball bearings, 638
Fleming, A. P. M., on Training for the industrial side of engineering, 337
Foley, L. B., on Train dispatching by wireless, 602
Foster, L., on Breakdowns in colliery electrical plant, 198
Gumaer, P. W., on Economic operation of electric ovens, 871
Hollis, E. P., on The case for the electrification of flour mills, 123; The case for the electrification of Portland cement works, 537; The case for the electrification of engineering works, 579
"Interested," on Log books and sheets for electricity works, 263
Jeffrey, C. S., on Temperature measurement in a modern power house, 523
Mackinney, V. H., on Good lighting and its effects, 610
Maclean, Prof. M., D. J. Mackellar, and R. S. Begg, on Distribution and rise of temperature in field coils. 279
Marchant, Prof. E. W., on Conditions affecting the variations in strength of wireless signals, 267, 276; on Measurement of wireless signals, 637
Maycock, W. P., on Some peculiar views on electric light switching, 711
Meares, J. W., on Hand regulation of a hydro-electric plant in India, 275
"M., L. A. de," on The electrical trade of Siam, 241
Munro, D. S., on Modern methods of electrical wiring, 266
Nicholson, J. S., on The magnetisation of iron, 109
Powell, S. M., on Rational rating for filament lamps, 631
Preece, W. L., on Telephone troubles in the tropics, 508, 561,
Raven, V. L., on Cab signals on British railways, 125
"Research," on Half-watt lamp fittings, 206
Rider, J. H., on The power supply of the Central Mining-Rand Mines group, 585, 633, 670, 705, 745, 779
Robertson, T. D., on Electric steel-making furnaces, 233
Roles, T., and A. S. Blackman on The practical result of the Point Five tariff, 853, 903
Rymer-Jones, J., on Improved method of making joints in gutta-percha-covered core, 312
Selvey, W. M., on Power plant testing, 669
Shuttleworth, N., on Polyphase commutator machines and their application, 244, 302
Smith, Dr. S. P., and R. S. H. Boulding, on The shape of the pressure wave in electrical machinery, 195
Sparks, C. P., on Electricity applied to mining, 340, 375, 419, 454, 491
Speyer, H. R., on Electric power in India, 774, 807
Stainer, W. A., on Cab signals on British railways, 161

AUTHORS—*continued.*
Stigant, S. A., and J. L. Thompson, on High-voltage dangers present in static transformers due to electrostatic capacity of the windings, 25, 36
Surveyor, A., on Utilisation of water-power, 493
Taylor, F. H., on The electrical equipment of a country house, 339
"Teacher, A," on Technical teaching as a profession, 68
Thompson, J. L., and S. A. Stigant, on High-voltage dangers present in static transformers due to electrostatic capacity of the windings, 25, 36
Tofield, H. C., on Modern wiring work, particularly in bad situations, 168, 204, 264
Turner, L.B., on Wireless call devices, 817
Watts, T. G., on Electric bell signalling in collieries, 30
Weaving, R., on Electric heating and cooking, 280
Webb, C. J., on Will the ignition magneto be superseded? 311
Wedmore, E. B., on Automatic protective switchgear for alternating-current systems, 37, 92, 456
Willcox, F. W., on The practical rating of electric incandescent lamps, 457
Willox, W., on Cab signals on British railways, 161
Wood, N. H., on Main-motor-starting switchgear used on modern German submarines, 763

Automatic protective switchgear for alternating-current systems, by E. B. Wedmore, 37, 92, 456

BADGES, War Office contracts and workers', 591
Bagdad, 75, 177
Bakery, A Canadian electric, 553
Ball bearings, The lubrication of, by A. V. Farr, 638

BANKRUPTCY PROCEEDINGS—
Behrens, F. J., 112
Broadbent, D. R., 855
Brookes, S., 75
Burgess, G., 316, 652
Clark, J. P. K., 433, 617
Curzon, S. A., 393
Drivers & Son, G., 355, 472
Duesbury, T., 825
Garsden, J. W., 112
Godfrey, H. J., 511, 759
Hilton, J. G. M., 178, 393
Hipkins, G. E., 75, 724
Jarvis, J. W., 724
Moore, T., 724
Oxley, H. H., 178,
Parfitt, G. J. T., 282, 316, 393, 511, 581, 724
Pease, W. H., 178
Swanison, J., 112
Tattersall, J. W., & T. W., 215, 249, 393, 581, 688, 825
Walker, Wm., 14, 144, 581
Wedge, W. R., 144
Whiteley, A., 112, 144, 215, 355, 546, 856
Woodcock, T. M., 178
Wood, W. H., 46
Wray, C., 581, 789

Barges, Electrically-driven, 501
Barges, Oil-electric, 712
Barton power scheme of the Manchester Corporation, The, 59
Batteries for alternating-current systems, Buffer, 591
Batteries for submarines, 650
Battery amalgamation, A, 855
Battery-bell signalling systems in mines, 816, 848, 881
Battery-charging for electric vehicles, by F. Broadbent, 467
Battery manufacture in Spain, 789
Battery trucks, Elwell-Parker, 500, 568
Beck searchlight projector, The, 571
Belgium, Anglo-Belgian electrical co-operation in, 784
Belgium, The electrical future of, 781
Bell signalling in collieries, Electric, by T. G. Watts, 30
Benevolent fund: An appeal, The I.E.E., 516, 552
Benevolent fund, The electrical trades, 571, 577
Benzol, Edison and, 362, 554
Berlin electrical engineers, Relief measures taken by, 87
Berlin electricity works, Municipalisation of the, 404
Birmingham post office, New electric clock at, 362
Birthday honours, The King's, 802
Blackpool traders' exhibition, 52
Blades clean, Keeping turbine, 176
Blasting accident, Singular electric, 116
Board of Trade assistance, 403
Board of Trade returns, Changes in the, 288
Boilers, The prevention of electrolysis in, 633
Bombay hydro-electric scheme, The, by A. Dickinson, 657, 707, 780
Bordeaux, Three-phase electric cranes at the Port of, 717
Bradford Kursaal, Electric cooking at the, 403
Brazil, 789
Brazil, Electrical supply trade in, 637
Breakdown and legal liability, A, 5
Breakdowns, Diesel engine, 456
Breakdowns in colliery electrical plant, by L. Foster, 198
Bridge, An electrically-controlled canal, 349
Bridge over the Blue Nile, An electrical, 552
British Association meeting at Manchester, The, 389, 698, 728
British Electrical and Allied Manufacturers' Association, 618
British Electrical and Allied Manufacturers' Association standardisation rules for electrical machinery, 742
British electrical firms, Manufacturing ability of, 66
British goods abroad, The marketing of, 534
British Industries Fair, 678, 697, 728
British wiring rules compared, The National electric code and, by F. Broadbent, 121, 134
Bruce Peebles and Co., Ltd., The works of Messrs., 697
Budget speech, The, 662
Buenos Ayres, Trade openings in, 76
Buffer batteries for alternating-current systems, 591
Building strike, An echo of the, 515
Bullets, A new radioscopic process for localising, 669
Bulloch, The late Mr. W., 243
Business as usual, War, 65

CABLE manufacturing, German, 144
Cables, by C. J. Beaver, 230
Cables, Loaded submarine, 185
Cable telegrams, Censorship of, 67
Cab-signalling at the "Mechanicals," 97
Cab-signalling needed, 801
Cab signals on British railways, by V. L. Raven, 125; by W. A. Stainer, 161; by W. Willox, 161
"California," The electrically-propelled super-dreadnought, 87
Callender's Hospital Fund, 249
Canada, 76, 207, 392
Canada and the exportation of electrical energy, 253
Canada, Notes from, 541, 675, 755
Canada, Swedish electrical exports to, 646
Canada, The position of engineering trade in, 215
Canada, Trade statistics of, 229
Canada, Trade with, 356
Canadian electric bakery, A, 553
Canal bridge, An electrically-controlled, 349
Canal locks, Electric towing system for the Panama, 464
Carbon Co., An American, 403
Cardiff accident, The, 502
Carlisle, Electricity extensions at, 542
Carriage problem, British manufacturers and the, 845
Carter electric ambulances for Durban, 799
Cement works for Queensland, Portland, 790
Cement works, The case for the electrification of Portland, by E. P. Hollis, 537
Censorship of cable telegrams, 67
Central Mining-Rand Mines Group, The power supply of the, by J. H. Rider, 585, 633, 670, 705, 745, 779

Central station men and recruiting, 624
Charges of Civil Engineers, Professional, 553
Charging stations, Electric vehicle, 363
Chicago, Milwaukee, and St. Paul railway, 3,000-volt D.C., Electrification of the Puget Sound lines of the, 231
Chief Technical Assistants' Association, The, 361, 772
Chile, 687
China, 12, 281, 392, 687, 723
China, British engineering in, 433
Cinematograph Exhibitors' Association, 841

CITY NOTES—
- Aberdeen Suburban Tramways Co., 299, 330
- Adelaide Electric Supply Co., 22
- Alderley and Wilmslow Electric Supply Co., 630, 667
- Alley and MacLellan, 365
- Altrincham Electric Supply Co., 365, 442, 480
- Aluminium Corporation, 866, 898
- Amalgamated Wireless (Australasia), 700
- American Telephone and Telegraph Co., 480
- American Westinghouse Co., 834
- Anchor Cable Co., 700
- Anderston Foundry Co., 768
- Anglo-American Telegraph Co., 119, 595, 667, 734
- Anglo-Argentine Tramways Co., 737, 769, 803
- Anglo-Portuguese Telephone Co., 593, 625
- Arbroath Electric Light and Power Co., 442
- Aron Electricity Meter, 739
- Auckland Electric Tramways Co., 667
- Automatic Telephone Manufacturing Co., 365, 406, 483, 867
- Babcock and Wilcox, 593
- Banbury and District Electric Supply Co., 805
- Barcelona Traction, Light and Power Co., 189, 702, 835
- Barnsley and District Electric Traction Co., 700
- Barton Electric Light Supply Co., 442
- Bastian Meter Co., 261
- Bath Electric Tramways, 405, 447
- Beardmore & Co., Wm., 480
- Berlin Elevated and Underground Railway Co., 629
- Berlin Grand Tramways Co., 371
- Birmingham District Power & Traction Co., 898
- Blackpool and Fleetwood Tramroad Co., 155, 299
- Bournemouth and Poole Electricity Supply Co., 299, 366, 448
- Braunton Electric Light and Power Co., 408
- Brazilian Traction, Light and Power Co., 119, 330, 557, 805
- Brisbane City Electric Co., 626
- Brisbane Electric Tramways Investment Co., 739, 771
- Bristol Tramways and Carriage Co., 258
- British Aluminium Co., 449, 484
- British Columbia Electric Railway Co., 119
- British Electric Traction Co., 866
- British Electric Transformer Co., 405, 444
- British Engine, Boiler and Electrical Insurance Co., 370
- British Insulated and Helsby Cables, 334, 406, 482
- British L. M. Ericsson Manufacturing Co., 334, 365, 446
- British Thomson-Houston Co., 664, 700
- British Westinghouse Electric and Manufacturing Co., 365, 449, 518
- Bromley (Kent) Electric Light & Power Co., 521
- Brompton and Kensington Electricity Supply Co., 365, 409, 447
- Bruce Peebles & Co., 261, 334
- Brush Electrical Engineering Co., 444, 518
- Buenos Aires Electricity Co., 261
- Buenos Aires Port and City Tramways, 189, 667
- Calcutta Electric Supply Corporation, 55, 261, 365, 663, 667, 738, 900
- Calcutta Tramways Co., 595, 628
- Callender's Cable and Construction Co., 700, 767
- Cambridge Electric Supply Co., 258
- Canadian General Electric Co., 365, 557, 805
- Cape Electric Tramways, 19
- Carmarthen Electric Supply Co., 442
- Castner-Kellner Alkali Co., 739
- Central Electric Supply Co., 225
- Central London Railway Co., 225, 256, 295
- Charing Cross, West End and City Electricity Supply Co., 296, 369
- Chatham and District Light Railways Co., 188
- Chelsea Electricity Supply Co., 299, 365, 410
- Chiswick Electricity Supply Corp., 667
- Chloride Electrical Storage Co., 667
- City and South London Railway Co., 225, 256
- City of Buenos Ayres Tramways Co. (1904), 225, 257, 626
- City of Carlisle Electric Tramways Co., 330
- City of London Electric Lighting Co., 55, 335, 366, 445
- Clevedon, Portishead and District Electric Supply Co., 594

CITY NOTES—*continued.*
- Cleveland and Durham Electric Power, 480, 520
- Clyde Valley Electrical Power Co., 480, 517
- Colombo Electric Trams and Lighting Co., 626
- Compagnie Générale d'Electricité, 299
- Compania de Electricidad de la Province de Buenos Aires, 297
- Companies Struck off the Register, 89, 225, 299, 480, 768
- Company Registration in 1914, 155
- Cork Electric Tramways and Lighting Co., 517
- Costa Rica Electric Light and Traction Co., 18, 667
- County of Durham Electrical Power Distribution Co., 296
- County of London Electric Supply Co., 299, 366, 407
- Craigpark Electric Cable Co., 667, 739
- Credenda Conduits, 899
- Crossley Brothers, 261
- Cuban Telephone Co., 768
- Cuba Submarine Telegraph Co., 629, 663
- Davis and Timmins, 335, 406
- Delabole Electric Lighting and Supply Co., 55, 187
- Delhi Electric Tramways and Lighting Co., 739, 769
- Derby Lamp Works, 411
- Devonport and District Tramways Co., 834
- Direct Spanish Telegraph Co., 365, 407, 446
- Direct United States Cable Co., 89, 557, 595, 627
- Doulton & Co., 768
- Dublin and Lucan Electric Railway Co., 406
- Dublin United Tramways Co., 119, 189, 225
- Dudley, Stourbridge and District Electric Traction Co., 626, 664
- Eastern Extension, Australasia and China Telegraph Co., 626, 667, 701, 899
- Eastern Telegraph Co., 626, 664, 738, 899
- East London Railway Co., 155
- Edison Accumulators, 371, 409
- Electrical and Industrial Investment Co., 189, 257, 409
- Electrical Distribution of Yorkshire, 259
- Electrical Power Storage Co., 834
- Electric and General Investment Co., 89
- Electric Construction Co., 736, 804
- Evered & Co., 593
- Fife Tramway, Light and Power Co., 299, 331
- Folkestone Electricity Supply Co., 406, 450
- France, 335
- French Investment Co., A, 483
- Gateshead and District Tramways Co., 480
- Gell Telegraphic Appliances Syndicate, 703
- General Electric Co., U.S.A., 703
- German Electrical Companies, 188, 556, 737, 865
- German-Netherlands Telegraph Co., 865
- German South American Telegraph Co., 833
- Globe Telegraph and Trust Co., 365, 864, 897
- Glover & Co., W. T., 299, 367, 700
- Gravesend and Northfleet Electric Tramways, 833
- Great Northern Telegraph Co., Ltd., of Denmark, 556, 726
- Greenwood & Batley, 899
- Guildford Electricity Supply Co., 482, 556
- Hadfields, 365
- Hastings and District Electric Tramways Co., 364
- Havana Electric Railway, Light and Power Co., 768
- Hawkes, O. C., 626
- Henley's Telegraph Works Co., W. T., 335, 406, 443
- Hong-Kong Tramway Co., 806
- Howard & Bullough, 480
- Huelva Gas and Electricity Co., 486
- Hydro-Electric Power and Metallurgical Co., 365
- Imperial Tramways Co., 897
- Indian Electric Supply and Traction Co., 556, 626
- India-Rubber, Gutta-Percha and Telegraph Works Co., 20, 867
- Indo-European Telegraph Co., 557, 628, 665
- International Light and Power Co., 19, 365, 834
- Italian Electrical Companies, 865
- Italian Supply Companies, 483
- Jackson & Co., P. R., 486
- Jarrow and District Electric Traction Co., 299, 335
- Johnson & Phillips, 593, 665
- Kalgoorlie Electric Power and Lighting Corporation, 557, 734, 768
- Kaministiquia Power Co., 89, 595
- Keith & Blackman, J., 867
- Kensington and Knightsbridge Electric Lighting Co., 261, 294, 368
- Kidderminster and District Electric Lighting and Traction Co., 630, 666
- Lanarkshire Tramway Co., 224
- Lancashire Dynamo and Motor Co., 486
- Lancashire Power Construction Co., 804

CITY NOTES—*continued.*
- Lancashire United Tramways, 324
- La Plata Electric Tramways Co., 627
- Launceston and District Electric Supply Co., 521
- Lewes and District Electric Supply Co., 704
- Lima Light, Power and Tramways Co., 768
- Lisbon Electric Tramways, 667, 735
- Listowel (County Kerry) Electric Light Co., 299, 449
- Liverpool District Lighting Co., 406, 442, 480
- Liverpool Overhead Railway Co., 156, 258, 332
- Llandudno and Colwyn Bay Electric Railway, 89, 188
- Llanelly and District Electric Lighting and Traction Co., 335
- London and Suburban Traction Co., 442, 479
- London Electric Railway Co., 225, 256, 296
- London Electric Supply Corporation, 225, 257, 332
- London Electric Wire Co. and Smiths, 299
- London United Tramways, 441, 481
- Lymington Electric Light and Power Co., 517
- Mackay Companies, The, 364, 805
- Madras Electric Tramways (1904), 406, 483
- Manila Electric Railroad and Lighting Corporation, 330, 834, 898
- Mansfield and District Tramways, 330
- Manx Electric Railway Co., 23
- Marconi's Wireless Telegraph Co., 485
- Mather & Platt, 261, 331
- Melbourne Electric Supply Co., 21, 740
- Mersey Railway Co., 257, 297
- Metalite, 23
- Metropolitan District Railway Co., 225, 257, 295
- Metropolitan Electric Supply Co., 330, 371, 408
- Metropolitan Electric Tramways, 442, 481
- Metropolitan Railway Co., 261, 295, 370
- Mexborough and Rawmarsh Construction Syndicate, 626
- Mexican Electric Light and Tramway Companies, 55
- Mexican Northern Power Co., 406, 739
- Mexican Tramways Co., 299, 767
- Middleton Electric Traction Co., 834
- Midland Electric Corporation for Power Distribution, 486
- Minehead Electric Supply Co., 442, 557
- Mirrlees, Bickerton & Day, 739
- Mirrlees, Watson & Co., 299
- Monte-Video Telephone Co., 557
- Montreal Light, Heat and Power Co., 119, 189, 595, 867
- Musselburgh and District Electric Light and Traction Co., 594
- Nairobi Electric Power and Lighting Co., 55, 626, 834
- National Electric Supply Co., 258, 867
- National Gas Engine Co., 225
- Neuhausen Aluminium Industry Co., 261, 365
- New British Ever-Ready Co., 739, 867
- Newcastle and District Electric Lighting Co., 298, 365
- Newcastle-on-Tyne Electric Supply Co., 261, 366, 445
- New General Traction Co., 835
- New Issue, 557
- Newmarket Electric Light Co., 364, 480
- New York Telephone Co., 335
- Northampton Electric Light and Power Co., 258, 331
- North Metropolitan Electric Power Supply Co., 479
- North of Scotland Electric Light and Power Co., 630
- Norway, 155
- Notting Hill Electric Lighting Co., 259, 298
- Official Notices re Companies, 225, 557
- Oldham, Ashton and Hyde Electric Tramway, 406
- Ontario Power Co. (of Niagara Falls), 406
- Oriental Telephone & Electric Co., 517, 594, 666
- Ottawa Electric Railway Co., 261
- Oxford Electric Co., 261, 299, 410
- Paignton Electric Light Co., 557
- Paisley District Tramways Co., 259
- Para Electric Railways and Lighting Co., 300, 367
- Paris Compressed Air Co., 119
- Parsons' Marine Steam Turbine Co., 225
- Penarth Electric Lighting Co., 700
- Peterborough Electric Traction Co., 700
- Petters, 805
- Potteries Electric Traction Co., 594, 595, 628
- Provincial Cinematograph Theatres, 557
- Puebla Tramway, Light & Power Co., 899
- Ramsgate and District Electric Supply Co., 365
- Rand Mines Power Supply Co., 897
- Rangoon Electric Tramway & Supply Co., 865
- Reduction of Capital, 89, 334, 441, 667

CITY NOTES—*continued.*
- Rees Roturbo Manufacturing Co., 836
- Rhondda Tramways Co., 701
- Richardsons, Westgarth & Co., 595
- Rio de Janeiro Tramway, Light and Power Co., 89
- River Plate Electricity Co., 739, 770
- Robey & Co., 441
- Rushden and District Electric Supply Co., 261, 331
- Russian A.E.G., 900
- Ruston, Proctor & Co., 805
- St. James' and Pall Mall Electric Light Co., 156, 224, 260
- Salisbury Electric Light and Supply Co., 409
- Sao Paulo Tramway, Light and Power Co., 89, 556
- Scarborough Electric Supply Co., 299, 366
- Shanghai Electric Construction Co., 734
- Shawinigan Water and Power Co., 406, 700, 867
- Shropshire, Worcester and Staffordshire Electric Power Co., 597, 805, 833
- Siemens-Schuckert Group of Companies, 54
- Slough and Datchet Electric Supply Co., 442
- Smithfield Markets Electric Supply Co., 189, 225, 258
- South London Electric Supply Corporation, 189, 406, 409, 482
- South Metropolitan Electric Light and Power Co., 261, 296, 329
- South Metropolitan Electric Tramways and Lighting Co., 441, 481
- Southport Tramways Co., 626
- South Staffordshire Tramways Co., 330
- South Wales Electrical Power Distribution Co., 667
- Spencer & Sons, J., 330
- Stewarts & Lloyds, 365
- Stock Exchange Notices, 89, 155, 225, 299, 334, 441, 480, 522, 703, 805, 834, 899
- Swiss Electrical Companies, 556 767
- Swiss investment undertaking, A, 865
- Swiss issue, A, 898
- Swiss Oerlikon Machinery Co., 19
- Submarine Cables Trust, 667
- Sunderland District Electric Tramways, 297
- Stratford-on-Avon Electricity Co., 664, 768
- Sydney Electric Light & Power Supply Corporation, 89
- Tata Hydro-Electric Supply Co., 55, 89
- Telegraph Construction & Maintenance Co., 261, 335, 368
- Telephone Co. of Egypt, 521
- Torquay Tramways Co., 262
- Traction & Power Securities Co., 156
- Tramways & General Works Co., 667
- Tramways, Light & Power Co., 299, 333
- Tyneside Tramways & Tramroads Co., 225, 257
- Underground Electric Railways Co. of London, 225, 295, 369
- United Electric Tramways of Montevideo, 833, 866
- United River Plate Telephone Co., 739, 768, 804
- Urban Electric Supply Co., 443, 520
- Veritys, 768
- Vickers, 480, 557
- Victoria Falls and Transvaal Power Co., 24, 89, 868
- Vulcan Boiler & General Insurance Co., 299, 867
- Waste Heat and Gas Electrical Generating Stations, 335, 367, 410
- Waygood-Otis, 24
- Wedmore Electric Light Co., 406
- Wellingborough Electric Supply Co., 704
- Wemyss & District Tramway Co., 406, 441
- West African Telegraph Co., 664, 736
- West Coast of America Telegraph Co., 701
- Western Telegraph Co., 334, 836
- Western Union Telegraph Co., 557
- West India & Panama Telegraph Co., 626, 735
- Westinghouse Brake Co., 89
- West London & Provincial Electric Supply Co., 769
- Westminster Electric Supply Corporation, 156, 258, 333
- Weston-super-Mare & District Electric Supply Co., 665
- White, J. G., & Co., 897
- Willans & Robinson, 626, 740, 770
- Windermere & District Electric Supply Co., 445
- Windsor Electrical Installation Co., 442, 594
- Winnipeg Electric Railway Co., 24, 441, 486, 556, 899
- Woking Electric Supply Co., 521
- Wolverhampton District Electric Tramways Co., 626, 664
- Worcester Electric Traction Co., 805
- Wycombe (Borough) Electric Light and Power Co., 406
- Yorkshire (West Riding) Electric Tramways Co., 119, 187, 189, 224, 406, 834
- Yorkshire (Woollen District) Tramways, 667, 704

Civil engineers, Professional charges of, 553
Clock at Birmingham post office, New electric, 362

Clocks, Wireless control of public, by A. E. Ball, 539, 624, 712
Clocks, Electric, 855
Club for London, A business, 591
Coach fitted with the Thomas transmission, A locomotive, 882
Coal pile, Anchor boards for, 87
Coal position on the business of electricity supply, The effect of the present, 414
Coal storage, Notes on, 398
Coal Supplies Conference, 592, 710, 765, 862, 894
Coal supplies, Electricity committee and, 154, 185
Code revised, The National Electrical, by F. Broadbent, 643
Collieries, Electric bell signalling in, by T. G. Watts, 30
Colliery electrical plant, Breakdowns in, by L. Foster, 198
Colonial trade, 31
Commissioners, Scientific and technical, by W. P Digby, 819
Commissions, 527
Committee-men and their relatives, Electricity, 662
Commutator machines and their application, Polyphase, by N. Shuttleworth, 244, 302
Composition, 473
Concentric wiring question in the U.S.A., The, 553
Concrete, Reinforced, 81
Conductors, Insulated zinc, 831
Conduit tramway effect, A, 185
Congress, 1915, International Engineering, 17
Consular notes, 12, 45, 75, 177, 213, 281, 392, 616, 687, 723, 789, 824
Consumer's point of view, Electric cooking: From "A," 387
Contraband problem, Copper wire manufacturers and the, 815

CONTRACTS CLOSED—
Aberdare, 436
Aberdeen, 589
Aldershot, 691
Argentina, 220
Atherton, 16
Australia, 85, 286, 360, 436, 475, 514, 550, 726, 762, 829, 859, 893
Aylesbury, 893
Ayr, 115, 397
Bacup, 85, 360
Barking, 16
Barnes, 252
Barnet, 859
Barnsley, 437, 859
Barrow, 320
Basingstoke, 550
Batley, 220, 514
Battersea, 86, 153, 287, 623, 692
Belfast, 16, 550, 589
Bermondsey, 321, 398, 437, 589, 656, 727, 859
Bethnal Green, 51, 320, 551
Bexhill-on-Sea, 762
Bingley (Yorks), 320
Birmingham, 320
Blackburn, 397, 437
Blackpool, 320
Bolton, 16, 182, 252, 320, 475, 550
Bradford, 85, 220, 550, 691, 762, 829
Bradwell, 50
Bridlington, 360, 793
Brighton, 475, 656
Bristol, 85, 252, 589
Burnley, 691
Burton-on-Trent, 360, 514
Bury (Lancs.), 360
Buxton, 793
Caledonian Railway, 829
Camberwell, 253
Canada, 16
Canterbury, 85, 475, 550
Cardiff, 320
Carlisle, 859
Chelmsford, 829
Chesterfield, 859
Clacton, 86, 550
Clyde Navigation, 220
Colchester, 360, 397, 589
Condensing plant contracts, 656
Connah's Quay, 252
Coventry, 152, 437
Crewe, 829
Croydon, 320, 475, 514, 550, 622, 859
Darlington, 360, 859
Dartford, 86, 360, 550, 829
Darwen, 829
Delagoa Bay, 182
Derby, 50, 656, 793
Dover, 762
Dublin, 793
Dudley, 515
Dundalk, 51
Dundee, 691
Dartford, 220
Dewsbury, 320, 550
Dorchester, 220
Dover, 220, 320
East Ham, 16, 437, 622, 726
Eccles, 51
Ecuador, 220
Edinburgh, 589, 726
Elland, 360
Finchley, 320
Fulham, 16, 220, 437
Gillingham (Kent), 86, 515
Glasgow, 51, 115, 182, 253, 320, 397, 515, 550, 622, 692, 762, 893
Gloucester, 360
Gosport, 859
Government contracts, 115, 286, 437, 584, 762, 893
Gravesend, 859
Grimsby, 51, 515, 656
Hackney, 153, 287, 360, 762

CONTRACTS CLOSED—*continued.*
Halifax, 252, 515, 589, 656
Hammersmith, 86, 183, 287, 397, 551, 656, 793, 859
Hampton, 589
Haslingden, 152, 793
Heckmondwike, 152, 859
Helsby, 152, 437
Hendon, 656, 726
Heywood, 115, 253
Holmfirth, 253, 691
Hong-Kong, 287, 691
Hornsey, 115
Horsham, 320
Hove, 550
Huddersfield, 182, 437, 515, 622
Hull, 182, 551, 829
Ilford, 253, 320, 475, 515, 589, 727
Ipswich, 253, 727
Islington, 115
Keighley, 220, 253
Kensington, 398
Kettering, 287
Kingston-on-Thames, 762
Leicester, 152
Leigh, 829
Leith, 692
Leyton, 182, 320, 515, 793
Lichfield, 589
Liverpool, 51, 182, 360, 515, 656
Llandudno, 287, 360
London, 16, 51, 86, 115, 152, 183, 220, 253, 287, 320, 360, 397, 437, 475, 515, 551, 589, 622, 656, 692, 727, 762, 859, 894
London County Council, 152, 183, 320, 437, 475, 622, 656, 692, 727
Lowestoft, 398, 859
Luton, 321
Maidenhead, 551, 692
Maidstone, 321, 727
Malvern, 727
Manchester, 51, 183, 321, 437, 475, 515, 551, 656, 793, 859
Melbourne, 85
Meter contracts, 361, 515, 551, 589, 623, 656, 692, 727, 793, 829, 859
Middlesbrough, 398
Middleton, 220
Morley, 86
Neath, 183
Newport (Mon.), 116, 253, 437, 692
New Zealand, 50, 361, 793
North Bierley, 321
North Ormesby, 692
Nuneaton, 86, 515, 656
Paddington, 692
Pontypridd, 727
Poplar, 623
Preston, 16, 656
Queensland, 550
Rawtenstall, 287, 437
Reading, 153
Richmond-on-Thames, 515
Rochdale, 692
Romford, 183, 220
Rotherham, 551
St. Albans, 398
St. Marylebone, 320, 398
St. Pancras, 320, 437
Salford, 86, 220, 321, 515, 551, 692, 793, 859, 894
Scotland, 287
Sevenoaks, 398
Sheffield, 86, 220, 361, 551, 829
Ship lighting, 86, 183, 220, 287
Shoreditch, 183, 656
South Africa, 398, 793
Southampton, 116, 183, 361, 398, 589, 656
Southend-on-Sea, 287, 727, 859
Southport, 220
Southwark, 153, 692
Spain, 762
Stafford, 16
Stalybridge, 183
Stepney, 51, 115, 183, 220, 321, 475, 623, 762, 894
Stockport, 86, 692, 829
Stretford, 86, 361, 692
Sunderland, 116, 437, 551, 589, 829
Swansea, 253, 859
Sydney, 550, 859
Tasmania, 762
Teddington, 153
Thames Ditton, 589
Thanet, 623
Tonbridge, 692
Torquay, 86, 220, 361
Tottenham, 727
Tunbridge Wells, 220, 361, 551, 692
Wakefield, 398
Walsall, 220, 361
Walthamstow, 153, 287, 437, 515, 623
Walton-on-Thames, 515
Warrington, 220
Watford, 116, 220, 361, 515, 894
West Bromwich, 51, 253
West Ham, 153, 437, 692, 894
Weymouth, 86
Whangarei, 793
Wigan, 220
Willesden, 287
Wimbledon, 551
Winchester, 692
Windsor, 361, 589
Wolverhampton, 220, 321, 361, 551, 859
Woolwich, 51, 360, 475
Wrexham, 153
York, 153, 183

CONTRACTS OPEN—
Aberdare, 181, 219, 252, 286, 319, 397, 436, 475
Aberdeen, 793
Aberdeenshire, 359
Adelaide, 16, 50, 84, 114, 726, 761, 793, 828, 858, 893
Aldershot, 16, 436, 475, 514, 549, 584, 621
Argentina, 655

CONTRACTS OPEN—*continued.*
Australia, 16, 50, 84, 114, 151, 181, 219, 252, 286, 319, 359, 397, 436, 475, 514, 549, 584, 621, 655, 691, 726, 761, 793, 828, 858, 893
Aylesbury, 114, 151, 182
Ayr, 397
Basingstoke, 514, 550, 858, 893
Batley, 475, 828, 893
Battersea, 85, 219, 252, 286
Beckenham, 50, 85, 114
Bedwas, 182, 219, 252, 286
Belfast, 182, 252, 286, 319, 359, 828
Bermondsey, 115, 152, 182
Bethal (Transvaal), 286, 320, 360
Birkenhead, 16, 50, 182, 286, 319, 793
Blackburn, 152, 182, 219, 252
Blackpool 182
Bolton, 50, 85, 114, 152, 182, 252, 286, 858
Bootle, 219
Bow, 286
Bradford, 252, 514, 550
Bray, 397, 436, 475
Bridgend, 397, 436, 475
Bridlington, 219, 793
Brighton, 436, 475, 514, 858
Brisbane, 50, 84, 114, 151, 181, 219, 252 286, 319
Bristol, 152, 182, 475, 514
Burnley, 319, 360, 397
Bury, 85, 114, 286, 319
Bury St. Edmunds, 726
Canary Islands, 50
Cardiff, 114, 152, 182, 219, 252
Carlisle, 360, 397, 436
Cheltenham, 85, 114
Chesterfield, 726
China, 16, 50, 655, 691
Christchurch (N.Z.), 761
Cleckheaton, 793
Colchester, 114, 152, 182, 828
Croydon, 16, 50, 85, 114
Darlington, 85, 114, 152, 360, 514, 550, 655, 691
Doncaster, 893
Dover, 152, 286, 319, 655, 691
Dublin, 16, 50, 219, 359, 691, 726, 761, 858
Dundalk, 319, 360, 397
Dundee, 114, 152, 286, 397, 436, 514, 550, 584, 726, 761
Ealing, 828
Eastbourne, 828, 858, 893
Eccles, 761, 793
Edinburgh, 16, 219, 286, 397, 436, 514, 726, 761, 793, 828, 858, 893
Edmonton, 286, 319, 761
Erith, 858, 893
Exeter, 828
Exminster, 858, 893
Finchley, 655, 691, 726, 761
Finsbury, 286
France, 286, 550, 655, 691, 893
Fulham, 219, 252, 829, 858, 893
Glasgow, 16, 182, 397, 436, 514, 550, 793, 828, 858
Gloucester, 182, 219, 252, 286
Grangemouth, 726
Grays, 793
Greece, 397
Grimsby, 286, 319
Guildford, 252, 286
Halifax, 114, 152, 182, 219, 360, 397, 621, 858, 893
Hammersmith, 219, 252
Harrogate, 436
Helsby, 152
Hemel Hempstead, 16
Hendon, 584
Heston and Isleworth, 286, 319
Hobart, 761, 793, 829
Hong-Kong, 16, 50, 114, 152
Hornsey, 252, 286, 320, 360
Hounslow, 360
Hove, 319, 360, 397
Huddersfield, 252, 286
Hull, 252, 286, 360, 397, 550
Ilford, 182, 219, 252, 320
India, 893
Ipswich, 85
Islington, 182, 219, 252
Italy, 320, 550
Johannesburg, 584, 621, 655
Kirkcaldy, 320, 360, 397, 761, 793, 828
Lancaster, 828
Larne, 85, 114
Launceston, 584, 622, 656, 691, 726, 761, 793, 829, 893
Leeds, 16, 50, 85, 114, 152, 182, 219, 252, 655, 691, 726
Leigh (Lancs.), 621, 655, 691
Leyton, 16, 50
Limerick, 397, 893
Lincoln, 550
Liverpool, 50, 320, 360, 893
Llandudno, 182
London, 16, 50, 85, 115, 152, 182, 219, 252, 286, 320, 360, 397, 436, 475, 514, 584, 621, 655, 726, 761, 793, 829, 858, 893
London County Council, 16, 50, 85, 115, 152, 182, 286, 320, 360, 436, 726, 761, 793
Londonderry, 320, 360
Macclesfield, 219, 252, 286, 320
Maidenhead, 829
Manchester, 16, 50, 85, 152, 182, 220, 252, 286, 320, 397, 436, 475, 514, 550, 655, 691, 726, 761, 793, 829, 893
Melbourne, 84, 181, 219, 252, 286, 359, 436, 475, 514, 549, 584, 621, 655, 691, 726, 761, 793, 828, 858, 893
Metropolitan Asylums Board, 829, 858, 893
Middlesbrough, 726
Middleton, 115
Mountain Ash, 514, 550, 584
Naples, 550
Newcastle-under-Lyme, 115, 152, 182

CONTRACTS OPEN—*continued.*
Newport (Mon.), 252, 286, 320
New Zealand, 50, 85, 115, 220, 252, 286, 360, 397, 436, 584, 761
North Bierley, 220
Norwich, 655
Nottingham, 397, 858
Office of Works, H.M., 182
Oldham, 85, 252
Perth (Aust.), 50, 84, 114, 761, 793, 893
Plymouth, 50, 85, 829
Pontypridd, 252, 286, 320
Portsmouth, 115, 152, 182, 220, 691, 726, 761
Queensland, 436, 475, 514, 550, 584
Rangoon, 726, 761, 793, 829, 858, 893
Redditch, 50, 85, 115, 152, 761, 793, 829
Reigate, 220
Rhondda, 475, 514, 550, 761, 793
Rochdale, 85, 115, 152, 320, 691
Rochford, 858
Rosslynlee, 397
Rotherham, 152, 182, 220, 252
Rugby, 360
St. Marylebone, 152, 182, 219
St. Pancras, 152, 182, 219, 436, 761, 793, 829
Salford, 220, 252, 320, 858, 893
Shanghai, 16, 50, 655, 691
Sheffield, 115, 436, 475, 514, 655, 691, 726
Shrewsbury, 829
South Africa, 584, 621, 655
Southend-on-Sea, 182
South Shields, 320, 360
Southwark, 475, 514
Spain, 16, 50, 85, 152, 182, 220, 286, 320, 360, 397, 436, 550, 584, 622, 655, 691, 859, 893
Stockton-on-Tees, 182, 220
Sunderland, 436
Swindon, 182, 220, 286, 320
Swinton and Pendlebury, 320, 360, 397
Sydney, 16, 50, 359, 397, 514, 550, 584, 621, 655, 691, 726, 761, 793, 828, 858
Tasmania, 584, 622, 656, 691, 726, 761, 793, 829, 859, 893
Toowoomba, 655, 691
Transvaal, 286, 320, 360
Tunbridge Wells, 16, 50, 85, 115
Tynemouth, 286
Wallingford, 550
Walsall, 859, 893
Walthamstow, 360, 397
Wandsworth, 320, 360, 584
Warrington, 115, 320, 360, 829, 859
Wellington (N.Z.), 50, 85, 115, 360, 397, 436, 584
West Bromwich, 859, 893
West Ham, 761, 793, 829
Westminster, 252
Whalley, 436, 475
Wigan, 115, 252, 286, 320, 360, 691, 726, 762, 829, 859
Wimbledon, 219, 252
Winchester, 622, 656
Woodstock, 85, 115, 152
Wrexham, 286, 320, 360

Control of separately excited generators, The rheostatic, by L. Boothman, 673
Converters, Mercury-vapour arc lamps and, 783
Convex dished ends, Stresses in, 468
Cooker, The Prentice "Lightning," 617
Cooking and heating apparatus, Standardisation of, 201
Cooking appliances, Hiring powers for, 459
Cooking at the Bradford Kursaal, Electric, 403
Cooking, Electric, by W. R. Cooper, 417, 528, 567
Cooking, Electric heating and, by R. Weaving, 280
Cooking (Point Fives), Electric heating and, 197
Cooking exhibit, Electric, 662
Cooking: From "A" consumer's point of view, Electric, 387
Coolidge X-ray tube, The, 87
Co-operation, More about, 237
Copper, 51, 66, 143, 166, 249, 254, 274, 287, 362, 438, 498, 516, 592, 606, 662, 715, 728, 815, 839, 908
Copper famine, Germany's, 185
Copper famine in Sweden, 117
Copper position, The, 387
Copper production, Russia's, 57, 552
Copper wire manufacturers and the contraband problem, 815
Core, Improved method of making joints in gutta-percha-covered, by J. Rymer-Jones, 312

CORRESPONDENCE—
Accumulator cells, Wonderful, by "A.W.B.," 8
Acquisition of enemy patent rights, by L. W. Goold, 212
Advertising and character, by E. J. Hill, 42, 138; A. M. Turner, 48, 106; R. C. Anderson, 42; "W.H.B.," 70; E. J. Reed, 70, 138; H. Berry, 106
Advertising methods, by "Consultant," 8
Alternating current *v.* direct current for lighting, by H. Harrison, 72; T. Stretton, 105; H. Fowler, 140, 211; C. A. Hall, 169, 307; P. Wardle, 170; F. W. Willcox, 170
Appointments vacant, by "In a Good Post," 843

Correspondence—*continued.*
  - Automatic-lift accidents, by Waygood-Otis, Ltd., 722; E. F. Butler, 777; Medway's Safety Lift Co., 778; G. Rosenbusch, 778; Smith, Major & Stevens, 843; "Leeds," 862; F. Broadbent, 886
  - Batteries for electric vehicles, by Edison Accumulators, 343
  - Battery bell signalling systems in mines, by H. R. Kempe, 887
  - Belgium, Electrical industry in, by "Z" Electric Lamp Manufacturing Co., 850
  - Belgium, The electrical future, of, by R. Steylaers, 794
  - British and overseas trade, by A. M. Turner, 210
  - Cable shortage, by "Contractor," 777; "A.M.I.E.E.," 843
  - Cab signalling, by Amos Ogden, 683; W. H. Dammond, 71, 722, 811, 844; "Traveller," 777; H. V. Kramer, 811; E. Sowberg, 844; L. Warburton, 850
  - Capturing German trade, by Walsall Electrical Co., 107; "Galvo," 170; "P.R," 270; "British Specialists," 270; "Suggestive," 573
  - City Guilds' electrical examinations, by A. P. Lundberg & Sons, 72; W. F. Dunton, 211
  - Coke fuel for steam raising, by "Engineer and Fuel Expert," 382; Horace Boot & Partners, 423; "Meldrums," 429
  - Commercial relations with Germany, by F. Coysh, 140
  - Consulting "Engineers," by "Delta," 212; "Station Engineer," 271, 429; "Alpha," 307; "Ero," 343; T. Stevens, 383; "J.B.," 422
  - Contracts with alien enemies, by T. W. Cole, 71, 138
  - Electrical patents owned by alien enemies, by The Westinghouse Patent Bureau, 307; W. P. Thompson & Co., 307
  - Electric cooking, by C. H. Wordingham, 542
  - Electricity supply on the large scale, by A. Gemmell, 210
  - Electric lighting authorities and the law of rating, by F. W. Purse, 212; "The Writer of the Article," 212
  - Electric light switching, by "W.E.S.," 344
  - Electric road rollers, by A. H. Seabrook, 574
  - Electric vehicles, by L. G. Toplis, 542
  - Employment for disabled soldiers, by W. H. Allen, 429
  - Engineering industry and the war, The, by J. S. Warner, 650, 722; by "H.L.J.," 683
  - Extra high-tension cable, by H. H. E. Wood, 271
  - From the fleet, by H. Christie, 41
  - From the front, by A. Maugham, 8
  - Garage heating, by "Interested Inquirer," 41, 138; "P.," 6, 817, 70; C. H. Archer, 105
  - German firms posing as Belgians, by E. Janssens, 7
  - German agencies, by "Contractor," 42
  - German or British? by E. Jacob, 9; Brimsdown Lamp Works, 9
  - German trade with Belgium, by Jos. Barrea, 141
  - Government and foreign trade, The, by Wm. Johnston, 342
  - Government cable contract, by A. R. Munday, 686, 720
  - Government control of factories, by Walsall Engineering Co., 422
  - Government electric power station of Bangkok, Siam, The, by "H.E.F.," 269; by "Bangkok," 422
  - Half-watt lamp fittings, by The British Thomson-Houston Co., 307
  - High and low voltage metal-filament lamps, by "Nela," 307
  - Individual driving of looms, by "Weaver," 72
  - Japan-China cable, by F. C. C. Nielsen, 382
  - Jowers' protective leakage device, by E. F. Butler, 106; The General Electric Co., Ltd., 169
  - Karachi (India) tramways (petrol), by Geo. Gale, 811
  - Lighting, A.C. *v.* D.C., by "Ex-Gas," 43
  - London County Council's electricity bill, by "Londoner," 71
  - London electrical workers' demands, by J. Potter, 404
  - London electricity supply scheme, by "Onlooker," 8
  - Mails to the Far East, by Prof. C. A. Smith, 254
  - Mathematical notation, by F. Jacob, 650
  - Modern wiring, by D. S. Munro, 306
  - Munitions of war, by Geo. Wilkinson, 843
  - Over-pressure protective gear, by K. Edgcumbe, 72
  - Overseas trade—nothing done, by A. M. Turner, 844
  - Pitting of brushes, by A. B. Johnstone, 886
  - Polish Refugee Students, by the Polish Information Committee, 850
  - Power and lighting rates, by (Coun.) W. Smith, 472
  - Preferential terms for arc lights for photo-printing, by F. Broadbent, 106; by H. Faraday Proctor, 106; by G. H. Browne, 542; by (Coun.) W. Smith, 722

Correspondence—*continued.*
  - Quarter-turn coupling, A, by A. Rawling, 308
  - Rear lights on vehicles, by J. G. Thain, 8
  - Salaries of junior engineers, by W. J. Ebben, 70, 139, 171; J. Kay, 105; "Experienced," 106; "One of Them," 138; W. E. Plowmen, 139; Wm. Cooper, 139; "Collar and Cuffs," 139; "Anti-Oil," 140; "A Senior Assistant," 140; "Three to Eleven," 171; "Slaves of the Lamp," 171; "Driver," 270; "Old Reader," 308; "Honi soit qui mal y pense," 308; by "Doubtful," 382
  - Showroom windows, by "Electric Supply," 423
  - Sole agents, by "One of Several Sole Agents," 591
  - Stray magnetism from tramway feeders by "Magnet," 107
  - Street lamps in Chicago, by S. C. Rogers, 211
  - Telephone as nursemaid, The, by E. O. Catford, 850
  - Telephone electricians wanted, 200, by R. MacLeod, 169
  - Telephones wanted, by "National Service League," 17
  - "Totally enclosed" motors, by "Walbrook," 382
  - Trade after the war, by "A.M.T.," 722
  - Trade routes to Russia, by "Traveller," 382
  - Trade with Russia, by A. M. Turner, 429
  - Trouble with oil, by "Engineer," 307, 429; "Charge Engineer," 344; "W.H B.," 344; "Triple-Expansion," 382
  - United States safety rules, by E. B. Rosa, 8
  - War and future trade, The, by E. Bergtheil, 683
  - War on German trade, by "Britisher," 141
  - Water heating by electricity, by The Editor, Journal of Gas Lighting, 542
  - "We can't take the risk," by The Crypto Electrical Co., 9
  - Wireless control of public clocks, by A. E. Ball, 721
  - Wireless in warfare, by G. R. C. Plop, 105
  - Wonderful accumulator cells, by A. F. Hawdon, 70, 172; "A.W.B.," 105, 270
  - Writer's cramp, by "W.H.B.," 344; "L.M.," 383; "Another W.H.B.," 383; "A.W.B.," 383

Cost, Load factor, output and, by C. A. Baker, 775, 808, 841
Costs, Electric vehicle, 802
Country house, The electrical equipment of a, by F. H. Taylor, 339
Crane and lift design, Recent advances in electrical, 26
Crane contracts for India, 77
Cranes at the Port of Bordeaux, Three-phase electric, 717
Cricket match, 794
Cuba, 824

DANGERS present in static transformers due to electrostatic capacity of the windings, High voltage, by J. L. Thompson and S. A. Stigant, 25, 36
Deed of assignment, 47, 111, 215, 283, 688, 758
Delays in delivery, 239
Development Committee, Electrical, 17, 478, 830
Diesel engine breakdowns, 456
Diesel Works, The Consolidated, 580
Directors, Responsibilities of, 814
Disinfectant, Electrolytic, 894
Disinfection by electrolysis, 116
Dissolutions, 47, 75, 215, 356, 394, 617, 688, 723
Dominican Republic, 824
Dominions Royal Commission, The, 604
Dunston, Fire at, 516
Duties on electro-technical products and on their raw materials, Russian customs, 563

EAST Africa Protectorate, 669
Economic operation of electric ovens, by P. W. Gumaer, 871
Edison & Swan Electric Lamp Works, The, 145
Educational notes, 18, 52, 116, 154, 185, 222, 321, 363, 477, 589, 662, 698, 728, 766, 802, 831, 862
Education and industry, 345
Education of the engineering worker, The, 309
Electrical Development Committee, 17, 310, 322, 478, 794, 830
Electrical driving in the woollen trade, by J. F. Crowley, 6
Electrical equipment of a country house, The, by F. H. Taylor, 339
Electrical "evaporation," 698
Electrical standards, 722
Electrical Trade Union, London District, The, 183
Electrical Wholesalers' Federation, 652
Electrically-controlled canal bridge, An, 349
Electrically-driven barges, 501
Electrically-driven U.S. warship, 765
Electric cars and accessories at the New York show, 221
Electricity applied to mining, by C. P. Sparks, 340, 375, 419, 454, 491
Electricity committees and coal supplies, 154 (See also under "Coal")
Electricity in farming, 796, 814, 837, 869
Electricity in mines, 487
Electricity in surgery, 223
Electricity in U.S. steel works, 476
Electricity on the Rand, 227
Electricity supply, 165
Electricity supply at Ahmedabad, India, 695
Electricity supply at Karachi, India, 729
Electricity supply extensions, The war and, 425
Electricity supply, The effect of the present coal position on the business of, 414
Electricity supply.—The selling side of electricity, I.—Showroom windows, 381; II.—An iron campaign, 388
Electricity works extensions at South Shields, 693
Electricity works, Log books and sheets for, by "Interested," 263
Electricity Works, Recent developments at the Salford, 79
Electric lighting authorities and the law of rating, 102, 133
Electric light switching, Some peculiar views on, by W. P. Maycock, 711
Electric supply executive staffs, New association, 361, 772
Electric vehicle: British experience, The, 17
Electric Vehicle Committee, The, 253, 402, 894
Electric vehicle demonstration, 254
Electric vehicle, The, 325, 500, 855
Electrification of engineering works, The case for the, by E. P. Hollis, 579
Electrification of flour mills, The case for the, by E. P. Hollis, 123
Electrification of hens, The, 185
Electrification of Portland cement works, The case for the, by E. P. Hollis, 537
Electro-chemical methods, Water softening by, 186
Electro-Harmonic Society, 438
Electrolysis, Disinfection by, 116
Electrolysis in boilers, The prevention of, 633
Electrolytic disinfectant, 894
Electrolytic manufacture of sodium, 639
Electromagnet, Locating projectiles, by "A.C.," 711
Electromagnets in war surgery, 553
Electrostatics and industry, 677
Elwell-Parker battery trucks, 500, 568
Enemy, Competing with the, 316
Energy losses in electric lamps, 440
Engineering Congress, 1915, International, 17
Engineering industry and the war, The, 607
Engineering Institutions' Volunteer Training Corps, The, 764
Engineering trade and the Press, The, 210
Engineering, Training for the industrial side of, by A. P. M. Fleming, 337, 374
Engineering worker, The education of the, 309
Engineering works, The case for the electrification of, by E. P. Hollis, 579
Engineers and the technical Press, 202
Engineers wages, Scottish, 894
Engineer, The status of the, 533
Engraving on celluloid, 825
Errors in power measurement by the two-wattmeter method, Correcting, 562
"Evaporation," Electrical, 698
European markets for electrical supplies, 603
Exhibit, Electric cooking, 662
Exhibition, A Manchester, 825
Exhibition, An Australian, 546
Exhibition, Blackpool Traders', 52
Exhibition, Glasgow, 881
Exhibition of industrial furnaces, 215
Exhibition postponed, The Shipping Engineering Machinery, 356
Explosion, Stowmarket, 698, 861
Explosions, Street, 878
Exportation of electrical energy, Canada and the, 253
Exports and imports during 1914, British electrical, 132
Exports and imports during 1914 and previous years, Electrical, 158
Exports and imports of electrical goods during December, 1914, 157; January, 1915, 301; February, 451, March, 597; April, 741; May, 901
Exports, Swedish electrical, 772

FACTORY, The fight in the, by "Commercial," 609
Fair, British industries, 678, 697, 728
Farming, Electricity in, 796, 814, 837, 869
Fatalities, 88, 118, 154, 185, 222, 254, 287, 362, 402, 440, 478, 516, 591, 656, 698, 728, 766, 801, 830, 862, 894
Feeder reactances, 362
Field coils, Distribution and rise of temperature in, by Prof. M. Maclean, D. J. Mackellar and R. S. Begg, 279
Fight in the factory, The, by "Commercial," 609
Finance, Industry, science and, 501
Finance, Municipal, 386
Fire, 149, 433, 516, 759, 825, 890
Fire extinguishers, Portable chemical, 52
Fire prevented, 790, 802
Fire prevention, Air raids and, 728, 765
Fires, Electrical, 214
Fittings, Half-watt lamp, by "Research," 206
Fixation of atmospheric nitrogen, The, 876
Flour mills, The case for the electrification of, by E. P. Hollis, 123
Foreign and Colonial tariffs on electrical goods, 32, 177, 344, 383, 424, 459, 568, 639, 674
Foreign concessions in Norway, 337
Foreign electrical trade in 1914, 76
Foreign trade in December, 88; January, 221; February, 361; March, 553; April, 692; May, 831
Foreign trade: "When in Rome—," 751
"Formidable," The loss of the, 67
Foster Engineering Co., 249
France, Aluminium production in, 394
France, The electrical industry in, 117, 559
Furnace, A new nitrogen electric, 166, 191
Furnace for routine foundry work, Large electric, 680
Furnaces, Electric steel-making, by T. D. Robertson, 233
Furnaces in Italy, Electric, 719
Furnaces, Large electric, 723
Future of Belgium, The electrical, 781
Future, The French electrical engineering industry and its, 117, 559

GALVANIZING, Cold, 432
Gas, Electricity in the purification of coal, 69
Gas engine tests, 733
Gas power plant, A large, 18
Generating plant, Private, by A. H. Dykes, 531
Generator, Large D.C., 590
Geneva water supply, 476
German business methods, 787
German cable manufacturing, 144
German control, Russian electrical industry, 807
German electrical concessions in Russia, 605
German firms, Russia and, 99
German influence in the past, Russian electrical affairs; 101
German interests in supply works, The Russian Government and, 570
German submarines, Main-motor-starting switchgear used on, by N. H. Wood, 763
German trade in 1913, 167
German trenches, Electric light and fans in, 764
Germany, 616
Germany, Electrical expansion in, 439
Germany's copper famine, 185
Germany, Syndication methods in, 99
Germany, Trading and industrial methods in, 199
Glasgow electricity works, 423
Glasgow Exhibition, 881
Glasgow hospital, A, 819
Glass switchboard, Large, 57
Golf, 322
Good lighting and its effects, by V. H. Mackinney, 610
Government and war munitions, The, 589
Government policy announced, A, 715
Greenock, The electricity supply to Port Glasgow from, 289
Guaranteed wiring, 117
Gutta-percha-covered core, Improved method of making joints in, by J. Rymer-Jones, 312
G.V. electric motor vans, 500

HALF-WATT lamp fittings, by "Research," 206
Half-watt lamps, 13
Hardening of metals, The, 128
Heating and cooking, Electric, by R. Weaving, 280
Heating and cooking (Point Fives), Electric, 197
Heating, Electrical, 222
Heating, Industrial electric, 254, 764
Heavy machines in Germany, 215
Hens, The electrification of, 185
Hereford, Farming supply at, 837
High-pressure transformer, A, 240
High-voltage dangers present in static transformers due to electrostatic capacity of the windings, by J. L. Thompson and S. A. Stigant, 25, 36
Hiring powers for cooking appliances, 459
Holland, Imports of, 493
Hong-Kong, Electrical trade in, 723
Honours, The King's birthday, 802, 832
Hospital, A Glasgow, 819
Hotel, The Regent Palace, 879
Hungarian aluminium oxide, 362
Hydro-electric Commission, The report of the Ontario, 873
Hydro-electric plant in India, Hand regulation of a, by J. W. Meares, 275

IGNITION magneto be superseded? Will the, by C. J. Webb, 311
Ilford railway accident, The, 439, 461
Imports and exports of electrical goods during December, 1914, 157; January, 1915, 301; February, 451; March, 597; April, 741; May, 901
Imports during 1914 and previous years, Electrical exports and, 158
Imports during 1914, British electrical exports and, 132
Imports of Holland, 493
Income tax, 272
Incorporated Municipal Electrical Association Development Committee, The, 17, 310, 322, 478, 794, 830
Incorporated Municipal Electrical Association meeting, 1915, 794, 902
Increasing the output, 813
India, 392, 616
India, Electric power in, by H. R. Speyer, 774, 807
India, Hand regulation of a hydro-electric plant in, by J. W. Meares, 275
Indian notes, 275, 313, 429, 541, 604, 639, 676, 778, 794
India, Technical education in, 744
Industrial electric heating, 254, 764
Industrial organisation, 385
Industry in France, The electrical, 117, 559
Industrial side of engineering, Training for the, by A. P. M. Fleming, 337, 374
Industry, Education and, 345
Industry, Electrostatics and, 677
Industry in France, The electrical, 117, 559
Industry in Italy, The electrical, 58
Industry in Scotland, Electrical, 46
Industry, Science and, 497
Industry, Science and Finance, 501
Industry, The war and the electrical, 646
Inquiries, 117, 185, 255, 323, 625, 698, 728, 831, 863
Installation work, Iron leads for, 221

INSTITUTION AND LECTURE NOTES—
American Institute of Electrical Engineers, 830
Association of Consulting Engineers (Inc.), 830
Association of Electrical Station Engineers, 624
Association of Mining Electrical Engineers, 184, 222, 288, 662, 765
Associazione Elettrotecnica Italiana, 184
Birmingham & District Electric Club, 51, 404
Bristol Association of Engineers, 439
Diesel Engine Users' Association, 184, 323, 477, 623, 765
Electrical Association of Australia, 51, 116, 439, 728, 895
Greenock Electrical Society, 516
Igranic Engineering Society, 255
Illuminating Engineering Society, U.S.A., 554, 895
Institute of Marine Engineers, 18, 698
Institute of Metals, 662
Institution of Civil Engineers, 288, 624
Institution of Electrical Engineers, 222, 477
Institution of Electrical Engineers (Birmingham Local Section), 87, 185, 222, 404, 516
Institution of Electrical Engineers (Calcutta Local Section), 404
Institution of Electrical Engineers (Hong-Kong Local Section), 153
Institution of Electrical Engineers (Manchester Local Section), 87, 153, 222, 288, 554, 624
Institution of Electrical Engineers (Newcastle Local Section), 323, 802
Institution of Electrical Engineers (Scottish Local Section), 87, 222
Institution of Electrical Engineers (Students' Section), 362, 404, 589, 698
Institution of Electrical Engineers ((Western Local Section), 362
Institution of Electrical Engineers (Yorkshire Local Section), 116, 288, 698, 765
Institution of Mechanical Engineers, 288
Iron and Steel Institute, 222, 589
Junior Institution of Engineers, 662, 728, 802
Liverpool Engineering Society, 830
Manchester University, 288
National Association of Colliery Managers, 288, 362
National Illumination Committee of Great Britain, 184
Northampton Polytechnic Institute, 439
Physical Society of London, 439, 830
Royal Institution, 185, 477, 516, 662
Royal Irish Academy, 288
Royal Society of Arts, 255, 554, 589
Rugby Engineering Society, 87
Salford Technical & Engineering Association, 153
Sheffield Electrical Social Union, 477
Society of Engineers, 185, 728
South African Institute of Electrical Engineers, 116, 288
Swansea and District Institute of Engineers, 116
Textile Institute, The, 698
Willesden Polytechnic Electrical Engineering Society, 185
Wireless Society of London, 153, 184
Institution of Electrical Engineers and the war, 782
Institution of Electrical Engineers: Annual report, 747; Annual meeting, 812
Institution of Electrical Engineers' Benevolent Fund, 516, 552
Institution of Electrical Engineers' (Yorkshire Local Section), 7
Insulation tests of electric ovens, Thermal, 762
Iron campaign, The selling side of electricity supply, An, 388
Iron leads for installation work, 221
Iron, The magnetisation of, by J. S. Nicholson, 109
Italian electrical trade, 249
Italian view of the Russian market, An, 617
Italian water power, Ownership of, 322
Italy, 213
Italy, Electrical developments in, 440
Italy, The electrical industry in, 58
Italy, Electric furnaces in, 719
Italy, Trade with, 906

JACKSON, Admiral Sir H., 795
Joints in gutta-percha-covered core, Improved method of making, by J. Rymer-Jones, 312

KARACHI, India, Electricity supply at, 729
Kenotron rectifier, The, 643, 644
Kobe, 76
Kwangtung, 177

LABOUR problems: Past, present, and future, 100
Lamp characteristics, Tungsten-filament, 765
Lamps, Energy losses in electric, 440
Lamps in mines, Electric, 153
Lamps, Rational rating for filament, by S. M. Powell, 631
Lamps, The practical rating of electric incandescent, by F. W. Willcox, 457
Lamp works, The Edison & Swan electric, 145
Large D.C. generator, 590
Lead, 4, 98, 202, 310, 426, 535, 642, 751 847
Lead scarcity in Russia, 733

LEGAL—
Aberdeen claim, An, 471
Adnil Electric Co. *v.* British Traders' Association, 802
A.E.G. Electric Co. *v.* Semple, 315
Alloa, The Burgh of, *v.* Alloa Theatre Co., 885
Arbroath electric works appeal, 10
Arc lamp carbons case, 402
Armorduct Manufacturing Co. *v.* Armitage, 613
Asuncion Tramway, Light & Power Co.: Brazil Railway Co. *v.* The Company and Others, 175
Attorney-General at the Relation of the Ilford Gas Co. *v.* The Ilford U.D.C., 117
Atwell *v.* West Ham C rporation, 684
Auto-Roto Syndicate *v.* Paul & Callard, 314
Barcelona Traction, Light & Power Co.: Mackenzie *v.* The Company, 314
Beck Engineering Co., 852
Bohndel, Otto, *v.* S. H. Lewis & Co., 52 4
Bohndel, Otto, *v.* S. H. Lewin & Co., 52
Bristol tramways and their electric supply, 824
British Insulated and Helsby Cables *v.* Crittall Mfg. Co., 316, 351, 389, 402, 431, 470
British Thomson-Houston Co. *v.* Duram, Ltd., 208
British Vacuum Cleaner Co.'s appeal dismissed, 719
Brown *v.* Lambeth Borough Council, 886
Calmont, King & Co. *v.* Owen, 824
Charge of stealing, 361, 510
Chester Corporation *v.* Chester Water Works Co., 719
City & South London Railway Co. *v.* H.M. Postmaster-General, 802
City of London Electric Lighting Co *v.* Bennett, 390
Consolidated Langlaagte Mines *v.* Victoria Falls and Transvaal Power Co., 430
Contractor, Charge against, 895
Costelloe *v.* Universal Radio Syndicate, 505
Cunningham, Ltd., 545, 576
Day *v.* Willard and others, 247
Delays and discounts, 478
Dewsbury Corporation *v.* Wilby, 10
Discount, A question of, 353
Douglas *v.* Pelican, 96
Edwards *v.* Mexican Light & Power Co., 246
Electrical Apparatus Co. *v.* Canadian British Engineering Co., 719, 885
Electrical Trade Union funds, Withholding, 431
Electric Utility Co., 246
Ellis *v.* Faraday & Sons, 174
Exhibition space contracts in war time 831

LEGAL—*continued.*
Extraction of water from peat by electricity (Patent Revocation case), 470
Eydmann *v.* The Premier Accumulator Co., 174
Fallon *v.* Middleton Electric Traction Co., 315
Fosbery *v.* Dublin United Tramway Co., 279
German electric pocket lamps, 851
Glasgow tramway accident claims, 756
Glover, W. T., & Co., 756
Gutmacher *v.* Levy Bros. & Co., 175
Hamilton *v.* Marconi's Wireless Telegraph Co., 174, 316, 363, 431, 471
Holbrook *v.* Ford, 354
Jones, R. L., & Co., *v.* Orpheum, 353, 390, 430
Lighting regulations, 470
Lighting summonses, 506
London County Council *v.* Assessment Committee of the Borough of Islington, 279, 470
London Pneumatic Tube Co. *v.* Veritys, 117
London Tube Railway compensation claims, 685
Macdonald *v.* L. & Y. Railway Co., 176
Meldon *v.* Morrow, 127
Merchandise Marks Act prosecution, 811, 830
Minchin *v.* Strauss, 75
Morris, H., *v.* Saxelby, 391, 506
Motor-cyclists' claim, A, 96
National Freehold Land and Building Society *v.* Maurice Freeman, 575
Newcastle-on-Tyne Electric Supply Co. summoned, 390
Nicholls *v.* Astley & Barwell, 685
Osram Lamp Works *v.* Scrando Lamp Co., 613
Osram Lamp Works *v.* The Corona Lamp Works, 143
Osram *v.* Pope's Electric Lamp Co., 315, 886
Patent revocation, 648
Penalty for exporting carbons, 801
Piggott & Co. *v.* Hicks & Co., 649
Plutte, Scheele & Co. *v.* Hudson, Sheed & Towell, 96
Postmaster-General *v.* Oxford Electric Tramways Co., 127
Postmaster-General *v.* Southwark B.C., 850
Power house accident.—Railway company fined, 354
Prepayment meter prosecution dismissed, 314
Prize Court, The, 127, 505, 574, 648
Question of means, A, 478
Rickman *v.* F. W. Berk & Co., 863
Rose Bros *v.* Kohlhausen, 476
Ruthenberg *v.* British Abrasive Wheel Co., 315, 351
Seear *v.* General Accessories Co., 208
Sinclair *v.* Levinsky, 353
Smoke nuisance, 363, 552, 894
Stolz Electrophone Co. (1913), 209
Swansea Gas Light Co. *v.* Swansea Rural District Council, 278
Sydney Customs duty dispute, A, 143
Taunton *v.* Harkness Bros., 574
Telephone installation case, 314
Thefts of electric lamps, 728
Trading with the enemy, 575, 685
Traffic at tramway stopping places, 756
Tramcar accident claim, 127, 143, 315
Tramcar ticket case, 361
Tram conductor's fraud, 254
Tungsten drawn wire.—Petition for licence, 315, 352, 390
Underwood *v.* British Uralite Co., 174, 613
Value of a dog, The, 354
West Ham Corporation, Damages against, 354
Westinghouse employé fined, A, 756
Whittaker *v.* L.C.C., 684
Wiring dispute, A house, 851
Workmen's compensation, 96, 127, 143, 430, 649, 852
Worksop and Retford Brewery Co.: Worksop Palace, 545, 578
Zucker *v.* Peters, 247

Legal Query Column, Our, 32, 72, 175, 271, 313, 510, 649
Leigh Infirmary, Generous gift to, 656
"Lest we forget," 750
Liability, A breakdown and legal, 5
Lift accidents, Automatic, by F. Broadbent, 681
Lift design, Recent advances in electrical [illegible] and, 26
Lift fatality, Electric, 728, 836

LIGHTING AND POWER NOTES—
Aberdare, 890
Aberdeen, 77, 149, 178, 317, 473, 653, 890
Abingdon, 249
Accrington, 47, 178, 724, 759
Acton, 653
Aldeburgh, 14
Aldershot, 433, 618, 759
Antrim, 215
Arbroath, 14, 582, 724, 890
Argentine, 47, 77, 249, 618, 759, 856
Ascot, 47
Ashton-under-Lyne, 249, 724, 856
Audenshaw, 317
Australia, 47, 77, 112, 178, 250, 283, 356, 394, 433, 473, 511, 547, 653, 724, 825, 827, 890
[illegible], 14, 394, 473, 724, 759
Bacup, 77, 356, 547
[illegible], 112

LIGHTING AND POWER NOTES—*continued.*
Ballyconnell (Co. Cavan), 14
Ballymena (Co. Antrim), 14, 215, 283, 394, 473
Bangor, 825
Barford, 283, 688
Barking, 14, 283, 473, 511, 581, 653
Barnes, 112, 250, 724
Barnet, 149, 356, 433, 473
Barnsley, 112, 394, 581, 724, 759, 856
Barnstaple, 891
Barrow, 48, 178, 317, 511, 688, 825
Barton-on-Humber, 856
Basingstoke, 433, 653
Bath, 77, 394
Batley, 215, 356, 825
Battersea, 78, 150, 217, 826
Bawnboy (Co. Cavan), 112
Beaconsfield, 48
Beaumaris, 216
Beccles, 112
Beckenham, 856
Bedford, 433, 582
Belfast, 14, 48, 178, 317, 395, 547, 825
Belgium, 48, 250
Belleek, 149, 317
Bermondsey, 250, 395, 654, 725
Berwick-on-Tweed, 856
Bethnal Green, 48, 180, 318
Bexhill, 356
Bexley, 112
Bidford-on-Avon, 856
Bingley, 112, 283, 394
Birmingham, 48, 688
Bispham, 14, 178, 856
Bitterne, 759
Blackburn, 216, 283, 356, 394, 511, 653, 825
Blackpool, 149, 178, 473, 618, 724, 759
Blackrock (Co. Dublin), 77, 178, 433, 653, 688
Bolton, 473, 581, 618
Bootle, 433, 653
Boroughbridge, 216, 250
Boston, 77, 149, 250, 473, 511, 582, 724
Bournemouth, 112
Bradford, 48, 216, 356, 433, 688, 724, 825, 856, 891
Bradford-on-Avon, 48
Bredbury and Romiley, 825
Brentford, 14
Bridlington, 77, 653
Brighouse, 48, 178, 688
Brighton, 283, 317, 433
Bristol, 317, 394, 688
British East Africa, 395
Broadstairs, 394, 473
Brymbo, 178
Buckhurst Hill (Essex), 394, 618
Burnley, 283, 317, 394, 434, 688, 825
Burton-on-Trent, 14, 250, 357, 547, 891
Bury, 112, 149, 434, 618, 688, 759, 891
Buxton, 891
Cahir (Co. Tipperary), 511
Cahirciveen (Kerry), 357, 618
Canada, 14, 216, 357, 394, 547
Canterbury, 216, 688, 891
Cardiff, 434
Carlisle, 112, 250, 582
Carnarvon, 547, 688, 856
Carrickmacross, 250
Carshalton, 724
Castletown-Berehaven, 759, 891
Castlewellan, 582, 618
Ceylon, 317
Chapel-en-le-Frith, 149, 250
Charleville, 250
Chatham, 395
Chelmsford, 178, 511, 653
Cheltenham, 14, 77
Cheriton, 216, 825
Chertsey, 149, 357
Cheshire, 283
Chesterfield, 112, 856
Chichester, 826
Chile, 48, 112, 179, 618, 688
China, 582, 891
Chingford, 77
Chipstead, 149, 688
Chislehurst, 434
Chorley, 179
Clacton, 77, 618
Cleckheaton, 179, 250
Cleethorpes, 149
Clifden (Co. Galway), 582
Colchester, 112, 826
[illegible], 653
Colwyn Bay, 149, 395
[illegible], 250
[illegible], 179, 653
Continental, 48, 77, 112, 149, 179, 250, 283, 317, 357, 434, 547, 582, 618, 653, 759, 826, 856, 891
Coventry, 48, 149, 317, 618, 653
[illegible], 149, 759
Crewe, 547
Croydon, 14, 317, 511, 724
[illegible], 179, 547, 582, 689
[illegible], 48, 317
[illegible], 759
Dalkey, 618, 689
Darlington, 48, 250, 357, 511, 759
[illegible], 77, 216, 547
[illegible], 216, 689, 856
Denton, 77
[illegible], 217
[illegible], 653
[illegible], 547
Doncaster, 77, 179, 216, 826
[illegible], 48, 150, 216, 283, 317, 357, 547, 618, 689, 724, 826
Dublin, 179, 250, 283, 317, 357, 395, 511, 582, 618, 653, 891
[illegible], 216
[illegible], 179
Dundee, 216, 317, 582, 689, 826
Dunfermline, 547
Durham, 150, 826
Ealing, 395
Earlestown and Newton-in-Makerfield, 14, 150

LIGHTING AND POWER NOTES—*continued.*
Eas[illegible], 473
East and West Ardsley, 317
Eastbourne, 216, 357
East Grinstead, 548, 618
East Ham, 15
East Sussex, 250, 724
Eccles, 179, 317, 473, 653
Edinburgh, 48, 77, 112, 179, 395, 582, 653, 891
Elland, 216, 512
Ely, 317, 759
Enfield, 826
Enniscorthy, 689
Enniskillen, 317
Epping, 150
Epsom, 112, 395, 689
Erith, 179, 653
Esher, 48
Essex, 77
Eton, 547
Exeter, 891
Falkirk, 618
Farnham (Surrey), 77
Faversham, 434
Federated Malay States, 891
Finchley, 15, 48, 317, 473
Fleetwood, 357
Fowey, 357
Frome, 112, 856
Frimley, 826
Frinton, 48, 317
Frodsham, 283
Fulham, 217, 358, 434, 857
Galashiels, 434
Germany, 179, 250, 582
Gillingham (Kent), 77, 216, 357, 511, 689, 826
Glasgow, 48, 250, 283, 317, 357, 395, 434, 582
Glastonbury (Somerset), 77
Glossop, 216
Gloucester, 317, 826
Goring, 112
Gortin (Co. Tyrone), 317
Gravesend, 724
Grays, 434, 759, 826
Greater London Scheme, 48
Great Harwood, 856
Greenock, 78, 179, 283
Greetland, 48
Gresford, 434
Grimsby, 150, 317, 357, 826
Hackney, 78, 150, 216, 358, 395, 434
Hale, 548
Halifax, 48, 317, 891
Hammersmith, 284, 395, 759, 857
Hampstead, 15
Hants, 759
Harrogate, 112, 283, 759
Haslingden, 179, 473, 653
Hawarden, 15
Haworth, 179, 582, 891
Hayward's Heath, 78, 250
Hazel Grove and Bramhall, 78
Hebburn-on-Tyne, 15
Heckmondwike, 891
Hendon, 216, 548
Henley-on-Thames, 78, 216, 434
Hereford, 78, 512
Heston and Isleworth, 318, 473
Hexham, 856
Heywood, 250, 318, 357, 512, 582, 619, 653, 724, 856, 891
High Wycombe, 434, 856
Holland, 77, 547
Holme, 78, 112, 250, 395, 548
Holmfirth, 78, 112, 250, 512
Holywell, 216
Hornsey, 619
Horrabridge, 179
Horsham, 284
Hove, 78, 724, 826
Hucknall Torkard, 891
Huddersfield, 284, 434, 619, 759
Hull, 284, 318, 434, 473, 619
Huntingdon, 395
Ilford, 15, 473, 654, 689, 856
India, 48, 150, 216, 357, 434, 473, 548, 619, 724, 891
Ipswich, 250, 473, 891
Irish E.L. schemes, 548
Irish water power schemes, 512
Irlam, 582
Islington, 15, 112, 689
Italy, 250, 283
Itchen, 395, 582
Japan, 512
Keighley, 78, 179, 474, 512, 619, 654, 724
Kendal, 826
Kensington, 892
Kettering, 759, 891
Kilkeel (Co. Down), 856
King's Lynn, 856
Kingston-on-Thames, 318, 395, 474, 512, 654, 759
Kingstown, 78, 284, 318, 357, 395, 582, 619, 654
Kintore, 216
Kirkcaldy, 856
Lake Coleridge (N.Z.), 49
Lambeth, 113
Lancaster, 826
Langport, 112
Leeds, 216, 318, 357, 474, 619, 689
Leek, 150, 759
Lees, 78, 434
Leicester, 284, 435
Leigh-on-Sea, 179, 395, 548, 689, 724
Lewisham, 619
Lexden and Winstree, 179
Leyton, 318, 474, 512
Limerick, 78, 179
Lincoln, 548
Linton, 857
[illegible], 217
Liverpool, 78, 179, 216, 284, 318, 891
Llandudno, 15, 48, 284, 358, 474
[illegible], 582
London, 15, 48, 78, 112, 150, 179, 216, 250, 284, 318, 358, 395, 434, 474, 512, 548, 582, 619, 654, 689, 725, 759, 826, 857, 891

LIGHTING AND POWER NOTES—*continued.*
London County Council, 217, 250, 284, 318, 358, 619, 654, 725, 892
London Electric Supply Bills, 284, 318, 358
Long Eaton, 856
Loughborough, 358, 582, 826
Loughrea, Co. Galway, 548
Lurgan, 113
Luton, 113, 180, 395, 826
Lytham, 78
Macclesfield, 318
Maidenhead, 48, 78, 689
Maidstone, 180, 318, 512
Malvern, 654
Manchester, 15, 49, 250, 284, 318, 358, 395, 512, 619, 654, 725, 759, 826
Mansfield, 619
Mansfield Woodhouse, 725
Market Drayton, 857
Market Weighton, 725
Marylebone, 48, 180, 318, 857
Masham, 150
Melton Mowbray, 857
Merthyr Tydfil, 654, 892
Middlesbrough, 857
Middleton, 358, 548, 759, 826
Midhurst (Sussex), 826
Mirfield, 654
Morecambe, 15, 434
Morley, 826
Mottram-in-Longdendale, 217
Mountain Ash, 474
Nantwich, 150, 284, 434
Nelson, 78, 284, 654
Newbury, 180
Newcastle power schemes, 217
Newcastle-under-Lyme, 582
Newcastle West (Co. Limerick), 78, 318
Newport (Mon.), 548, 582
Newton Abbot, 434
New Zealand, 15, 49, 150, 284, 358
Normanton, 395, 583
Northampton, 654, 827, 892
North Ormesby, 892
Norway, 179, 250, 357, 434, 547
Nottingham, 49, 217, 689
Nuneaton, 217, 358, 654
Oakworth, 113
Oldham, 49, 78, 180, 217, 583, 759
Ormskirk, 180, 217, 251
Oulton Broad, 548, 689, 827
Pembroke (Dublin), 318, 358
Penistone, 113, 180
Penketh, 113
Penryn, 113
Penshurst, 113
Penzance, 474
Perth, 217, 434, 474
Peterborough, 180, 759, 827
Plymouth, 150, 284, 760
Poplar, 318, 619, 826, 891
Portaferry (Co. Down), 217, 474
Portstewart, 548, 892
Portuguese West Africa, 619
Preston, 892
Queensbury, 548
Queensferry, 251
Radcliffe, 892
Randalstown (Co. Antrim), 78
Rawdon, 113, 857
Rawtenstall, 284, 760
Reading, 217
Reigate, 180, 284, 318, 827
Restricted lighting, 217, 857
Rhyl, 395
Richmond-on-Thames, 15, 512
Ripon, 78, 251, 619
Rochdale, 251, 583, 619, 827, 892
Rochester, 583
Romsey, 284
Rotherham, 689, 827
Rugby, 654
Runcorn, 49, 548, 619, 689
Russia, 434, 618, 653, 891
St. Anne's-on-Sea, 857
St. Anne's (Lancs.), 217, 358, 548, 689, 827
St. Helens, 827
St. Helier, 113
St. Pancras, 113, 217, 318, 582, 826
Salford, 49, 78, 180, 434, 512, 654, 760, 857, 892
Saxilby (Lincs.), 689
Selby, 113, 619
Sevenoaks, 78, 113
Shanklin, 548
Sheerness, 857
Shelf, 548
Sheffield, 83, 217, 358, 512, 548, 689
Shipley, 358, 474, 827, 857
Shoreditch, 113, 250, 619
Shrewsbury, 892
Skelton and Brotton (Yorks.), 78, 358
Skerries (Co. Dublin), 284
Slaithwaite, 251, 725, 857
South Africa, 83, 113, 150, 395, 512
Southampton, 113, 180, 512, 654
Southend-on-Sea, 284, 760
Southport, 218, 689, 760
South Shields, 760
South Wales, 760
Southwark, 15, 150
Spain, 48, 149, 250, 434, 547, 759, 826
Stafford, 358, 548, 760
Stalybridge, 180
Stanley (Yorks.), 583, 689
Stepney, 318, 759, 892
Stirling, 284
Stockport, 83, 892
Stockton Heath, 318, 583
Stockton-on-Tees, 251, 512
Stoke-on-Trent, 180, 318, 654
Stone, 583
Stratford-on-Avon, 857
Street, 150
Stretford, 218, 827
Sunderland, 180, 583
Surrey, 113, 180
Sutton, 689
Swansea, 180, 251, 512, 548, 725, 827
Sweden, 250

LIGHTING AND POWER NOTES—*continued.*
Swindon, 251
Swinton and Pendlebury, 251, 395, 583
Tamworth, 15
Tarporley, 15
Tasmania, 827
Taunton, 395
Teignmouth, 857
Tempo (Co. Fermanagh), 892
Tenby, 395
Thurmaston, 318
Tipperary, 251
Torpoint, 83, 512
Torquay, 83, 218, 548, 689
Tottenham, 251
Truro, 113, 251, 395, 583
Tullamore, 284
Tunbridge Wells, 83, 434, 548, 827
Turkey, 317
Turton (Lancs.), 548
Tynemouth, 15, 583
United States, 434, 857
Upper Beeding, 474
Upper Greetland, 512
Urmston, 251
Venezuela, 512
Wakefield, 218, 760, 827
Walkden, 395
Walsall, 49, 83, 113, 358, 548, 689, 857
Walthamstow, 15, 150, 619
Wanstead, 395
Warminster, 857
Warrington, 83, 180, 318, 548, 690
Warwickshire, 619
Waterford, 583, 654
Waterloo, 358
Watford, 690, 760, 857
Weaverham, 827
Wednesbury, 251
Wednesfield, 396
Wells, 113, 396, 583
West Bromwich, 49, 690, 827
West Ham, 113, 150, 284, 435
West Hartlepool, 583
Westminster, 434
Wharfedale, 654
Whitefield, 83
Whitstable, 113
Wigan, 218, 549, 690
Willesden, 15, 150, 180, 284, 435, 549, 760, 892
Wimbledon, 49, 218, 358, 690, 857
Winchester, 396, 435
Windermere, 218
Windsor, 83, 113, 435
Wistaston, 690
Wokingham, 83
Wolverhampton, 83, 358, 690
Wombwell, 435
Woodford, 113, 396
Woolwich, 48, 150, 250, 619, 857
Worcester, 83, 218, 513
Worcester Park, 251
Worksop, 150
Worthing, 513
Wrexham, 49
Yarmouth, 857
York, 83
Yorkshire Electric Power Bill, 113, 150, 218, 251, 284, 396
Ystradgynlais, 760

Lighting and its effects, Good, by V. H. Mackinney, 610
Lighting fixtures, Artistic, 463

LIQUIDATIONS—
Acton Lamp Co., 178
Altheat Co., 144
Apparatus & Accessories, 316
Argentine Electrolytic Syndicate, 47
Atlas Electrical Co., 758
Beck Engineering Co., 824
British Prometheus Co., 144, 362
Buenos Aires Port and City Tramway Co., 890
Central Wireless Co., The, 433
Chinnery Engineering Co., The, 581
Coast Development Corporation, The, 789, 824
Colne and Trawden Light Railways Co., 617
Combination Gas-Steam Engine Syndicate, 723
Consolidated Diesel Engine Manufacturers, 433, 581
Cooper & Roberts, 617
Dettifoss Power Co., 316
Dryers, 14
Dry Gas Electric Fire Extinguisher Co., 75
East Coast Development Corporation, 890
Ebro Light & Power Construction Co., 282
Electric Railway Signalling Syndicate, 653
Electric Stores, 111
Electromobile Co., The, 617
Electro Steel Foundries, 14, 75
Felgate Installation Co., 14, 47
General Electrolytic Parent Co., 75, 111
Grindell Matthews Wireless Telephone Syndicate, 75
Harrow Road and Paddington Tramways Co., 653
Helsby Wireless Telegraphy Co., 111
High Peak Magneto, The, 249
Hove Electric Lighting Co., 617
Leitner Electrical Co., 111
Lighthouse Radiator Co., 282
Meldrum Bros., 14, 215
Metalite, 546
Miners' Lamp Electric Lighting Co., 215
Molybdenum & Tungsten Traders, 249
National Engineering Co., 14
Oldham Boiler Works Co., 758
Otis Elevator Co., 510
Patent Exploitation Trust, 723

LIQUIDATIONS—*continued.*
Pintsch's Electric Manufacturing Co., 856, 890
Premier Lighting & Engineering Co., 178, 546
Pure Lubricating Oil Co., 546
Rapid Light Controlling Syndicate, 653
Redglo, 14
Roundhay & District Electric Lighting Co., 433
Salsbury Lamps, 249
Sandwich, Deal and Walmer Electricity Supply Co., 144
Schleyder's Economic Steam Furnace (Continental), 47, 394
Spagnoletti, 47
Spanish National Submarine Telegraph Co., 510, 581
Stolz Electrophone Co. (London), 298
Street Lighting Co., 14
Tannett, Walker & Co., 178
Uitenhage Electric Light and Power Co., 144
Universal Belting Co., 178
Universal Radio Syndicate, 144
Westminster Lighting, Heating and Ventilating Co., 215

Lisbon, 177
Liverpool & District Electrical Masters' Association, 604
Loaded submarine cables, 185
Load factor, output and cost, by C. Ashmore Baker, 775, 808, 841
Locomotive, A mercury rectifier, 136
Locomotive coach fitted with Thomas transmission, A, 882
Log books and sheets for electricity works, by "Interested," 263
London County Council contract prices, 652
London County Council tramway employés, 477, 728
London electrical workers, 288, 439, 523
Losses in electric lamps, Energy, 440
Losses with a tachograph, Detecting production, 661
Low-tension auxiliary supply in high-tension D.C. traction systems, 221
Lubrication of ball bearings, The, by A. V. Farr, 638
Lubrication troubles, 427

MACHINERY, B.E.A.M.A. standardisation rules for electrical, 742
Magnetic elements, 816
"Magnetic" invention, The latest, 794
Magnetic particle, The nature of the ultimate, 682
Magnetisation of iron, The, by J. S. Nicholson, 109
Magneto be superseded? Will the ignition, by C. J. Webb, 311
Main-line signalling on railways, by W. C. Acfield, 565
Manchester Corporation, The Barton power scheme of the, 59
Manchester, Electrical progress at, 34
Manufacturers and the carriage problem, British, 845
Manufacturing ability of British electrical firms, 66
Marketing of British goods abroad, The, 835
Markets for electrical supplies, European, 603
Mathematical notation, 624
Measurement in a modern power house, Temperature, by C. S. Jeffrey, 523
Measurement of wireless signals, by Prof. E. W. Marchant, 637
Mechanical road traffic, Heavy, 764
Meldrum destructor in Australia, A, 282
Men who stay at home, 815
Mercury rectifier locomotive, A, 136
Mercury-vapour arc lamps and converters, 783
Metal exports from the United States, 889
Metal market, 57, 191, 337, 523, 669, 807
Metals, The hardening of, 128
Meter approved, 14
Meters in Russia, Electric, 394
Metric system, The, 831
Metropolitan Association of Electric Tramway Managers, 603
Mills, The case for the electrification of flour, by E. P. Hollis, 123
Miners' dispute, 255
Miners' lamps, Approved, 895
Mines, Battery-bell signalling systems in, 816, 848, 881
Mines, Electricity in, 487
Mines, Electric lamps in, 153
Mining, Electricity applied to, by C. P. Sparks, 340, 375, 419, 454, 491
Mining installation, A South Wales, 388
Minister of Commerce, A, 652
Mobilisation of science, The, 846, 862
Modern methods of electrical wiring, by D. S. Munro, 266
Modern wiring work, particularly in bad situations, by H. C. Tofield, 168, 204, 264
Molybdenum from Australia, 553
Monopoly, Petrograd electricity: proposed, 255
Moral law, Neutrality and the, 273
Motor searchlight plant, A, 773
Motor vans, G.V. electric, 500
Municipal authorities and coal supplies (see under Coal Supplies)
Municipal Electrical Association, The Incorporated, 310, 322, 478, 794, 830, 879, 902

Municipal finance, 386
Municipal service, The use of electric vehicles in, by F. Ayton, 904
Municipal stores: The need for organised buying, 552
Municipalisation of electricity, Russia and, 477, 640, 861
Municipalisation of the Berlin electricity works, 404
Municipalisation, Russian views on, 640
Municipalities and the purchase of tramway undertakings, 908

NATIONAL electrical code and British wiring rules compared, by F. Broadbent, 121, 134
National electrical code revised, The, by F. Broadbent, 643
National electrical week, 323
National Physical Laboratory, 895
National trade policy, 130
Neutrality and the moral law, 273
"Neutrals," Trading with, 847, 863

NEW COMPANIES—
  Acton Battery Co., 18
  Anglo-Burmah Wolfram Syndicate, 699
  Anglo-Chinese Engineers' Association, 766
  Ardee Electric Co., 625
  Barraclough Bros., 864
  Barwell & Co. (Lighting), J., 18
  Bedale and District Electric Supply Co., 53
  Britannic Electrical Co., 18
  British Bachelet Ordnance Co., 803
  Buttevant Electric Co., 864
  Caerphilly Electric Supply Co., 155
  Carter, H. D., 479
  Cinema Supplies, 155
  Cork and District Electric Supply Co., 479
  Crombie's Patents, 593
  Devon & Cornwall Acetylene Co., 53
  Drycells, 405
  East Lancashire Electrical Co. (Accrington), 625
  East London Electric Co., 324
  Ecco Battery Co., 766
  Elbren Metallising Co. (1915), 555
  Electrical Supplies Co., 224
  Electrical Wholesalers' Federation, 663
  Electric Lamp Factors, 186
  Electrodes, 324
  Electro Galvanizers, 53
  Elieson Electric Traction Co., 187
  Fallolite, 555
  Ferguson, Pailin & Co., 663
  Free Wire Light Co., 864
  Fuller's Wire and Cable Co., 864
  Gardner & Co., B. T., 53
  Garstang, H., 864
  General Cable Manufacturing Co., 766
  Goodwin & Co., S., 118
  Gwalchmai Electricity Supply Co., 18
  Halliwell & Co., 766
  Highfield Syndicate, 766
  Holme Electric Co., 766
  Kaywright Engineering Co., 224
  London Telephone (New System) Co., 897
  Lyon & Wrench, A., 224
  Manley & Sandy (1915), 441
  Mico, 803
  Midhurst & District Electric Supply Co., 88
  Mid-Somerset Electric Supply Co., 441
  M-L. Magneto Syndicate, 294
  Newcastle West and District Electric Light & Power Co., 555
  Newton Brothers (Derby), 441
  Nordisk Electrical Power Co., 832
  North British Electrical Co., 897
  Pearn & Co., H. L. V., 593
  Pearson's Electric Miners' Lamp Co., 593
  Perfection Light Co., 88
  Polden & Co., F., 699
  Poulsen Wireless Telegraph Co., 803
  Pullan Engineering Co., 53
  Radio Electric Lamp Co., 555
  Raybould & Co., W. E., 118
  Robinson & Co., A., 187
  Roto Engineering Co. (Bradford), 479
  Salsbury Co., 555
  Seear, Scott & Co., 441
  Semple & Co., 803
  Simplex Sleeper Syndicate, 734
  Smith & Mortimer, 324
  Southdown Motor Services, 832
  Sperry Gyroscope Co., 187
  Spicer & Co., 224
  Standard Insulator Co., 224
  Standard Woodwork Manufacturing Co., 18
  Strand Electric Supply Co., 53
  Sunlight Manufacturing Co., 405
  Surrey Electrical Co., 324
  Synd, D. & M. (Hollister's Patents), 88
  Tungsten, 441
  Tyneside Alloys, 699
  Wadebridge & District Electric Supply Co., 53
  Wilson's Patent Noiseless Winch Co., 324

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT—
  Adapter for small cooking apparatus, 108
  "Amanco" electric lighting sets, 887
  Anti-aircraft searchlight, 391
  Automatic lamp cell charging apparatus, 247
  Benjamin half-watt fittings, 648

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT—*continued.*
  Beuttell fittings, 173
  "Brilliant" suction cleaner, The, 430
  British Thomson-Houston automobile accessories, 756
  British Thomson-Houston electric fans, 612
  British Thomson-Houston "Eye-Rest" fittings, 95
  British Thomson-Houston half-watt fittings, 647
  British Thomson-Houston loom motors, 684
  Country house lighting sets, 391
  Country lantern, 95
  Credenda electric heating and ventilation, 276
  Dictograph, The, 469
  Direct-current motors, New, 172
  Ediswan fan and "Dimmer" switch, 248
  Ediswan half-watt lamp fittings, 142
  Electrically-driven cloth printing machine, 612
  Electrically-operated carriage-drive gates, 611
  Electric lighting of ambulance trains in France, 613
  Electro-medical apparatus, 430
  Firadanac mining switchgear, The 576
  General Electric Co. explosion-proof switchgear, 468
  General Electric Co. extensible swing brackets, 207
  General Electric Co. ironclad house-service set, 95
  General Electric Co. opal shades, 64
  Glassware to give sunlight colour value, 530
  Hand-grinding machine, Electric, 173
  Heating surface for Lancashire boilers, Extra, 379
  Henley fuse-boxes, 108
  Higgs motors, 544
  High-power, high-pressure water rheostat, 544
  Homonolith, 378
  H.O. switch lampholder, 849
  Igranic electric vehicle controllers, 378
  Immersion heater, 173
  Inching starter, E.A.C., 141
  Indicator movements, 888
  Interlocking switch plug, 143
  Ironclad distribution fuseboards, 208
  Ironclad switch, New, 9, 391, 647
  Jower's protective leakage device, 63
  Kasenoid, 469
  Kitchen in Derby, An electric, 276
  Ladder, New, 173
  Lamp suspension, New, 10
  Lektrik ceiling roses, 142
  Lock-out contactor, The, 718
  Magnetic separator, New, 142
  Mazdalux reflectors, 380
  Naylorgraph, The, 612
  Ozonair water steriliser, 820
  Paragon earthing cone, 173
  Parsons paraffin motor, A, 530
  "Presto" hand-lamp, 208
  Quarter-turn rod coupling, 248
  Railway carriage lighting, 810
  Railway construction lighting plant, 392
  Reactive-factor meter, 64
  Reflector, New street lighting, 63
  "Refractor" globe, Holophane, 9
  Renewing tungsten lamps, 821
  Rifle flashlight, 143
  Rolling mill, An electrically-driven, 141
  Rotary pumps, 379
  Roto-drum pumps, 820
  Runbaken ignition magneto, The, 248
  "Salford" switches, Unit system of, 10
  Series lighting system, A, 172
  Shop window reflectors, 577, 647
  Simplex radiators, 208
  Spinning extraordinary, 757
  Spring inspection fitting, 684
  Steering-wheel, Electrically heated grip for, 577
  Street lighting fitting, 109
  "Switch-off" labels, 888
  Terminal for portable accumulator, 719
  Tide gauge, 810
  Tucker tumbler switch, New, 849
  Vacuum tubes for telephone line protection, 544
  Variable speed A.C. commutator motors, 576
  Verity's fixtures, 108
  Weights and measures computer, 378
  "Witton" field regulators, 378
  "Witton" handguard cut-outs, 849
  "Witton" main regulator, 757
  "Witton" multiple switch starters, 821
  "Witton" tramway sectioning switch, 684

New South Wales Government power station, The, 103
New York Show, Electric cars and accessories at the, 221
New York, The new turbine plant of the Interborough Co., 840
New Zealand, 613, 687
New Zealand, Trade of, 41, 57
New Zealand, Water Power in, 861
Nigeria, British trade with, 356
Nile, An electrical bridge over the Blue, 552
Nitrogen furnaces, Electric, 166, 191
Nitrogen, Norwegian, 127
Norway, 177
Norway, Foreign concessions in, 337
Norwegian aluminium industry, The, 17

OBITUARY—
  Adams, Prof. W. G., 555
  Albright, J. F., 18
  Allen, W. E., 186
  Anson, J. W., 896
  Bulloch, Wm., 223
  Bonnett, C., 864
  Byng, Sec.-Lieut. H. G., 799
  Chapman, E., 255
  Charlton, T., 896
  Claxton, R. H., 294
  Cloete, B., 734
  Crossley, Lieut. Brian, 758
  Davy, M. G., 766
  Donald, J. A., 294
  Drake, A., 699
  Drummond, A. L. J., 864
  Dugdale, R., 324
  Fall, D., 699
  Farmer, F. W., 294
  Ford, H. H., 803
  Franklin, Wm., 593
  Friedrichs, H. F., 699, 734
  Garbutt, H., 364
  Godby, H. A., 405
  Gordon, W., 803
  Gorer, 699
  Hawkins, H. C., 699
  Hiller, Herr M., 555
  Hoare, C. E., 864
  Holliday, C., 324
  Hollingworth, Lieut.-Col. Geo., 441
  Honison, J., 53
  Ickringill, A. J., 223
  Jent, M. H., 663
  Jones, Dr. H. L., 517
  Keen, A., 223
  Lamb, Sir J. C., 517
  Lawson, Sir A. J., 832
  Lawson, F. W., 323
  Lege, M. Jean A., 555
  Leonard, H. W., 405
  Ljungberg, E. J., 593
  Long, W., 294
  Lowe, F., 864
  MacLellan, J. A., 593
  Martin, M. P., 766
  Matthews, G., 294
  Matthews, H. M., 592
  Maurice, G., 699, 733
  McIlveen, W. O., 832
  Medway, M. T., 478
  Moffett, Sec.-Lieut. J. L., 405
  Morton, W., 155
  Naylor, J. S., 699
  Page, Major S. Flood, 555
  Pearson, F. S., 699
  Pollard, 405
  Proctor, J. W., 294
  Rathenau, Herr E., 896
  Ritchie, R. O., 186
  Robinson, Prof. H., 478
  Smith, D., 555, 593
  Smith Saville, R. W., 832
  Stegman, G., 53
  Stokes, M., 88
  Sumner, F., 18
  Swinyard, T., 405
  Toon, Lance-Sergt. Frank, 118
  Traynor, M., 294
  Tresilian, R. S., 803
  Tuke, R., 517
  Vignoles, L. U., 555
  Waddon, J.P., J. H., 223
  Walmesley, J., 896
  Whensa-Nicholl, C., 18
  Whittaker, E., 832
  Woolcombe, B. N., 323
  Wright, J., 88

OFFICIAL RETURNS—
  Abingdon Electric Supply Co., 88
  Adelaide Electric Supply Co., 364
  Altrincham Electric Supply, 864
  Amazon Telegraph Co., 155
  Atlas Carbon and Battery Co., 864
  Auckland Electric Tramways Co., 441
  Auto-electric Transmission, 699
  Barbados Electric Supply Corporation, 734
  Bastian Meter Co., 864
  Beck & Moss, 864
  Birkdale District Electric Supply Co., 864
  Bishopscastle Electric Light & Power Co., 324
  Blackwell & Co., R. W., 364
  Bombay Electric Supply & Tramways Co., 294
  Bournemouth and Poole Electricity Supply Co., 833
  Bourton-on-the-Water Electric Light and Power Co., 255
  Brilliant Arc Lamp & Engineering Co., 119, 441
  Brilliant Sign Co. (1907), 767
  British Battery Co., 767, 897
  British Electric Automatic Machines, 699
  British Electric Transformer Co., 833
  British Insulated & Helsby Cables, 833
  British L. M. Ericsson Manufacturing Co., 699
  British Mica Co., 864
  Bromley (Kent) Electric Light and Power Co., 803
  Brompton and Kensington Electricity Supply Co., 833
  Burmah Electric Tramways & Lighting Co., 364
  Burnham & District Electric Supply Co., 255
  [illegible] Electric Supply Co., 441
  [illegible] Electric Railway and Power Co., 405
  [illegible] & Power Co., 441, 556, 734, 864
  Charing Cross, West End & City Electricity Supply Co., 625
  Chelsea Electricity Supply Co., 803

OFFICIAL RETURNS—*continued.*
  City of London Electric Lighting Co., 803
  City of Oxford Electric Tramways, 119
  Coast Development Corporation, 555, 767
  Coatbridge and Airdrie Electric Supply Co., 18, 155
  Cordoba Light, Power & Traction Co., 294
  Corona Lamp Works, 479
  Costa Rica Electric Light & Traction Co., 294
  County of Dorset Electric Supply Co., 441
  County of London Electric Supply Co., 833
  Creed, Bille & Co., 364
  Cryselco, 803
  Cunningham, 18
  Curtis & Co., 405
  Derby Lamp Works, 555
  Direct Spanish Telegraph Co., 625
  Drake & Gorham, 187
  Duram, 832
  Eastern & South African Telegraph Co., 833
  East India Tramways Co., 187
  Edison Accumulators, 405
  Electrical (Installations), 18
  Electrical Distribution of Yorkshire, 803
  Electric Reduction Co., 441, 593
  Electric Zinc Co., 699
  Electro-Mechanical Brake Co., 89, 324
  Ely Valley Lighting Co., 89
  E. S. Co., 364, 402
  Ferranti, 224
  Flather & Co., 555
  Flexible Wheels, 441
  Foster & Co., H. F., 556
  Foster & Pullen, 767
  Foster Engineering Co., 294, 405
  Frinton-on-Sea and District Electric Light & Power Co., 89
  General Accessories Co., 89
  Gosport and Alverstoke Electric Lighting Co., 224
  Harrow Electric Light & Power Co., 734
  Hellyar & Sons, 699
  Henley's Telegraph Works Co., W. T., 625
  Holophane, 294
  India-Rubber, Gutta-Percha and Telegraph Works Co., 441
  Isle of Wight Electric Light & Power Co., 734
  Jarrow and District Electric Traction Co., 699
  Keith & Blackman Co., J., 118, 119, 803
  Kensington and Knightsbridge Electric Lighting Co., 699
  Kesnor & Co., T., 187
  Kingolite Co., 832
  Lamp Manufacturing Co., 556
  London Electric Supply Corp., 556
  Madras Electric Tramways (1904), 833
  Mather & Platt, 699
  Maud & Turner, 89
  Maxim Lamp Works, 89, 118
  Melton Mowbray Electric Light Co., 699
  Metropolitan Electric Supply Co., 833
  Midget Lamp Co., 593, 803
  Mond Nickel Co., 294
  Monte Video Telephone Co., 187
  Montreal Tramways & Power Co., 556
  Musselburgh and District Electric Light & Traction Co., 119
  National Telewriter Co., 364
  Navaltum, 864
  Naylorgraph, 479
  Newcastle and District Electric Lighting Co., 699
  Newcastle-upon-Tyne Electric Supply Co., 405, 479
  Newtons, 734
  Northampton Electric Light & Power Co., 803
  North-Eastern Electric Smelting Co., 53, 699
  Northwich Electric Supply Co., 833
  Notting Hill Electric Lighting Co., 625
  Novelty Construction Co., 734
  Oriental Telephone & Electric Co., 155, 699
  Oswestry Electric Lighting & Power Co., 734
  Ozonair, 897
  [illegible], 224
  Pernambuco Tramways & Power Co., 18, 734
  Phœnix Electric Heating Co. (1914), 734
  Printex Accumulator Co., 119
  Prismatic Arc Signs, 119
  Provincial Tramways Co., 224
  Railless Electric Traction Co., 255
  Rangoon Electric Tramway & Supply Co., 405
  Rawlings Bros., 803
  Resisto-Electrical Manufacturing Co., [illegible]
  Rhondda Tramways Co., 53, 479
  Royce, 88
  St. Helens Cable & Rubber Co., 224
  St. James' and Pall Mall Electric Light Co., 441
  Sax & Co., J., 53
  [illegible] and District Electric Supply Co., 555
  Sheerness and District Electric Power and Traction Co., 294
  Shipston Electrical Co., 324
  South Metropolitan Electric Light & Power Co., 897
  Spagnoletti, 155
  Spencer, J., 294, 324

Official Returns—*continued.*
  Spensers, 155
  Stearn Electric Lamp Co., 53
  Stella Conduit Co., 734
  Sterling Telephone & Electric Co., 405
  Suffolk Electricity Supply Co., 88
  Sun Electrical Co., 294, 324
  Suppliers' Construction Co., 324
  Telegraph Construction & Maintenance Co., 556
  Telephone Company of Egypt, 155, 625, 803
  Telephone Development Co. (1912), 53
  Torquay Electric Light & Power Co., 255
  Torquay Tramways Co., 118, 734
  Turner & Co., G. H., 555, 699
  United Electric Car Co., 255
  Universal [illegible] Cables, 767
  Universal Electric Contracts, 53
  Veritys, 118
  [illegible] and District Electric Supply Co., 155
  Walsall Electrical Co., 255
  Wardle Engineering Co., 89
  Waste Heat & Gas Electrical Generating Stations, 625
  Wellingborough Electric Supply Co., 294
  Westminster Electric Supply Corporation, 441
  Wycombe Borough Electric Light and Power Co., 767

Oil-electric barges, 712
Oil fuel difficulties, Petrograd electric station, 733
Ontario Hydro-electric Commission, The report of the, 873
Organisation, Industrial, 385
Output and cost, Load factor, by C. A. Baker, 775, 808, 841
Output, Increasing the, 813
Ovens, Economic operation of electric, by P. W. Gumaer, 871
Ovens, Thermal insulation tests of electric, 762
Overseas trade, Wire manufacturers and development of the, 536
Oxygen, Electrolytic production of, 203

PANAMA Canal locks, Electric towing system for the, 464

Parliamentary
  Aberdare tramways, 649
  Dewsbury Corporation Bill, 591
  Doncaster Corporation Bill, 86, 185
  Electric Lighting Provisional Order (No. 2) Bill, 683
  Electric Railways (Facilities) Bill, 683
  Expenditure under electrical Private Bills, 73
  Halifax Corporation Bill, 614
  Irish Electric Lighting Orders, 683
  Lincoln Corporation Bill, 683
  London County Council's Tramways Bill, 293
  London Electric Supply, 254
  London Electric Supply (No. 2) Bill, 293
  Opposition to Private Bills, 254
  Petitions, 293
  Plymouth Corporation Bill, 683
  Second Readings, 293, 323
  Sheffield and Rotherham Tramways, 591
  South Shields Corporation Bill, 86, 185, 614
  Standing Orders, 86, 185, 254, 293
  Yorkshire Electric Power Bill, 649

Patent applications, 144, 790
Patent restoration, 652
Patents and alien enemies, 29, 126, 185, 222, 255, 288, 321, 363, 402, 438, 552, 662, 727, 830, 861
Patents in 1914, 499
Patents, New, and Published specifications, 32, 64, 96, 128, 164, 200, 236, 272, 308, 344, 384, 424, 460, 496, 532, 568, 604, 640, 676, 712, 748, 780, 812, 844, 876, 908
Patents owned by alien enemies, Electrical, 271
Patents, Tungsten wire, 373
Peru, Import trade of, 902
Petrograd electricity: Proposed monopoly, 255
Petrograd electric station: Oil fuel difficulties, 733
Philippine Islands, 824
Photographers, A lesson to, 554
Pliotron in wireless telegraphy and telephony, The, 753
Pocket torches, 363
Point Five tariff, The practical result of the, by A. S. Blackman and T. Roles, 853, 903
Policy announced, A Government, 713
Polyphase commutator machines and their application, by N. Shuttleworth, 244, 302
Portable electrical workshops, 17
Port Glasgow from Greenock, The electricity supply to, 289
Potentiometer rheostats, and rheostats with protective resistance, by L. Boothman, 427
Power from sawdust, 552
"Powerful light" defined, 322
Power house, Temperature measurement in a modern, by Chas. S. Jeffrey, 523
Power measurement by the two-wattmeter method, Correcting errors in, 562
Power on the Rand, Electric, 569
Power plant testing, by W. M. Selvey, 669
Power station, The N.S.W. Government, 103
Power supply of the Central Mining Rand Mines Group, The, by J. H. Rider, 585, 633, 670, 705, 745, 779
Precipitation of smoke and fumes, The electrical, 679
Preferential rates, 86, 99, 438, 499
Prentice "Lightning" cooker, The, 617
Press, Engineers and the technical, 202
Press, The engineering trade and the, 210
Pressure wave in electrical machinery, The shape of the, by Dr. S. P. Smith and R. S. H. Boulding, 195
Prices, Advances in, 393, 433, 581, 687
Prices, L.C.C. contract, 652
Prices to profits, The relation of supply, 253
Pritchett & Gold and Electrical Power Storage Co., 855
Private arrangements, 14, 76, 111, 144, 178, 393, 473, 479, 511, 616, 652, 688, 723, 789, 855, 889
Professional Conduct, 846
Quackery, War and, 847

Proceedings of Societies and Institutions—
  Automatic protective switchgear for alternating-current systems, by E. B. Wedmore, 37, 92, 456
  Bell signalling in collieries, Electric, by T. G. Watts, 30
  Bombay hydro-electric scheme, The, by A. Dickinson, 657, 707, 780
  Breakdowns, Diesel engine, 456
  Breakdowns in colliery electrical plant, by L. Foster, 198
  Cables, by C. J. Beaver, 230
  Cab signals on British railways, by V. L. Raven, 125; by W. A. Stanier, 161; by W. Willox, 160
  Collieries, Electric bell signalling in, by T. G. Watts, 30
  Commissioners, Scientific and technical, by W. P. Digby, 819
  Commutator machines and their application, Polyphase, by N. Shuttleworth, 244, 302
  Cooking (Point Fives), Electric heating and, 197
  Cooking, Electric heating and, by R. Weaving, 280; W. R. Cooper, 417, 528, 567
  Diesel engine breakdowns, 456
  Electrical driving in the woollen trade, by J. F. Crowley, 6
  Electricity applied to mining, by C. P. Sparks, 340, 375, 419, 454, 491
  Engineering, Training for the industrial side of, by A. P. M. Fleming, 337, 374
  Field coils, Distribution and rise of temperature in, by Prof. M. Maclean, D. J. Mackellar, and R. S. Begg, 279
  Furnaces, Electric steel-making, by T. D. Robertson, 233
  Generating plant, Private, by A. H. Dykes, 531
  Good lighting and its effects, by V. H. Mackinney, 610
  Hardening of metals, The, 128
  Heating and cooking, Electric, by R. Weaving, 280; W. R. Cooper, 417, 528, 567
  Heating and cooking (Point Fives), Electric, 197
  India, Electric power in, by H. R. Speyer, 774, 807
  Industrial side of engineering, Training for the, by A. P. M. Fleming, 337, 374
  Institution of Electrical Engineers: Annual report, 747; Annual meeting, 812
  Institution of Electrical Engineers (Yorkshire Local Section), 7
  Iron, The magnetisation of, by J. S. Nicholson, 109
  Lamps, The practical rating of electric incandescent, by F. W. Willcox, 457
  Lighting and its effects, Good, by V. H. Mackinney, 610
  Magnetisation of iron, The, by J. S Nicholson, 109
  Main-line signalling on railways, by W. C. Acfield, 565
  Measurement of wireless signals, by Prof. E. W. Marchant, 636
  Metals, The hardening of, 128
  Mining, Electricity applied to, by C. P. Sparks, 340, 375, 419, 454, 491
  Modern methods of electrical wiring, by D. S. Munro, 266
  Municipal service, The use of electric vehicles in, by F. Ayton, 904
  Point Five tariff, The practical result of the, by A. S. Blackman and T. Roles, 853, 903
  Polyphase commutator machines and their application, by N. Shuttleworth, 244, 302
  Power plant testing, by W. M. Selvey, 669
  Power supply of the Central Mining-Rand Mines Group, The, by J. H. Rider, 585, 633, 670, 705, 745, 779
  Pressure wave in electrical machinery, The shape of the, by Dr. S. P. Smith and R. S. H. Boulding, 195
  Private generating plant, by A. H. Dykes, 531
  Railways, Cab signals on British, by V. L. Raven, 125; by W. A. Stanier, 161; by W. Willox, 161
  Railways, Main-line signalling on, by W. C. Acfield, 565, 599
  Rand Mines Group, The power supply of the Central Mining-, by J. H. Rider, 585, 633, 670, 705, 745, 779

Proceedings of Societies and Institutions—*continued.*
  Rating of electric incandescent lamps, The practical, by F. W. Willcox
  Result of the point five tariff, The practical, by A. S. Blackman and T. Roles, 853, 903
  Rontgen Society, The, 209, 383, 818
  Scientific and technical commissioners, by W. P. Digby, 819
  Searchlights, The development and application of, 163
  Shape of the pressure wave in electrical machinery, The, by Dr. S. P. Smith and R. S. H. Boulding, 195
  Signalling in collieries, Electric bell, by T. G. Watts, 30
  Signalling on railways, Main-line, by W. C. Acfield, 565, 599
  Signals, Conditions affecting the variations in strength of wireless, by Prof. E. W. Marchant, 267, 276
  Signals on British railways, Cab, by V. L. Raven, 125; by W. A. Stanier, 161, by W. Willox, 161
  Solar energy, Utilisation of, by A. S. E. Ackermann, 675
  Steel-making furnaces, Electric, by T. D. Robertson, 233
  Switchgear for alternating-current systems, Automatic protective, by E. B. Wedmore, 37, 92, 456
  Telephone troubles in the Tropics, by W. L. Preece, 508, 561
  Temperature in field coils, Distribution and rise of, by Prof. M. Maclean, D. J. Mackellar, and R. S. Begg, 279
  Testing, Power plant, by W. M. Selvey, 669
  Train dispatching by wireless, by L. B. Foley, 602
  Training for the industrial side of engineering, by A. P. M. Fleming, 337, 374
  Tropics, Telephone troubles in the, by W. L. Preece, 508, 561
  Vehicles in municipal service, The use of electric, by F. Ayton, 904
  Visibility, Practical aspects of, 748
  Water-power, Utilisation of, by "A Surveyor," 493
  Wave in electrical machinery, The shape of the pressure, by Dr. S. P. Smith and R. S. H. Boulding 195
  Wireless call devices, by L. B. Turner, 817
  Wireless signals, Conditions affecting the variations in strength of, by Prof. E. W. Marchant, 267, 276
  Wireless signals, Measurement of, by Prof. E. W. Marchant, 637
  Wireless, Train dispatching by, by L. B. Foley, 602
  Wiring, Modern methods of electrical, by D. S. Munro, 266
  Woollen trade, Electrical driving in the, by J. F. Crowley, 6

Profession, Technical teaching as a, by "A Teacher," 68
Profits, The relation of supply prices to, 253
Projectiles by A.C. electromagnet, Locating, 711
Projectors, Searchlight, by C. W. Denny, 348, 413
Promotion of the electrical trade, The, 28

Prospectuses
  Cornwall Electric Power Co., The, 805
  South Metropolitan Electric Light and Power Co., 805

Prosperity week, Electrical, 592
Publicity—the soul of business, by E P. Bennett, 674
Puget Sound lines of the Chicago, Milwaukee, and St. Paul Railway, 3,000-volt D.C. electrification of the, 231
Purification of coal gas, Electricity in the, 69

RADIOSCOPIC process for localising bullets, A new, 669
Radium, 154
Radium factory, Scottish, 438
Radium hospital, 53
Rail manufacture in Australia, 72
Railway collision, The Smithy Bridge, 749
Railway levitated, A, 87

Railway Notes—
  Argentina, 113
  Australia, 284, 396
  Brighton Railway electrification, 285
  Buenos Aires Underground Railway, 113
  Canada, 285
  Chile, 396
  Clayton-le-Moors, 218
  Continental, 49, 83, 151, 180, 285, 620, 760
  Glasgow, 114
  India, 181
  Italy, 49, 83, 151
  Lancashire & Yorkshire Railway electrification, 251
  London, 181, 219, 251, 690
  London Electric Railway Companies' Facilities Bill, 725
  Mansfield, 251
  Nelson, 655
  North-Eastern Railway electrification, 251
  North London Railway electrification, 319

Railway Notes—*continued.*
  North-Western electrification, 319
  Norway, 180
  Quarry Bank, 858
  Post Office Tube flooded, 549
  St. Helens, 84
  South Africa, 219
  South-Western Railway electrification, 319
  Spain 760
  Switzerland, 285, 620
  United States, 49, 792
  Venezuela, 725
  West Sussex, 87

Railway, The Swedish iron ore, 439
Railways, Cab signals on British, by V. L. Raven, 125; by W. A. Stanier, 161; by W. Willox, 161
Railways, Main-line signalling on, by W. C. Acfield, 565, 599
Rand, Anti-German riots on the, 862
Rand, Electricity on the, 227
Rand, Electric power on the, 569
Rand Mines Group, The power supply of the Central Mining-, by J. H. Rider, 585, 633, 670, 705, 745, 779
Rat, A too-enterprising, 552
Rates, Preferential, 86, 99, 438, 499
Rathenau foundation, A, 322
Rating, Electric lighting authorities and the law of, 102, 133
Rating of electric incandescent lamps, The practical, by F. W. Willcox, 457
Rational rating for filament lamps, by S. M. Powell, 631
Rays, New, 831
Reactances, Feeder, 362
Recruiting, Central station men and, 624
Rectifier, The Kenotron, 643, 644
Regent Palace Hotel, The, 879
Regulation of a hydro-electric plant in India, Hand, by J. W. Meares, 275
Reinforced concrete, 81
Relatives, Electricity committee-men and their, 662
Relief measures taken by Berlin electrical engineers, 87
Resistances, Some notes on shunt regulating, by T. Carter, 716, 752, 800
Responsibilities of directors, 814
Restraint of trade, 536
Result of the Point Five tariff, The practical, by A. S. Blackman and T. Roles, 853
Review of 1914, 1

Reviews—
  Alternating current electricity, by W. H. Timbie and H. H. Higbie, 177
  Aluminium: Facts and figures, 12
  American Electricians' Handbook, by T. Croft, 598
  American Handbook for Electrical Engineers, by H. Pender, 598
  Anleitung zum Bau Elektrischer Haustelegraphen Telephon Kontrol und Blitzableiter Anlagen, 44
  Annuaire de l'Electricité, 356
  Annuaire pour l'An 1915, 581
  Boilers, Economisers and Superheaters, by R. H. Smith, 525
  British Standard Specification for Portland Cement, 546
  Brown's Marine Electrician for Seagoing Engineers, by A. E. and A. H. Larkman, 280
  Business Prospects in India, by A. T. Stewart, 432
  Business Prospects in Russia, by A. T. Stewart, 394
  Clock Repairing and Making, by F. J. Garrard, 490
  Colliery Manager's Pocket Book and Diary for 1915, 214
  Drawing for Electrical Engineers, by G. W. Worrall, 526
  Dynamo and Electric Motor Building, by A. H. Avery, 490
  Electrical Engineering in India, by J. W. Meares, 823
  Electrical Engineer's Diary for 1915, 76
  Electrical Practice in Collieries, by D. Burns, 561
  Electric Bells, Alarms and Signalling Systems, by H. G. White, 800
  Electric Cooking, Heating, Cleaning, etc., by "Housewife" (Maud Lancaster), 205
  Electric Furnace, The, by Dr. A. Stansfield, 823
  Electric Mine Signalling Installations, by G. W. L. Paterson, 860
  Electric Wiremen's Work, by J. H. Havelock, 44
  Electron Theory of Matter, The, by Prof. O. W. Richardson, 560
  Engineer's Year-Book of Formulæ, Rules, Tables, Data, etc., by H. R. Kempe, 316
  Experiments, by P. E. Edelman, 400
  First Principles of Production, 617
  High-speed Telegraphy, 111
  How to Cook by Electricity, by A. Cross and A. Waterman, 723
  Key to the London Telephone Directory, 581
  Kinematograph Year Book, Diary and Directory for 1915, 76
  Laboratory Course in Electrochemistry, by O. P. Watts, 599
  Light, Radiation and Illumination, by P. Högner, 45
  Lockwood's Builders' and Contractors' Price-book, 214
  Logarithm Table, Improved Four-Figure, by G. C. McLaren, 652
  Magnets and Electric Currents, by J. A. Fleming, 76

REVIEWS—*continued.*
  Micrometers, by A. W. Marshall and G. Gentry, 789
  Model Answers to Test Questions in Wireless Telegraphy, 860
  Model Power Boats, by E. W. Hobbs, 651
  Morse, Samuel F. B.: His Letters and Journals, by E. L. Morse, 489
  Motion Picture Operation: Stage Electrics and Illusions, by H. C. Horstman and V. H. Tousley, 205
  Polyphase Currents, by A. Still, 799
  Practical Electrician's Pocket-book and Diary, 47
  Practical Engineer Electrical Pocket-book and Diary, 177
  Principles of Electrical Measurement, by A. W. Smith, 526
  Reid's Handy Colliery Guide, 652
  Sell's Directory of Registered Telegraphic Addresses, 282
  Spon's Architects' and Builders' Pocket Price Book, 214
  Submarines, Torpedoes and Mines, by W. E. Dommett, 581
  Tables Annuelles de Constantes et Données Numériques, 432
  Telegraphy—Preece and Sivewright, revised by W. L. Preece, 401
  Test Questions in Wireless Telegraphy, 44
  Underwar, The, by A. G. Whyte and T. C. Elder, 560
  Universal Electrical Directory, 546
  Whitaker's Almanack for 1915, 12
  Willing's Press Guide for 1915, 76
  Wireless Telegraphy, by R. Stanley, 400
Rheostatic control of separately excited generators, The, by L. Boothman, 673
Rheostats, and rheostats with protective resistance, Potentiometer, by L. Boothman, 427
Rifle League, Electricity Supply, 118
Rifle ranges, Miniature, 476
Riots on the Rand, Anti-German, 862
Rontgen Society, The, 209, 383, 818
Ropeway for automatic disposal of ashes, Aerial wire, 502
Roumanian petroleum industry, Electricity in the, 590
Rubber, 35, 132, 239, 347, 462, 570, 678, 782, 878
Rules for electrical machinery, B.E.A.M.A. standardisation, 742
Rules, Standardisation, 714
Russia, 13, 283, 346, 824
Russia and electric lamp production, 347
Russia and German firms, 99
Russia and municipalisation of electricity, 477, 640, 861
Russia, Electric meters in, 394
Russia, German electrical concessions in, 605
Russia, Lead scarcity in, 733
Russian architects and electricity, 553
Russian churches, Ban on electricity in, 354
Russian copper production in 1914, 552
Russian Customs duties on electrotechnical products and on their raw materials, 563
Russian electrical affairs: German influence in the past, 101
Russian electrical industry: German control, 807
Russian electrical trade, 215, 394
Russian equivalent tables, 316
Russian Government and German interests in supply works, The, 570
Russian hydro-electric power, 440
Russian manufacturing, The promotion of, 347
Russian market, An Italian view of the, 617
Russian market, The, 213
Russian trade and electrical prospects, 415, 452
Russia's copper production, 57
Russia's importation of electrical goods, 228
Rust, Removal of, 764

SALFORD electricity works, Recent developments at the, 79
Sawdust, Electricity from, 154, 552
Science and finance, Industry, 497, 501
Science, The mobilisation of, 497, 846, 862
Scientific and technical commissioners, by W. P. Digby, 819
Scotland, Electrical industry in, 46
Searchlight plant, A motor, 773
Searchlight projectors, by C. W. Denny, 348, 413
Searchlight projector, The Beck, 571
Searchlights, The development and application of, 163
Selling side of electricity supply: I.—Showroom windows, 381; II.—An iron campaign, 388
Seville, 177
Shanghai, Electrical progress in, 896
Shape of the pressure wave in electrical machinery, The, by Dr. S. P. Smith and R. S. H. Boulding, 195
Showroom windows, The selling side of electricity-supply: 381
Shunt regulating resistances, Some notes on, by T. Carter, 716, 752, 800
Siam, 12, 393, 601
Siam, The electrical trade of, by "L. A. de M.," 241
Sick pay, Municipal employés', 384
Signalling at the "Mechanicals," Cab-, 97
Signalling in collieries, Electric bell, by T. G. Watts, 30
Signalling on railways, Main-line, by W. C. Acfield, 565, 599
Signalling systems in mines, Battery-bell, 816, 848, 881
Signals, Conditions affecting the variations in strength of wireless, by Prof. E. W. Marchant, 267, 276
Signals on British railways, Cab, by, V. L. Raven, 125; by W. A. Stanier, 161; by W. Willox, 161
Single and multiple ground-wire antennæ, 773
Smelting tin dross electrically, 661
Smithy Bridge railway collision, The, 749
Smoke and fumes, The electrical precipitation of, 679
Sodium, Electrolytic manufacture of, 639
Solar energy, Utilisation of, by A. S. E. Ackermann, 675
Soldering aluminium, 337, 831, 876
South Africa, 12, 384
South African winding accidents, 67
South America, A Swiss financial enterprise in, 191
South America, Electrical supply trade in, 506
South Shields, Electricity works extensions at, 693
South Wales mining installation, A., 388
Spain, 12, 45, 281
Spain, Battery manufacture in, 789
Spain, Shortage of electrical goods in, 214
Spain, Trade statistics of, 373
Spark, Ultra-violet rays from the oscillating, 640
Specification, A blank, 238
Specifications and new patents, Published, 32, 64, 96, 128, 164, 200, 236, 272, 308, 344, 384, 424, 460, 495, 532, 568, 604, 640, 676, 712, 748, 780, 812, 844, 876, 908
Standardisation of electric motor vehicles, 849
Standardisation of cooking and heating apparatus, 201
Standardisation rules, 714
Standardisation rules for electrical machinery, B.E.A.M.A., 742
Standards, Electrical, 722
Static electricity on a long transmission line, 554
Status of the engineer, The, 533
Stealing, Alleged, 433
Steamer, A new turbo-electric, 221
Steel-making furnaces, Electric, by T. D. Robertson, 233
Steel works, Electricity in U.S., 476
Storage, Notes on coal, 398
Stowmarket explosion, 698, 861
Stores: The need for organised buying, Municipal, 552
Straits Settlements, Trade statistics of the, 281
Street explosions, 878
Stresses in convex dished ends, 468
Strike, London electrical workers', Threatened, 521
Submarines, Batteries for, 650
Submarines, Main-motor-starting switchgear used on modern German, by N. H. Wood, 763
Super-Dreadnought "California," The electrically-propelled, 87
Supply, Electricity, 165
Surgery, Electricity in, 223
Surgery, Electromagnets in war, 553
Surgery, The telephone in, 194
Swansea electricity extensions, 573
Sweden and elsewhere, The telephone industry in, 62
Sweden, Copper famine in, 117
Sweden, Export trade of, 244
Sweden, Water-power utilisation in, 860
Swedish electrical exports, 323, 646, 772
Swedish iron ore railway, The, 439
Swiss electrical industry, The, 203
Swiss engineering and the war, 67
Swiss financial enterprise in South America, A, 191
Swiss Information Office, 316
Switchboard arrangement and equipment, Notes on, 91
Switchboard attendants, Shortage of, 591
Switchboard, Large glass, 57
Switchgear for alternating-current systems, Automatic protective, by E. B. Wedmore, 37, 92, 456
Switchgear used on modern German submarines, Main motor-starting, by N. H. Wood, 763
Switching, Some peculiar views on electric light, by W. P. Maycock, 711
Sydney contracts, 473
Sydney electricians, 624
Syndication methods in Germany, 99

TACHOGRAPH. Detecting production losses with a, 661
Tariffs on electrical goods, Foreign and Colonial, 32, 177, 344, 383, 424, 459, 568, 639, 674
Tasmania, 177, 213
Teaching as a profession, Technical, by "A Teacher," 68
Technical education in India, 744

TELEGRAPH NOTES—
  Adriatic cables cut, 858
  Argentina, 50, 792, 858
  Australia, 84, 114, 828
  Austro-Spanish wireless, 655
  Bolivia, 50
  Cable-cutting exploit, A daring, 436

TRAMWAY NOTES—*continued.*
  Cable rates reduced, 359
  Canada, 84, 584, 828
  Censorship of telegrams, 151
  Cheap telegrams for the Forces, 50
  China, 219, 252, 359, 828
  Direct telegraphy to Russia, 436
  Field telegraphs in East Africa, 84
  Fire alarms at Luton, 84
  Greece, 514
  High-speed cable-cutting, 514
  Hong-Kong, 621
  Illicit wireless installations, 16, 50, 84, 181, 219, 319, 621, 725, 858
  Imperial wireless chain, 319
  International Telegraphic Conference, 319
  Jamaica, 761
  Japan, 114, 475, 514
  Landing licences for Trans-Atlantic cables, 285
  Libya, 621
  New Atlantic cable, 728
  New cable, 219, 792
  North Sea cable, 792
  Norway, 151
  Pacific cable, 726, 828
  Panama Canal, 792
  Postal telegraph and telephones annual report, 514
  Re-transmission of cables, 691
  Russia, 84, 893
  San Francisco Exposition, 621
  San Marino, 84
  Secret wireless on board ship, 549
  South Africa, 726
  Spain, 655
  Special services in London, 223
  Spy, A telegraph, 792, 828
  Storm interruptions, 16, 50
  Straits Settlements, 792
  Telegrams for places abroad, 285
  Telegrams in code, 16, 319, 514
  Telegraphic Union, The, 181
  Telegraph messengers, 436
  Telegraph operators, 893
  Telegraph service, 621
  Time signals, 761
  Trans-Atlantic wireless, 828
  United States, 114, 181, 252, 584, 691, 828
  Uruguay, 792
  Week-end letter telegrams, 726
  Wireless amalgamation, 828
  Wireless antenna, A real, 219
  Wireless at Cape Cod, 655
  Wireless control ship, 359
  Wireless injunction, 828
  Wireless in warfare, 84
  Wireless on aeroplanes, 359
  Wireless on board ship, 726
  Wireless signalling on railways, 761
  Wireless telegraphists wanted, 475
  "Wireless" wire, 151

Telegraphy and telephony in 1914, 33
Telegraphy, Trans-Oceanic, 727
Telephone disservice, The, 715
Telephone industry in Sweden and elsewhere, The, 62
Telephone in surgery, The, 194

TELEPHONE NOTES—
  Accrington, 359
  Argentine, 396
  Australia, 828
  Automatic telephones, 219
  Basingstoke, 252
  Canada, 151
  China, 84
  France (Algeria), 858
  Grangemouth, 436
  Guernsey, 359
  Hull, 359
  London telephones, 285
  Long-distance telephony, 181, 219
  Norway, 436, 726
  Nottingham, 761
  Petrograd telephone system, 780
  Postal telegraphs and telephones annual report, 514
  Provision for telephones, 397
  Rawtenstall, 285
  Romford, 50
  Russia, 621, 655
  Spain, 893
  Storm interruptions, 16, 50
  Submarine telephones, 514
  Telephone progress, 584
  Telephone repeaters, 621
  Telephone service, The, 84, 114, 549
  Telephone tariffs, 359
  Telephonic interruptions, 151, 18
  Telephonic probe, A, 50
  Trans-Continental telephony, 285
  Turkey, 514
  United States, 114, 621
  Wireless telephony, 655

Telephone troubles in the Tropics, by W. L. Preece, 508, 561
Telephony and telegraphy in the field of war, 590
Telephony in 1914, Telegraphy and, 33
Telephony, Trans-Continental, 274
Temperature in field coils, Distribution and rise of, by Prof. M. Maclean, D. J. Mackellar, and R. S. [illegible], 279
Temperature measurement in a modern power house, by C. S. Jeffrey, 523
Testing, Power plant, by W. M. [illegible], 669
[illegible] Electrical [illegible], 862
[illegible], Gas engine [illegible]
[illegible] of electric [illegible] Thermal insulation, 762
[illegible] transmission [illegible] A [illegible], 887
[illegible] electric [illegible] the Port of [illegible], 717
[illegible], 147

Tin dross electrically, Smelting, 661
Tire guarantees, Electric vehicle, 624
Towing system for the Panama Canal locks, Electric, 464
Traction systems, Low-tension auxiliary supply in high-tension D.C., 221
Trade, American foreign, 652
Trade and electrical prospects, Russian, 415, 452
Trade, Colonial, 31
Trade, Foreign, in December, 88; January, 221; February, 361; March, 553; April, 692; May, 831
Trade, Foreign: "When in Rome —," 751
Trade in Canada, The position of engineering, 215
Trade in 1914, 13, 45
Trade in 1914, Foreign electrical, 76
Trade of New Zealand, 41, 57
Trade of Peru, Import, 902
Trade of Siam, The electrical, by "L. A. de M.," 241
Trade of Sweden, Export, 244
Trade openings in Buenos Ayres, 76
Trade policy, National, 130
Trade, Restraint of, 536
Trade statistics of Australia, 29
Trade statistics of Canada, 229
Trade statistics of Siam, 601
Trade statistics of Spain, 373
Trade statistics of the Straits Settlements, 281
Trade statistics of the United States, 321
Trade, The promotion of the electrical, 28
Trade, The war and future, 641
Trade war, The, 52
Trade with Australia, Our, 547
Trade with Canada, 356
Trade with Italy, 906
Trade with Nigeria, British, 356
Trading and industrial methods in Germany, 199
Trading with "Neutrals," 863
Train dispatching by wireless, by L. B. Foley, 602
Training for the industrial side of engineering, by A. P. M. Fleming, 337, 374

TRAMWAY NOTES—
  Aberdeen, 49, 150, 180, 218, 251, 396, 435, 549, 583, 857
  Accrington, 83, 690, 760
  Argentina, 150, 180
  Ashton-under-Lyne, 284, 396, 760, 827
  Australia, 15, 113, 284, 513, 791
  Barnes, 218, 583, 725
  Barnsley, 180
  Barrow, 180
  Belfast, 15, 49, 113, 396, 620
  Belgium, 725
  Bingley, 114
  Birkenhead, 583
  Birmingham, 285, 791
  Blackburn, 318, 654
  Blackpool, 151, 180, 285, 474, 620, 827
  Board of Trade tramway statistics, 218
  Bolivia, 218, 858
  Bolton, 318, 396, 513, 549, 725, 760, 792, 827, 857, 892
  Bournemouth, 83, 654
  Bradford, 83, 218, 248, 358, 620, 690, 725, 827
  Brazil, 513
  Brighouse, 49
  Bristol, 435, 513
  Burnley, 180, 760, 827
  Burton-on-Trent, 892
  Bury, 114, 218, 318, 358, 620, 654, 690
  Canada, 549
  Canary Islands, 620
  Cardiff, 83, 251, 620
  Cheadle and Gatley, 435
  Chester, 474, 654, 792
  Chile, 49, 114
  China, 396
  Clifton (Lincs.), 725
  Colne, 654
  Colwyn Bay, 15, 474
  Continental, 15, 83, 319, 396, 435, 474, 725, 858
  Coventry, 792
  Croydon, 151, 319. 725
  Darlington, 760
  Darwen, 690
  Derby, 49
  Dewsbury, 151
  Doncaster, 49, 218, 358, 827
  Dublin, 319
  Dundee, 114, 435, 654
  Dunfermline, 513
  Ealing, 396
  East Ham, 620, 725
  Eccles, 181, 655
  Edinburgh, 83, 180, 251, 285, 435, 474, 513, 549, 892
  Elland, 151
  Fife, 114
  France, 83
  Germany, 15
  Glasgow, 251, 359, 396, 435, 474, 583, 620, 690, 760, 792, 892
  Greenock, 892
  Halifax, 49, 83, 151, 181, 319, 513, 760
  Haslingden, 655
  Heywood, 83, 725, 892
  [illegible], 114, 251
  Hollingworth, 83
  Hove, 858
  Huddersfield, 49, 151, 251, 396, 620, 760
  Hull, 83, 285, 396, 474, 583, 792, 892
  Hyde, 114
  Ilford, 319, 396, 475, 583
  India, 760
  Ipswich, 725
  Italy, 83, 319, 396, 474, 858
  Japan, 760
  [illegible], 47

TRAMWAY NOTES—*continued.*
- Leeds, 285, 359, 589, 620, 655
- Leicester, 359
- Liverpool, 15, 435
- London, 15, 49, 151, 218, 285, 319, 359, 396, 435, 475, 583, 620, 655, 690, 725, 761, 792, 827, 858
- London County Council, 15, 151, 218, 251, 285, 435, 620, 725, 761, 792, 827, 858
- Lowestoft, 396
- Luton, 396
- Maltby, 83
- Manchester, 15, 181, 251, 396, 513, 549, 583, 620, 690, 761, 828
- Merthyr Tydfil, 218
- Morecambe, 285, 435
- Morley, 84
- Mossley, 114
- Musselburgh, 359, 435, 583
- Nelson, 219
- Newcastle-upon-Tyne, 84, 181, 285, 435, 513, 584, 620, 725, 792
- Northampton, 49, 251, 319, 858
- Nottingham, 84, 690
- Oldham, 475, 549, 690, 892
- Paisley, 725
- Plymouth, 151, 690
- Portsmouth, 513
- Preston, 114, 761
- Radcliffe, 584
- Ramsbottom, 792
- Rawtenstall, 620
- Reading, 584, 690
- Rhondda, 49, 151
- Rochdale, 181, 549, 620, 828, 892
- Rotherham, 151, 690
- Salford, 49, 475, 513, 620, 655, 690, 725, 761, 792
- Scarborough, 251
- Sheffield, 84, 359, 828
- South Africa, 435, 620, 761
- Southampton, 114, 725
- Southend-on-Sea, 151, 892
- South Lancs., 396
- Southport, 319, 621
- South Shields, 181, 219, 549, 690
- South Staffordshire, 725, 761
- Spain, 151, 319, 435
- Stainland, 49
- Stalybridge, 181, 792, 828
- Stepney, 49
- Stoke-on-Trent, 16, 49
- Sunderland, 181, 792, 829, 858
- Swinton, 359
- Tottenham, 858
- United States, 151, 181, 549
- Uruguay, 319
- Venezuela, 513
- Wallasey, 84
- Walsall, 219, 359, 549, 858
- Warrenpoint, 319
- Warrington, 435
- West Bromwich, 792
- West Ham, 285, 435, 828
- Whitworth, 761
- Wigan, 219, 513, 584, 621, 690
- Wolverhampton, 359
- Yarmouth, 858
- Yeadon, 84
- York, 285, 621, 792

Tramway Managers, Metropolitan Association of Electric, 154
Tramway undertakings, Municipalities and the purchase of, 908
Trans-Continental telephony, 274
Transformer, A high-pressure, 240
Transmission line, Static electricity on a long, 554
Trenches, Electric light and fans in German, 764
Trolley wire, Auxiliary steel, 88
Tropics, Telephone troubles in the, by W. L. Preece, 508, 561
Troubles, Lubrication, 427
Tungsten-filament lamp characteristics, 765
Tungsten wire patents, 373
Turbine blades clean, Keeping, 176
Turbine, New Swedish, 154
Turbine plant of the Interborough Co., New York, The new, 840
Turbo-electric steamer, A new, 221

ULTRA-VIOLET rays from the oscillating spark, 640
United States, Metal exports from the, 889
United States, The industrial position in the, 243
United States, Trade statistics of the, 321
University of Hong-Kong, 117
Uruguay, 789
Utilisation of water-power, by "A Surveyor," 493

VEHICLE: British experience, The electric, 17
Vehicle charging stations, Electric, 363
Vehicle Committee, The Electric, 154, 253, 402, 592, 733, 894
Vehicle costs, Electric, 802
Vehicle demonstrations, Electric, 254
Vehicles, Battery-charging for electric, by Frank Broadbent, 467
Vehicles in municipal service, The use of electric, by F. Ayton, 904
Vehicles, Standardisation of electric motor, 849
Vehicle, The electric, 325, 500, 855
Visibility, Practical aspects of, 748
V[illegible], 592, 831, 863, 895

WAR and electricity supply extensions, The, 425
War and [illegible] trade, The, 221
War and future trade, The, 641
War and quackery, 847
War and the electrical industry, The, 646
War: Business as usual, 65

WAR ITEMS—
- Accrington electricity employés, 176
- After the war, 650
- Air raids and street lighting, 888
- Allowances to dependents, 431
- Aluminium, Swiss, 213
- American electrical exports for October, 52; for December, 354
- American electrical industry: Its opportunity, 354
- Anchor Volunteers, 822
- Anglo-Belgian Co., 278
- Anglo-Belgian electrical co-operation, 822
- Anglo-Russian commerce, 213
- Anglo-Russian trade relations, 615
- Appeal for assistance, An urgent, 74
- Appeal for Belgian refugees, An, 355
- Appeals, 74
- As others see us, by Walther Rathenau, 685
- Australia, 471
- Australia and British manufactures, 888
- Australia and enemy trading, 137, 822
- Australia and German trade, 11, 342
- Australia, Enemy goods for, 546
- Australia, Wage disputes in, 888
- Australian action settled, 87
- Australian charge, An, 720
- Australian company and the war, An, 545
- Australians and electrical contracts, 107
- Australian trade, Germans and, 432
- Badges, Electricity staff, 686
- Badges for war workers, 246
- Belfast electricians and national relief, 74
- Belgian engineers, Employment of, 212
- Belgium, British electrical trade in, 698
- Belgium's hour of need: An appeal, 615
- Belgium, Trade in, 213
- Birmingham Electrical Volunteer Force, 341
- Blackpool employés, 278, 650
- Blackpool lights, 107
- Board of Trade assistance, 107, 212, 245, 277, 355, 472, 507, 545, 578, 614, 650, 686, 720, 758, 788, 852
- Board of Trade electrical exchange meeting, 73
- Board of Trade electrical exhibition, 43
- Board of Trade reports, 277
- Bradford electricity employés' wages, 355
- Bradford employés and the relief fund, 137
- British Aluminium employés, 176
- British Industries Fair, 1916, 788
- Brussels, The position in, 650
- Burnley tramwaymen, 43
- Cable manufacturing at Perivale, 74, 153
- Canada, The trade position in, 431
- Capturing German trade, 107
- Carbon-making in Australia, 720
- Carlisle supply men, 578
- China, British trade with, 507
- China, Enemy trading in, 888
- Coal-Mining and the War, 852
- Coal prices, 342
- Commandeering spelter, 822
- Commercial travelling after the war, 788
- Competition with Germany and Austria-Hungary, 12
- Constantinople telephone system, 686
- Contravening Lighting Orders, 578
- Copper enough for thirty years, 212
- Copper famine, A, 43
- Copper, Germany's need of, 246
- Custodis, Ltd., *re*, 822
- Dartford.—Fire alarms delayed, 686
- Denmark, 822
- Divisional Engineers—Royal Naval Division, 43
- Dublin electricity staff, 278
- Edinburgh tramwaymen, 137
- Electrical men wanted, More, 578
- Electrical Trade Union men with the Forces, 44
- Electric "fall in," 137
- Electricity works employés, 614
- Electric lighting engineers, 355
- Employment of disabled sailors and soldiers, 888
- Engineers' war wages, 651
- Engineer Volunteer Training Corps, 516, 615
- English capital in Germany, 578
- France, Notes from, 277
- Franco-British trade tour to South America, 246
- French Government contracts, 175
- French relief fund, 246
- Future of British engineering trade, The, 651
- Gateshead tramwaymen and Red Cross, 822
- German cable makers' syndicate, The, 615
- German electrical companies in war time, 471
- German electrical exports, A new veto on, 341
- German electrical machinery dumped in Australia, 11, 614
- German engineers and their prospects, 176
- German fires, 74
- German methods in Australia, 43
- German private war allowances to workmen's families, 12
- German-Russian electric finance cum force majeure, 615
- Germans at Shanghai, 546
- German trade, 137
- German wireless, 322
- Glasgow tramway recruiting, 788
- Glasgow University engineers' offer, 614

WAR ITEMS—*continued.*
- Glow-lamp manufacture in Holland, 342
- Government and engineering labour, The, 278
- Government cable contracts, 650, 686, 720
- Greece, 852
- Harrogate electricity staff and war munitions, 888
- Haslingden Corporation contracts, 43
- Higher wages, 246
- Hungarian company and the war, A, 578
- Industrial situation in Denmark, 107
- International metal workers, 508
- Italy, 472
- Italy, Openings in, 821
- Italy, Trade with, 507, 686
- Japan and Australia, 354
- Kieff electrical war tax, 651
- Kieff, German electric concern sequestrated in, 277
- Labour at war factories, 651
- Lamp makers and the war, 471
- Lamps for Johannesburg, 757
- Lamps for Malay States, 213
- Lancashire tramway employés and the war, 12
- Letter from the Front, A, 293, 888
- Lighting of London streets, The, 720
- London County Council and alien firms, 137
- London Electrical Engineers (T.R.E.), 508
- London Engineers, 1st, 478
- London Works and War Munitions, 852
- Manchester car collections, 614
- Manchester roll of honour, 107
- Manchester tramwaymen, 246
- Manufacturers and electricity works extensions, 507
- Manufacturing works in Germany, 136
- Maximum prices for metals, 212
- Mechanics called back, 888
- Melbourne City Council and British preference, 221
- Melbourne City Council and Messrs. Siemens, 11
- Melbourne electrical contract, A, 432, 507
- Metal prices in Germany, 277
- Motor lorry at Erith, Electric, 720
- Municipal expenditure in war-time, Limiting, 720
- Municipal repair shops, 578
- Municipal workmen for armament factories, 546, 650
- Munitions of war, 546
- Munitions of war: Additional labour, 508
- Newcastle electrical manufacturers and war munitions, 650
- New Zealand, 471
- Oldham tramway contracts, 74
- Oldham tramways and war bonuses, 757
- Once bit, Twice shy, 614
- "One clear call," 43
- Ourselves from "The Front," To, 822
- Personal, 44, 74, 107, 137, 176, 213, 246, 278, 342, 432, 472, 508, 546, 578, 615, 651, 686, 721, 758, 788, 822, 852, 888
- Petrograd electricity: Hitch in procedure, 822
- Petrograd Electricity Works, 888
- Petrograd Electric Lighting Co., 685
- Pocket lamp battery syndicate, A,
- Positions in Austria, 137
- Post Office Engineering Volunteer Training Corps, 43
- Power transmission and the war, 471
- Prices of installation materials in Germany, 107
- Professional classes and the war, 255, 831
- Prospects in China, 136
- Public lighting in war time, 321
- Rawtenstall employés with the Colours, 74
- Recruiting, No obstacle to, 508
- Recruiting tramcar at Rochdale, 137
- Relief allowances to municipal employés, 74
- Rochdale problem reconsidered, 137
- Roll of honour, 44, 74, 107, 137, 176, 246, 278, 342, 355, 432, 472, 508, 546, 578, 615, 651, 687, 721, 758, 788, 822, 852, 888
- Royal Automobile Club and X-ray apparatus, 107
- Royal Flying Corps, 44
- Runaway bombardment, 11
- Russia, 472, 651, 822
- Russia: A suggestion from Petrograd, British trade with, 507
- Russia: Catalogues wanted, 61
- Russia, German capital in, 614
- Russia, Incandescent electric lamps in, 278
- Russia and British relations, 277
- Russia, Opportunities for manufacturers in, 545
- Russia: Trade routes, 341
- Russian cables, Germans and, 578
- Russian demand for electric fittings, 720
- Russian electric lamp industry, 245
- Russian, Learning, 278
- Russian mica and wolfram, 431
- Russian patents, 639
- Russian tax on electricity, Proposed, 246
- Russian trade, Anglo-, 508
- Salary advances to men on active service, 213
- Science in industry, 507
- Siemens's employés with the Forces, 650
- Siemens's sympathies, Mr. Alexander, 176
- Signal Service, 1st London Divisional Engineers, 342

WAR ITEMS—*continued.*
- Silvertown war relief fund, 176
- Smoke nuisance, 821
- South Africa, Anti-German outbursts in, 788
- Steel production in Germany, 888
- Sterilising of wounds, Electric, 758
- Stockport tramwaymen, 137
- Swiss Aluminium Co., 355
- Switchboard service in wartime, 651
- Sydney contracts, 43, 107, 507
- Technical institutions and enemy members, 757
- Technical schools and munitions, 758
- Telegraphists at the Front, 137
- Telegraphs at the Front, 73
- Telephones wanted, 107
- Thermit, 342
- Trade follows travel, 74
- Trade war exhibitions, 137
- Trade with Australia, 74
- Trading with the enemy, 614
- Tuckers at the Front, 245
- U.S.A., Feeling in the, 431
- U.S.A., German exports to, 651
- U.S.A. electrical exports, 52, 545
- Uruguay-German enterprise, 342
- Victoria Falls staff's threat, 686
- War and factory premises, 107
- War and German cables, 137
- War bonus, 278, 342, 650
- War bonuses for single men, No, 651
- War bonus protest, 471
- War exhibition, 788
- War munitions, 822
- Warning to manufacturers, 246
- War Office and Messrs. Siemens, 342
- War, Professional classes and the, 255
- War service badges and recruiting, 721
- War trade department, A, 278
- Westinghouse staff and munitions of war, 758
- York electricity employés, 277

War munitions, The Government and, 589
War Office contracts and workers' badges, 591
War risk and workmen's compensation, 35
War, Swiss engineering and the, 67
War, Telephony and telegraphy in the field of, 590
War, The engineering industry and the, 607
War, The I.E.E. and the, 782
War, Workers' earnings and the, by "Commercial," 306
Warsaw, 77
Warship, Electrically-driven U.S., 765
Water-power in New Zealand, 861
Water power, Ownership of Italian, 322
Water-power utilisation in Sweden, 860
Water softening by electrochemical methods, 186
Water-tube boilers, 215
Water supply, Geneva, 476
Wave in electrical machinery, The shape of the pressure, by Dr. S. P. Smith and R. S. H. Boulding, 195
Wills, 405, 478, 803, 896
Winding accidents, South African, 67
Windings, High-voltage dangers present in static transformers due to electrostatic capacity of the, by J. L. Thompson and S. A. Stigant, 25, 36
Wire, Auxiliary steel trolley, 88
Wire-drawing industries, The, 426
Wireless call devices, by L. B. Turner, 817
Wireless control of public clocks, by A. E. Ball, 539, 624, 712
Wireless signals, Conditions affecting the variations in strength of, by Prof. E. W. Marchant, 267, 276
Wireless signals, Measurement of, by Prof. E. W. Marchant, 637
Wireless telegraphy and telephony, The Pliotron in, 753
Wireless, Train dispatching by, by L. B. Foley, 602
Wire manufacturers and development of the overseas trade, 536
Wire manufacturers and the contraband problem, Copper, 815
Wiring, Guaranteed, 117
Wiring, Modern methods of electrical, by D. S. Munro, 266
Wiring question in the U.S.A., The concentric, 553
Wiring rules and regulations, English and American, 129
Wiring rules compared, The National Electrical Code and British, by F. Broadbent, 121, 134
Wiring work, particularly in bad situations, Modern, by H. C. Tofield, 168, 204, 264
Wood Green electricity undertaking, The, 731
Woollen trade, Electrical driving in the, by J. F. Crowley, 6
Workers' earnings and the war, by "Commercial," 306
Workmen's compensation, 223
Workmen's compensation, War risk and, 35
Workshops, Portable electrical, 17

X-RAYS and contraband, 176
X-ray tube, The Coolidge, 87

ZEPPELIN raid and lighting, 604
Zinc conductors, Insulated, 831

Printed by WM. CATE, LTD., 147-150, Gt. Saffron Hill, Charterhouse Street, E.C., and Published by the Proprietors, H. ALABASTER, GATEHOUSE & Co., 4, Ludgate Hill, London,

THE
ELECTRICAL REVIEW.

VOL. LXXVI. JANUARY 1, 1915. No. 1,936.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: January 1, 1915. [No. 1,936.

Page
1914 ... 1
The A.E.G. on the War ... 3
Lead ... 4
On Advertisement and Character ... 4
A Breakdown and Legal Liability ... 5
Electrical Driving in the Woollen Trade, by J. F. Crowley ... 6
Institution of Electrical Engineers ... 7
Correspondence—
- German Firms posing as Belgians ... 7
- U S A Safety Rules ... 8
- Wonderful Accumulator Cells ... 8
- London Electricity Supply Scheme ... 8
- Rear Lights on Vehicles ... 8
- Advertising Methods ... 8
- From the Front ... 8
- "We Can't take the Risk" ... 9
- German or British? ... 9

New Electrical Devices, Fittings and Plant (*illus.*) ... 9
Legal ... 10
War Items ... 11
Business Notes ... 12
Notes ... 17
City Notes ... 19
Stocks and Shares ... 24
High-Voltage Dangers present in Static Transformers due to Electrostatic Capacity of the Windings, by J. L. Thompson (*illus.*) ... 25
Recent Advances in Electrical Crane and Lift Design (*illus.*) (*concluded*) ... 26
The Promotion of the Electrical Trade (*concluded*) ... 28
Trade Statistics of Australia ... 29
Electric Bell Signalling in Collieries, by T. G. Watts ... 30
Our Legal Query Column ... 32
Foreign and Colonial Tariffs on Electrical Goods ... 32
New Patents Applied For, 1914 ... 32
Abstracts of Published Specifications ... 32
Contractors' Column ... Advertisement page xx

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.

DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LAUNCESTON: Gordon & Gotch, Cimitiere Street.

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto I 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

IN PREPARATION.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

1914.

THE extraordinary circumstances under which we take in hand our review of the past year present a startling contrast to the conditions which prevailed 12 months ago. At that time there were signs of a falling-off in the general trade of the country, but we considered that this circumstance of itself did not justify apprehensions concerning the course of the purely electrical industry. The field for electricity, both at home and abroad, was regarded as practically unlimited and inexhaustible, and certain to present abundant opportunities for years to come. For a period of seven months that followed there was great activity in the factories, and everything seemed to point to 1914 being a record year, with a big volume of business and less strenuous competition, when the awful calamity of war between the Great Powers of Europe shook world finance and world industry to their very foundations.

In the early months of the year there was serious trouble in the Labour world; the struggle in the building trades and the disaffection among electrical workers occupied a good deal of thought, and at one time threatened to entangle the central station employés. But the catastrophe of war led to the making of peace within our own borders, and masters and men have patriotically put aside their disagreements the while they show a solid front to the common enemy of liberty and civilisation. It will go down to history as one of the first and greatest consequences of the outbreak of war that political and industrial strife was hushed. Class had been arrayed against class, and even sex against sex; Labour was relentlessly at war with Capital, and Unionist labourer was increasingly bitter against non-Unionist. Such was the position early in the year. The atmosphere was speedily changed as it became recognised in every stratum of society that there was an imperative national call for a union of all forces in the Empire in defence of our common heritage and interest.

It is not wise to attempt to prophesy, but it seems inconceivable that after the experiences, sacrifices, and new problems that these five months have brought to all the nations involved, political and industrial differences can ever again, or at any rate for many years, be treated in the same heated and acrimonious spirit. The scribes who several years ago edified us with their answers to the question: "Whither are we tending?" would probably wish to reconsider their speculations in the light of recent events, for the chastening of society from top to bottom, the new and closer relationships between certain nationalities, the birth of a new Germany, and the pursuit of new and higher ideals among all peoples, may be expected to characterise the years that follow the cessation of hostilities. But the war is far from finished, and there is no suspicion of millennial horizons—the year that opens to-day will make heavy demands upon all branches of the Services, and not least of all the industrial services, for the United Kingdom must needs be the workshop of the Allies, providing war material to the utmost of its productive capacity. It is this class of activity in electrical engineering works, coupled with the absence of such large contingents of skilled labour with the military forces, which renders the outlook for 1915 from the purely electrical standpoint one of some dubiety.

Reviewing the past year from a technical point of view, up to the end of July the normal course was followed—including the placing of not a few important orders with German firms. The most notable event in the lighting world was the marketing of the half-watt lamp in January by the group of companies which control the tungsten lamp manufacture; fortunately—for violent changes in practice are harmful and may even prove disastrous to small concerns and individuals—the new lamps were available only for high candle-powers or for low voltages, and the disturbance caused by their arrival, of which full warning had been given, was comparatively small. That they provided a most welcome stimulus to electrical development in certain directions cannot be doubted; for example, it is recorded that tradesmen who had resisted the attractions of other illuminants for the external lighting of their shop fronts were unable to withstand the charms of the newcomer: numerous installations of street lighting were carried out, for which the arc lamp was too large a unit and the ordinary tungsten lamps showed too small a margin of economy to justify the conversion from gas; and in many large halls, shop interiors, &c., they were found to effect a great improvement.

In the heating and cooking field steady progress has been made towards the perfecting of the apparatus, and the extended guarantees now given by some makers afford convincing testimony to the improvements that have been effected in the construction of the heating elements. Some entirely new types of apparatus were introduced, and certainly the conditions to be met are now much better known and more adequately provided for than they were a year ago; but all the technical advances made are still insufficient to account for the extraordinary development in the popular appreciation of, and demand for, electrical cooking and heating. Where energy is to be had for 1d. a unit or less, the success of the former and its ability to compete with gas cooking are well established; but no one attempts to maintain that electrical heating, under ordinary conditions, is economical in comparison with gas or coal heating as regards the actual cost of fuel or energy, and therefore, in order to account for the remarkable demand for electric radiators which has been observed during the year, it is necessary to assume that the advantages inherent and peculiar to electric heating, such as portability of the radiator, perfect cleanliness, freedom from fumes and fire risk, and ease of control, far outweigh the consideration of running cost. The rather startling figures given by the President of the Institution of Electrical Engineers and various supply station engineers, as to the growth of the heating and cooking load, are corroborated by the undoubted activity that exists amongst the manufacturers of the apparatus, and it is clear that the conditions which we have pointed out as necessary to the rapid improvement of the appliances and the reduction of their cost—namely, a large output and an assured demand—are now in course of practical realisation. Moreover, it is unanimously reported that the diversity factor of this class of load is such that it has not appreciably increased the peak due to the lighting load.

The use of electric power has developed along normal lines; the application of electric driving to mines and to textile industries in particular has made good progress, its superiority in both departments to all other agencies being no longer a matter for argument. The installation of electric winders, it is true, remains exceptional, but this, we believe, is due entirely to local conditions, especially to the prior installation of steam plant at existing collieries; where a new pit is sunk, the electric method of winding can be adopted without hesitation. The steadily increasing adoption of the electric hand lamp in coal mines is also worthy of mention; we confidently anticipate its universal use in this connection.

In central-station practice the most marked feature of recent times, perhaps, has been the definite decision that for large undertakings high-pressure three-phase transmission to sub-stations is pre-eminently the best method to adopt. In special cases the high-pressure direct-current system championed by Mr. Highfield may prove to be the more desirable, but for urban areas the three-phase system reigns supreme. This is not a matter of the past year alone, but during the year several new examples have matured and others have been launched. Various projects of this kind of the first magnitude are now in progress, such as those of Manchester, Liverpool, Glasgow, &c., in each of which the main distribution is on the D.C. system. The new generating station at Manchester bids fair to become the largest in the kingdom, and as this city has led the way in adopting turbines of 15,000 KW., so it will continue to maintain its lead by installing sets of 25,000 KW. The rapid and continuous progress made in supply-station practice has necessarily brought the question of obsolescence into prominence of late years, and it is now generally agreed that this is a very important factor in the supply economics of the present day. The excessive periods for repayment of loans that were sanctioned by the London County Council in its unregenerate days are now seen to be absurdly and dangerously extended, and the Council has lately endeavoured to introduce reforms even in respect of existing loans, suggesting that loans for plant granted for 42 years should be paid off in 15 years.

In the provinces the extension of areas of supply has occupied the attention of both companies and municipalities; while the old antagonism between these parties has been greatly modified, there still remains a considerable amount of jealousy on the part of the latter, and the concentration of supply which is hoped for in technical circles remains a dream of the future, except in the case of the great cities, many of which are seeking to supply their small neighbours. The use of overhead mains, on the part of both municipalities and companies, has made good progress, and the Board of Trade has manifested a growing measure of sympathy with its advocates. The disposition of several gas companies to undertake also the supply of electricity is a sign of the times. Closer attention has been given to the lighting of small property, with very promising results.

The complete electrification of the new dock at Hull was a noteworthy item of the year's achievements.

Amongst minor technical movements may be mentioned the progress of the Ljungström turbine, higher speeds for turbines, and the wider use of reactances, wet air filters, and suction ash-handling plant.

As we anticipated last year, the question of the future supply of electricity to London has assumed a prominent position; the report of Messrs. Merz and MacLellan to the L.C.C. opened up new lines, along which the Council decided to move, with the object of combining the advantages of municipal ownership with those of company management. The question is now before Parliament, where, no doubt, it will be thoroughly thrashed out in Committee. The Council's Bill has not been favourably received by either the Metropolitan Borough Councils or the companies—some of the latter, indeed, are promoting a scheme of their own; but opposition at the present stage need not be regarded very seriously—it is the only way to secure the best terms for the professed opponents.

Another matter before Parliament is the I.M.E.A. Bill to confer additional powers upon municipalities; this is mainly interesting on account of its influence upon the relations between the supply station managers and the electrical contractors. The latter, rejecting the compromise offered them, which at least might have formed an admirable basis for negotiation, are opposing the Bill with tooth and nail, but we trust that when the issue is joined they will see fit to make terms and put an end to the conflict, which we believe is only kept alive by the irreconcilability of a few members on either side.

In the field of electric traction the progress of the railless system has been maintained, and a new factor—the electric 'bus—has entered the arena. There have been electric 'buses and electric 'bus companies before, we know—only too well—but the conditions are now changed, and we hope to see notable developments in this direction in the near future. The possibilities of the commercial electric vehicle have been at last brought home to the supply engineers, and the Electric Vehicle Committee, formed in 1913, has done splendid work in popularising it and paving the way to its general adoption. Already over 100 vehicles are in use, and giving undoubted satisfaction. There is scope for an enormous development in this field.

The steam railway companies are at last taking very definite steps towards the electrification of their suburban services, and several important projects are in progress in the metropolitan area, as well as in the North of England and in Australia and Argentina; these, however, are but the commencement of a revolution which will provide an enormous amount of work for British electrical firms.

In tramway circles the most noteworthy event of the year perhaps was the failure of the immense system of the London County Council to meet its obligations without recourse to the reserve fund, owing to the severe competition of the motor-omnibus; similar troubles were experienced to a less extent by all the electric tramways in the metropolitan area, whereas in provincial cities the tramways prospered. Since the outbreak of war, however, the conditions have materially changed; the pressure upon the London tramways has been relieved by the dispatch of large numbers of omnibuses to the front, while, on the other hand, the provincial tramways have suffered from severe depression. Drastic measures have been proposed at Manchester and Liverpool to deal with the congestion of traffic in the central areas. Interruptions of service on the L.C.C. tramways in the spring, and again in December, accentuated the undesirability of depending entirely upon one source of supply for so extensive and important a system.

The declaration of war between this country and Germany in August exerted a most important influence upon the whole of the industry. Some of the largest works were called upon to devote their whole output to the service of the Government, and at the same time the influx of electrical goods from the Continent came almost to a full stop. On the other hand, large numbers of men were called up to the Colours as Reservists or Territorials, and many others joined the new Army, including a large proportion of skilled men whose services are very seriously missed; indeed, it is a question whether the Government would not have been well advised to forbid the enlistment of skilled workmen at the start, as it practically did in the autumn, for the manufacture of munitions of war, motor vehicles, equipment, &c., is of the first importance. Electrical manufacturers thus found their operations severely hampered at a time when an increased output was imperatively called for. However, every effort was made to cope with the exceptional conditions, and the steady inflow of raw materials rendered possible by our command of the sea has prevented any difficulty on that score. The general feeling amongst British manufacturers, as shown by their replies to inquiries which we addressed to them, was one of cheerful optimism, and it appears to be widely believed that the tide is flowing in our favour, not only on the field of battle, but also in the industrial warfare in which we are engaged. The cry in both cases is for more trained men; and men cannot be trained in a day.

The achievements in the telegraph and telephone departments and in wireless have been of no mean importance, but we must defer reference to these and perhaps some other matters to a later issue. From what we have said it will be obvious that, notwithstanding the war, the year 1914 was one full of technical and industrial interest, and that under normal national conditions the result would have been such as to justify general feelings of satisfaction.

Death has removed from the electrical world two men whose names had become household words on both sides of the Atlantic—Sir Joseph Wilson Swan and George Westinghouse. The passing of Robert Kaye Gray has made a vacant place in many hearts which no other can ever fill; A. Bruce Anderson, chairman of the B.E.A.M.A., a man of commercial enterprise and ambition, met with a premature end in the *Empress of Ireland;* and other outstanding losses have been experienced by the deaths of Professors E. J. Houston, Minchin and Poynting, Augustus Strob, Paul Heroult, J. Gott, A. R. Sillar (Pekin), R. Hope Jones, and S. W. Newington. Captain Lord Guernsey, killed in action, Lord Suffield and Lord Merthyr, all had financial and other interests in electrical or allied industrial concerns.

THE A.E.G. ON THE WAR.

One of the most extraordinary speeches which have yet been delivered in regard to the war and the possible future course of events was made by Dr. Walter Rathenau at the Berlin meeting on December 10th of the shareholders in the Allgemeine Elektrizitäts Gesellschaft. Certain Swiss reservists who have been recently permitted to leave the field and resume their former occupations, subject to the liability of again being called to the colours in connection with the protection of the Swiss frontiers, declare that the Germans are confident of victory, a sentiment which also characterised the address of the chairman of the Berlin company in question, and received the very warm approval of the shareholders. This question, however, is of considerably less importance from an electrical point of view for the moment than is the general situation of this industry in Germany, and of the A.E.G. in particular, at the present time, and it will, therefore, be of advantage for the trade in Great Britain to hear the Teutonic point of view as set forth at that meeting.

According to the German newspapers, Dr. Rathenau stated that the Germans were living in an economic situation which was quite unusual, and which could not be compared with any previous economic experience. The Continental blockade at the beginning of the last century was child's play as contrasted with the great restriction which has now been forced upon the Germans. Hitherto German industry has existed to a far-reaching extent on imports and exports; its first duty now has been to depend upon itself, and this problem, in his opinion, has been solved in a surprising manner. In explanation of this statement the speaker remarked that a large portion of German economy served directly or indirectly for the defence of the country, and for that purpose a transposition of the whole economic mechanism was requisite - a change without a parallel, and for which only a few months were available. A country which has provided out of itself inland compensation for the large deliveries from abroad, upon which it was dependent, is considered to deserve immense recognition in an economic respect, and the A.E.G. is claimed to have succeeded in this achievement. At present the company is producing many articles of which no one previously thought, whilst many other operations to which a large portion of its forces was formerly devoted are no longer being carried out. The chairman believes that German economy will persevere in this capacity for effecting changes, and that the new method will continue to stand the test during the duration of the war.

Let us now see what idea prevails as to the future. On this point, Dr. Rathenau remarks that when the war is over and the reconstruction of economy becomes necessary the problems which will come forward will be considerably more difficult, although he expresses the hope that the work of reconstruction will be accomplished under other and much more brilliant prospects than the Germans have ever experienced; but the problems will be very serious and will requisition the whole of the forces of the economic life. If it is considered what the cost of the war is to Europe, that the expenditure for the European market far exceeds £5,000,000,000 per annum, that this sum must be recovered, and that many relations with other countries will be broken up—if these facts are considered the result is that the economic life will be confronted with problems such as have never been known. The presumption for this was of a political kind, and they were deeply convinced, the chairman observed, that under no circumstances could victory be withheld from the Germans, an observation which gained the lively approval of the meeting. He was, however, of opinion that there was something else to be acquired: ascendency which was manifested in victory, and which economically must amount not to the length of one horse, but to that of one hundred horses. What is implied by this phrase is not quite obvious, but it is probably explained by the subsequent assertion that peace cannot be bought, but must be dictated by Germany, and that that can only take place when the enemies of the country are subdued in the old Roman sense.

The question of the duration of the war next engaged attention. The chairman, whilst being unable to commit himself on the matter, stated that the news from the East made it appear as if there was some foundation for the hope of a short war, but he declared that it was necessary also to expect a long one, and in that event German economy had to prepare itself for the task. The adversaries reckon that German weakness lies in this direction, but Dr. Rathenau observes that they will make a mistake in this matter. A long war presupposes just as strenuous a struggle in economy; this struggle will be just as successful, and even a war of long duration will be endured by Germany. How will this be done? The chairman states that the Germans, in the first place, have the capital, which has been accumulated in the past 30 years, and that if the nation had remained of an agricultural character as in 1870, instead of having become an industrial country, it would have been impossible to carry on the present war. Admittedly the industrialisation of the country has been good; it has enormously strengthened its resources. The best means of defence, however, are considered to be represented by the man and his moral value—a value which has never been lacking in German technics and economy. Dr. Rathenau further remarked that the Germans knew that their technics would also take up and solve the problems of the day. Thus, in the whole situation, the A.E.G. had endeavoured to force its equipment as high as possible, and had transferred its technical arrangements to other branches. In conclusion, the chairman stated that the Germans had confidence in success and in the strength and the moral services of the country, and for these reasons their hope was strong and immovable.

The extraordinary speech of Dr. Rathenau, as representing such an influential company as the A.E.G., will doubtless be considered with interest in electrical circles in this country. Although the chairman refrained from specifically informing the shareholders of the exact changes in production which have been made in certain departments, it is obvious that the alterations can only refer to the substitution of war materials for articles of peace in so far as war materials were not previously made by the company. But the A.E.G. is not alone in this respect, as various iron and steel companies, finding that their trade in certain departments has been brought to a standstill, have also embarked upon the manufacture of war material in order to assist in meeting the demand. But when Dr. Rathenau speaks of the probability of German economic endurance for a long war, he omits to mention the very important fact that, apart from the comparative scarcity of certain ores for making hematite pig-iron for the production of the particular quality of steel that is required for armaments, there is an ever-increasing dearth of the non-ferrous metals—copper, nickel and aluminium—which are also needed for the purposes of the war. As it will be exceedingly difficult to procure any further supplies from outside the country, it is probable that the peculiar economic conditions which have already been set up by the circumstances just referred to will play an important part in bringing the war to a conclusion.

Lead.

The market for lead has been rather variable during the last few weeks. There was considerable strength shown at times, and a level of £19 5s. was established and retained for some time for prompt metal, all the early deliveries being under efficient control, while large demands were being met with from Russia, to say nothing of the excellent position of the ammunition makers here who were taking large supplies regularly for Government needs. The anticipated closing of Archangel has not yet come into effect, but it cannot be delayed much longer no matter what efforts are made to keep open the port, but while this may check Russian buying in the London market and stop shipments from here to Archangel, Russian demands will then be diverted upon New York. Already business has been done for shipment from America to Vladivostock, and unsuccessful efforts have actually been made to ship lead in cargoes direct from Spain to that port.

It is quite clear that the cost of transport is not going to be any hindrance to Russia getting everything needed for the pursuit of war against the Huns. In considering the effects of the war upon the demand for lead, it may be remarked that according to the German papers consumption in that country has increased owing to war requirements, and prices have advanced considerably. The latest news available as to lead there is to the effect that something like 575 marks per metric ton is the price, and if this is correct it betokens a serious scarcity of the metal in Germany. That country normally imports a good deal of lead, say, about 100,000 tons a year, and the cutting off of so large a quantity cannot be expected to pass unnoticed.

A factor, which it is felt is bound to make some impression upon the general tendency of prices, is the excessive cost of freights from Spain to England . . . indeed the cost of transport by sea is beginning to verge upon the prohibitive, and it is a factor the consequences of which must not be ignored entirely. A new development has been seen in the offering of regular monthly quantities of lead from China. It is not expected that this trade will assume any important dimensions, but it is something new, and as such deserves passing reference.

There was a little while ago a good deal of lead offered from the United States, but the position has rather altered within the last week or so, and the American position is one of less willingness to sell for export. It is believed that the stocks which were held across the Atlantic a few months ago have been very materially reduced by the heavy export movement, and this being the case the position of producers there is much better than it was. Hence the lessened disposition shown to offer metal for sale.

The output of the Broken Hill region has been curtailed by the various difficulties which came into operation after the declaration of war, but there is little doubt that when peace is restored the trade currents will be found to have been diverted in many important respects, and it is certain that the efforts now being made will secure that Australian concentrates will be treated in British and not in German furnaces. With the holidays trade has lulled off, but fundamental conditions are much as before.

On Advertisement and Character.

It is very generally recognised that no man in any profession or trade can hope to maintain a proper degree of efficiency unless through the pages of a publication relating to his calling he keeps himself fully informed of the course of practice and of trade events. What others have done, or are doing, naturally has a bearing upon what the student may have in hand or in contemplation, and it may vary the details of some new commercial enterprise. The editorial pages are, of course, the main vehicle through which such information is conveyed, but the educative value of advertisement pages is also beyond question, and the average reader, whether his bent be scientific or commercial, does not need to be informed that such is the case. But it is not always apparent that the advertiser knows the educative and business-getting value of the space at his disposal. There are advertisements and advertisements, and while advertisers and their publicity staffs may hold very different views as to what is the most suitable form of announcement for an advertisement, nothing is more certain than that a form of advertisement which may make a persuasive or possibly a smart appeal to one buyer and lead to business, may happen to set on edge the teeth of another equally important potential customer. A correspondent dwells upon this point in another part of this issue. It has often been said that American publications show American firms to possess a better appreciation of what is really business-like advertising; this may be perfectly true in respect of some of their popular magazines prepared for the American reader, and it certainly is correct if it refers to their liking for big advertisements. But American methods are legitimate if restricted to America. For Britishers whether at home or in the Colonies a British type of advertisement generally carries greater weight. We have no intention to indulge in a homily on the average British temperament and the pitfalls that are to be avoided and the qualities that are to be displayed in our efforts to satisfy it, but we certainly feel that it is a matter to which British technical and trade advertisers of electrical and engineering manufactures might devote greater consideration. A sleepy sort of advertisement which, like the laws of the Medes and Persians, altereth not, is only used nowadays by those who are behind the times and do not study how to make advertisement expenditure yield the highest return. On the other hand, there may be advertising of the flash in the pan order which sets the Thames on fire one week, and lies in sackcloth and ashes the next. Another class of advertisement not unknown is one bordering on the offensive, striking the eye, it is true, but having in the long run an unfavourable effect upon the mind. These are matters upon which it would be extremely interesting to hear the views of both advertisers and readers. We are inclined to think that in the case of electrical and allied manufacturers the character of an advertisement only does a little less than the goods themselves to build up reputation. A flippant advertisement probably gains for its votaries a character the opposite of serious.

A BREAKDOWN AND LEGAL LIABILITY.

[By our Legal Contributor.]

The recent breakdown at Greenwich which must, of necessity, have occasioned a vast amount of inconvenience to a large number of persons, suggests certain interesting legal questions. Can the London County Council, as undertakers of the tramway system in South London, be held responsible, and, if so, to what extent, for damage caused? We need not deal with the question of liability for personal injuries, as no one seems to have suffered in that way; but many a breadwinner may have suffered pecuniary loss owing to his not having been able to get to work in time through the breakdown of his customary means of locomotion. Can he sue the County Council?

Curiously enough, one may search the law books through without finding any light or leading upon the exact nature of the obligation which is thrown upon a tramway authority by the sale of a ticket. The Tramway Act, 1873, is silent in the matter; while the Act which empowers the County Council to run tramcars makes no special mention of the obligations of the Council to the citizens.

One is, therefore, constrained to go back to first principles in order to define the legal position. It is a question of contract, and so far as the relations between the tramway authority and the passenger are concerned, the question is—what is the obligation of the authority? A man buys a ticket for 1d. in order to travel from Blackfriars Bridge to the Elephant and Castle. All the County Council are bound to do is to take him there. One supposes that the law would infer a contract to take him there within a reasonable time. If a breakdown occurred while the tramcar was *en route*, the fare could get his money back; but that would be the extent of the liability of the Council. That body is under no obligation to run a tramcar on any particular day—or, rather (to put the matter a little more accurately), they are under no obligation to carry Mr. James Robinson (or anyone else) from his residence in the suburbs to his office in the City. If the cars are running, Mr. Robinson, of Tooting, has as much right to a seat as Mr. Brown, of Balham; but if the cars are stopped for a day or a week, neither of these two gentlemen could sue the County Council for damages. So it is conceived that if, as a result of the breakdown a week or two ago, a City man sustained damages caused by delay, he would have no claim against the London County Council.

Even in the case of a railway company it has been held that the mere issue of a ticket from A to B, apart from any conditions in the time bills, implies no warranty that a train will start at the time at which the passenger is led to expect it, and if the train arrive too late to enable him to complete a through journey, he cannot recover damages. *A fortiori* the County Council, whose tramcars run according to no particular time table, are under no liability to their passengers.

It is somewhat odd that clauses which are to be found in Acts of Parliament relating to the supply of electricity, and which excuse the undertakers for the damage caused by breakdowns, are not to be found in Tramway Acts or provisional orders. It may be interesting to refer to the relevant provisions of the Electric Lighting (Clauses) Act, 1899. After providing for the infliction of certain penalties for delay, it goes on:—

"Provided that the penalties to be inflicted upon the undertakers under this section shall in no case exceed in the aggregate in respect of any defaults not being wilful defaults on the part of the undertakers, the sum of £50 for any one day, and provided also that in no case shall any penalty be inflicted in respect of any default if the Court are of opinion that the default was caused by inevitable accident or *force majeure*, or was of so slight or unimportant a character as not materially to affect the value of the supply."

Nice questions sometimes arise as to what constitutes *force majeure*, which is sometimes described in legal documents as "the Act of God or the King's enemies" In a case which was heard in Dublin in 1899 it was proved that the supply of energy had broken down owing to certain defects in a cable which had not made themselves apparent for a considerable time. It was held that the company were excused on the ground of inevitable accident (Sun Insurance Co. *v.* Dublin Corporation, December 9th, 1899). But the defence of *force majeure* or inevitable accident will not avail a company in every case. In Shadditch *v.* London Electric Supply Corporation, the keeper of licensed premises at Deptford summoned the defendant Corporation for failure to supply electricity to his premises. The default was admitted, but the defence was *force majeure*, it being contended that the supply of electricity having become deficient owing to unavoidable causes, it became essential that some part of the district of the company should be cut off, and that Deptford was selected as causing the least public inconvenience. The full penalty of 40s. was inflicted in each of the seven cases, with 20 guineas costs in the first case and 2s. costs in each of the others. It would seem, however, that where the company are taken by surprise, and asked to supply a number of consumers for whom they have not made adequate arrangements, they will be leniently dealt with. Thus, in Marylebone Vestry *v.* Metropolitan Electric Supply Co., the company were summoned by the Vestry and Guardians for default in supplying electrical energy to the workhouse and Vestry premises on certain days. The company admitted the default, and contended that the same was due to inevitable accident, caused by the great increase in the demand for electricity, which had exceeded their expectations. The case was at first adjourned, and eventually small fines were imposed.

It would seem that if any negligence on the part of the company can be proved, it is futile for them to urge a plea of *force majeure* or inevitable accident.

Thus the faulty laying of a cable which led to a break owing to subsidence; defective insulation leading to short circuit; carelessness at the central station which led to a stoppage of all the machinery; none of these things could be pleaded in answer to a summons for failure to supply. On the other hand, the breakage of a cable owing to floods, the bursting of a boiler, or sudden stoppage of machinery owing to some undetected fault, would always be received as a complete answer to a charge of failing to supply.

But it is essential in the interests of the consumer that the company shall take every precaution to secure that even when one set of engines breaks down another shall be ready to take its place.

We have stated the law as to breakdowns in lighting stations with a view to drawing attention to a curious distinction between the liability of a tramway and a lighting authority. No doubt that distinction may be explained by the fact that whereas an electric lighting company or authority is bound to enter into contracts of an enduring nature, the tramway company is under no obligations save those which we have enumerated in the early part of this article.

ELECTRICAL DRIVING IN THE WOOLLEN TRADE.

By J. F. CROWLEY, M.Sc., B.A.

(*Extract of Lecture delivered before the* Halifax Textile Society, *on December 3rd*, 1914.)

Electricity has not found the same application to textile factories here as it has in other countries, largely owing to lack of knowledge of its advantages on the part of manufacturers. It is proposed to consider the engineering problems that arise when a decision to install electrical driving is adopted. It will be assumed that it has been decided to adopt two-phase or three-phase current, and that questions of voltage and frequency which may depend on the current available from the local supply authorities, the size of the factory, &c., are discussed with an electrical engineer familiar with the conditions.

In considering the application of electrical driving to the woollen trade, it should be borne in mind that this trade has certain peculiarities from a driving point of view, such as :—

(*a*) Small total H.P. required for each factory as compared with, for instance, the jute trade or the cotton trade.

(*b*) Particularly poor load factors, that is, a small percentage of the machinery running at a given instant.

(*c*) A varying trade, which may mean the shutting down of a number of machines for long periods, or, again, the running of machines at night when trade is brisk.

Where such conditions prevail, electrical driving shows to particular advantage. When it is decided to install electrical driving the first point that requires decision is the type of drive to be installed. Broadly speaking, the choice of the manufacturer lies between :—

(*a*) Group driving in large units.
(*b*) Group driving in small units.
(*c*) Individual driving.

We do not find in the woollen trade the degree of standardisation of machinery and lay-outs that obtains in the cotton trade ; consequently the case of each woollen factory has to be considered on its merits to an even greater extent than is necessary in the cotton trade.

Group Driving.—The simplest application will be the installation of a single motor to replace an existing engine, which is generally a very unsatisfactory application, since, while it means the provision of a steady turning movement on the main shaft, it means also the retention of all existing shafting with no reduction in friction losses, &c. For the average case, therefore, the shafting should be divided up into carefully selected groups, each group being driven by a separate motor. It was realised early that by dividing up shafting into large groups, and driving these groups by means of electric motors, many advantages could be obtained over the older systems of driving from one central source. It is now being realised that these advantages are greater still where the driven units are smaller and when still shorter lengths of shafting are taken. Thus, the method of group driving in small units is gradually obtaining wider recognition. The movement in this direction has been aided by the improvement in the efficiencies of small motors, and the reduction in cost of these machines.

Having decided on the grouping of the shafting, the next point to receive attention should be the motor speed, and the method of connecting the motor to the shafting. In woollen factories shafting speeds are low, frequently not exceeding 90 R.P.M., and the points mentioned, therefore, require special attention if expensive motors of unduly low speeds are to be avoided.

Speaking generally, the ideal group drive consists of a motor placed in the centre of the line shaft and provided with flexible couplings on both sides for connecting to it. With this arrangement the speed fluctuations of long shafts are avoided, and also the losses in the connecting link between the motor and the shaft. With low-speed shafts, however, this is out of the question, since the cost of an electric motor, other things being the same, increases as the speed is lowered, and belt drives, rope drives, gearing and chains have to be considered. Where speed ratios are not abnormal, and the conditions enable satisfactory centres to be obtained, and where also the powers to be transmitted are not excessive, belts provide a very satisfactory drive. Where the powers to be transmitted are great, belts can be replaced by ropes, which have also a wide field where a number of defferent shafts have to be connected to the same motor, as is the case in the modern rope race, or by steel belts which are largely used in Saxony, but have not come very widely into use here. Where the distance between centres is small, and a large reduction ratio is required, other methods must be adopted. Worm gears are generally to be avoided owing to their low efficiency, which does not improve with time. Double helical gearing, on the other hand, has reached a high state of perfection, and chain-driving has come very widely into use for factory drives. Generally chains possess the great advantage of having, and of maintaining, a high transmission efficiency, while the drives are not affected by slight alterations in shafting alignment, as would be the case with gearing.

Individual Driving.—Any advantages claimed for group driving in small units over group driving in large can be claimed for individual driving over both systems, while, in addition, special advantages can be obtained with special machines, such as looms, mules, ring doubling frames, centrifugals, &c.

The advantages of individual driving are :—

1. Saving in power.
2. Increase in production due to—
(*a*) Specific advantages in the case of certain machines.
(*b*) Better supervision, &c.

Against these must be put the greater cost of an individual drive installation over a group drive installation. The proper balancing of these advantages against the increase in cost is the problem that the manufacturer has to solve, and here he will find expert assistance indispensable.

Regarding the first advantage claimed for individual drive—namely, saving in power—two points might be referred to :—First, the accurate measurement of power transmission losses has only been possible since the introduction of electrical driving ; secondly, these losses are very much greater than is ordinarily assumed. To take one instance only, the increase in friction losses when shafting is loaded up is usually treated as negligible, though it is frequently very large, as can be seen from the following test figures.*

The test was carried out for 20 hours on six looms on group drive, then for a similar time on the same looms on individual drive, with the following results :—

Group Drive.

Total number of picks...	187,876
Consumption of motor, shafting belts and looms ...	72 KW.-hours
Consumption of motor, shafting belts and loose pulleys	32 KW.-hours
Apparent consumption of looms	40 KW.-hours

Individual Drive.

Total number of picks...	361,206
Consumption when driving looms	53 KW.-hours
Consumption for 187,876 picks	27 KW.-hours
Actual consumption of looms (motor efficiency 75 per cent.) = ·75 × 27	20 KW.-hours

Now, the difference between the apparent consumption on group drive and the actual consumption on individual drive, viz., 20 KW.-hours, is due to the additional losses caused by the loading of the shafting. The shafting, belts and loose pulleys, as distinct from the motor, took 22 KW.-hours, and hence the additional losses form 91 per cent. of the light-load losses.

Subsequently, at another factory, the same writer took a further test, when the additional losses proved to form 174 per cent. of the light-load losses. These figures are rather illuminating when we remember how general is the method of measuring friction losses by indicating an engine on light load.

The efficiency of a modern loom motor of the size used in these tests would not be less than 87 per cent.

In estimating the saving in power with individual drive, account must be taken of the load factor on which the machines are running, since, of course, the advantages of individual driving are the greater the worse the load factor. By load factor is meant what in the weaving shed is known as "weaving efficiency"—that is, the ratio of the actual production of the shed to the maximum possible, assuming no stoppages of the looms for any cause during normal working hours. With individual driving, the power consumption for each machine ceases when the machine stops, while with group driving, the whole of the shafting and belting must be run while a single machine is required, thus :—

If N = the load factor of the mill, per cent.,
I = the power lost with individual drive, and
G = the power lost with group drive,

then for the energy losses with individual and group drive to be equal, $I \times N/(G \times 100)$ must equal 1.

If this formula gives a result greater than 1, then individual driving is at a disadvantage from a transmission loss point of view, while, if the result is less than 1, the advantage lies with individual driving. In no case that the lecturer is aware of have individual loom drives with high-efficiency motors shown to disadvantage.

Individual Driving of Looms.—A weaving shed in Lancashire has a weaving efficiency of 77 per cent. to 80 per cent. for ordinary looms, and approaching 95 per cent. for automatic looms. In the woollen trade, however, 60 per cent. would be an average figure, and it would probably be correct to say that only a high-class shed would reach 66 per cent. This means, therefore, that at a given instant 40 per cent. of the looms are shut down, showing what a large saving in power should be effected with the introduction of individual drive.

If a regular drive is provided at the loom shaft, it will be found that the average speed of the loom can be increased, and it is this regular drive which a three-phase loom motor particularly does provide, improving the weaving efficiency of the loom for two reasons :—

1. The regular speed reduces the number of warp and weft breakages very considerably.

2. The time absorbed by stoppages is considerably reduced owing to (*a*) The shorter time taken by an operative to start a motor as compared with the moving of a belt from a loose to a fast pulley ; (*b*) The high starting torque of the motors, which still further assists in securing prompt starts with the "lay" in any position.

It is satisfactory, as a result of something like 40 tests carried out in various parts of the country with individual drive, to be able to say that in no case has a smaller increase in production than 10 per cent. been obtained, while in some cases the percentage increase has been as high as 25 per cent. Improvement in the quality of the material is a result invariably found with individual drive, and should mean a distinct saving in the mending department.

Simplicity and safety in the weaving shed are not being sacrificed to obtain the results referred to. The motor and the switch are of the simplest possible construction, and contain few parts likely to get out of order.

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* *E.T.Z.*, Band 49, 1912, G. W. Meyer.

Individual Driving of Mules.—Spinning on the mule, as distinct from spinning on the ring frame, is a discontinuous operation, and steadiness of drive is of vital importance. Broadly speaking, two main principles should be observed in the driving of mules, either:—

(*a*) To drive as many mules as possible, preferably all the mules in a factory, from one motor, or

(*b*) To drive each mule individually.

To quote from a paper read before the Institution of Electrical Engineers by Mr. H. W. Wilson:—"Spinning mules represent one of the most variable loads it is possible to obtain. It is necessary to drive a number of them from a single machine, so as to damp out the fluctuations as much as possible, and get something representing an even load. With four mules on a single motor, the writer has seen variations in demand from 15 to 90 H.P. almost instantly, and this manifestly represents a condition of affairs under which no motor can maintain an absolutely constant speed. Broadly speaking, it cannot be said to be a good practice to drive fewer than 12 mules from a single motor of, say, 150 H.P."

Again, a recent writer, in describing an installation, says:—"Mules gave a load varying in the case of a 75-H.P. motor driving two pairs of mules, from 40 to 120 H.P."

The actual H.P. figures apply to cotton mules, but the difference between cotton mule powers and woollen mule powers is one of degree, and not one of kind, since approximately the same percentage fluctuations are present, and the same treatment is needed. With individual drive, the variations in speed that occur simply ease the passage from one stage to another in the cycle of operations, while a constant speed is obtained during the actual spinning period when steadiness of speed is essential.

With mechanical drive, on the other hand, or with group electrical drive, the peak loads of a certain group of mules may synchronise and produce a speed variation on the system of serious effect on the other mules, since it does not happen to synchronise with their operations. This point is of far greater moment than an improvement of a few per cent. in actual speed variation itself.

Individual Driving of Centrifugals.—There are few machines in a woollen factory that are shut down for longer periods than the centrifugals, and, generally speaking, the individual driving of these machines is desirable on this account, and also on account of the difficulties connected with the starting and stopping of the machines. Wherever possible, a vertical motor should be employed, with its rotor mounted direct on the spindle of the centrifugal, the motor being placed either above or below the bowl, depending on the design of the centrifugal. In case this drive is not practicable, individual driving may be carried out with a quarter-twist belt drive. Owing to the great inertia of the bowl which has to be accelerated, the motor starter has to be of a specially large size. When a centrifugal is stopped, the stored energy has to be dissipated in some way, and with individual driving, particularly where a large number of centrifugals are installed, it is often advisable to adopt electrical braking over a considerable portion of the retardation period, since, by this means, a large part of the energy absorbed by the machine during the acceleration period can be returned to the line. For this purpose, where the number of centrifugals to be driven is small, three-phase, pole-changing motors are generally employed. For sugar refineries, where a considerable number of centrifugals are generally installed, it is often advisable to adopt continuous current, as this enables simple systems of economical starting and electrical braking to be used.

Conclusion.—Individual electrical driving is employed to a large extent in Germany, and the speed control this gives the operative is largely responsible for the ascendancy Germans have been able to obtain in certain sections of the textile trade, notably calico printing. It is exactly four years since experiments were carried out which led to the putting down of the first large individual driving installation in this country—that of 800 motors in the shed of Messrs. Frears, Lord & Brother, Bradley Fold. When the order for this pioneer plant was placed, only one British firm could manufacture loom motors, and that firm got the order. In the case of a recent loom motor order obtained by the same firm, they found themselves in competition with not less than five other British electrical firms. You cannot have better proof than this that individual driving is the right thing.

INSTITUTION OF ELECTRICAL ENGINEERS.

A SPECIAL MEETING of the members of the YORKSHIRE LOCAL SECTION took place on December 17th, at the Hotel Metropole, Leeds, the chair being occupied by the chairman of the Section (Mr. T. Roles). The meeting had been specially convened in order that the President of the Institution (Sir John Snell), the treasurer (Mr. Robert Hammond), and the secretary (Mr. P. F. Rowell), might have an opportunity of meeting the members of the Section, as the usual occasion for that purpose—the annual dinner—had been abandoned.

The CHAIRMAN extended a cordial welcome to the three representatives of the Institution from London. After referring to some of the activities of the Local Section, he urged that the members should be kept better informed as to what was going on up in town.

SIR JOHN SNELL promised that he would put before the Council the suggestion that more publicity should be given to the doings of the Council in the *Journal*, and said he believed that the Council did not desire to hide things from the members. He thought great good had been done in the co-ordination of the Papers Committee of the Institution, one result being that papers were now not only read in London, but were read and discussed in the provinces as well, thus getting a wide and catholic discussion upon them, and making members of local sections feel that they were all combined in one Institution. One of his first wishes was that the Local Sections should be in accord with the Council. With the stringent qualifications which were now required by the Institution of Electrical Engineers in regard to the admission of new members and new students or graduates, and the requirements in regard to examinations, there would be brought about a pronounced improvement in the status of the electrical engineer. A sign of the times was seen recently in the request which had been made to the Institution of Electrical Engineers, through him as the President, to nominate from among the members of the Institution some 20—and more were yet to be appointed—gentlemen for commissions in the Royal Garrison Artillery. He had no doubt that in time the Institution would be asked to nominate people for some of the other Government services. There was a great deal of sound sense in the suggestion of the chairman in his address to the Section, that while trade was slack, obsolete plant should be replaced and improved methods of driving adopted. If electrical engineers could point out to manufacturers that by the adoption of electrical systems they could save some 25 or 30 per cent. on their cost of power production—which would mean over 1¼ per cent. on their total cost of production—if they were sensible people they would take notice of the advice and put their houses in order. This especially applied to textile districts, where a very small fraction of a penny per pound on materials made all the difference between profit and loss. He supposed that when peace was restored the Germans would revive competition, and unless the British manufacturers looked to it the competition would become, as time went on, more and more keen. In connection with this question he expressed the hope that British electrical manufacturers would put their hands to the plough and see that they sent abroad both to the Colonies and to foreign countries properly trained electrical men to represent them. They all knew that great complaint was made that manufacturers sent out to the Colonies and to foreign countries representatives who, whilst they were admirable commercial men, were not sufficiently good engineers to be able properly to represent the British electrical engineering industry in other countries. He would like to see the younger members of the electrical profession learn, in the first place, Spanish, and afterwards Russian, because he thought that in Spain and Russia there was going to be a great expansion of electrical activity. In conclusion, Sir John referred in detail to the privilege which had been given to the Institution of assisting the War Office in connection with an Engineering Unit of the new Royal Naval Division, and he expressed the view that this Unit, which was highly skilled in all branches of engineering, would have very special work to do during the next few months.

The meeting of the BIRMINGHAM LOCAL SECTION on Wednesday, December 16th, was also attended by Sir John Snell and Mr. Rowell. After an expression of welcome from the chairman, Dr. Railing, Sir John Snell addressed the meeting, and after referring to the work of the Local Sections reminded the members of the objects for which those Sections were established and of the useful functions they were able to perform. He afterwards dealt with the subject of remuneration of young engineers, pointing out the advantages that would accrue to the community if the electrical profession were made sufficiently attractive to the men of the highest ability, and expressing the hope that the Institution might be successful in effecting an improvement in this respect. He also urged the advisability of all young electrical engineers joining the Institution and thereby gaining a status which would help them in their careers.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

German Firms posing as Belgians.

With reference to Belgian agencies, it seems that a number of Belgian electrical dealers are trying to get into touch with British makers in order to represent them on the Continent.

That is quite right and marks a step towards a keen Anglo-Belgian co operation.

But what would surprise many manufacturers is that German limited companies, trading in Belgium under French names, and calling themselves "all Belgian," have sent their representatives or "technical engineers" as well over here.

They also want British goods, perhaps with the purpose of selling out their German stock under a British label.

I should like to know what are the patriotic feelings of the Belgians who act as agents of our enemies' firms? They are certainly not at the front where their right place should be.

Kindly warn the British firms of the unfair proceedings I have stated.

E. Janssens.

London, E.C., *December 22nd*, 1914.

U.S.A. Safety Rules.

The second part of your comment on the rules in Circular No. 49 of the National Bureau of Standards has been read with much profit in the November 6th issue.

We note that you support the advantages of standardisation in operating safety rules. The variations in British practice which you mention, some companies issuing booklets, others posting instructions, and still others relying upon verbal instructions, parallel closely the conditions found in this country.

Due to the different character of construction, standard safety rules for British practice could undoubtedly omit some of the provisions which seem advisable for American practice. In fact, as construction betterments are made, some of the safety rules now necessary will gradually become less applicable and finally unnecessary in this country. It seemed advisable in the first edition of such rules to include the precautions which present construction and practice render necessary. We shall be very glad to render any assistance should such a work be undertaken in Great Britain.

A principal difficulty found by long observation, many conferences, and the consideration of many sets of rules, is that proper qualification of employés, even for the same work, conveys such varying ideas and permits so many unequally safe practices, that, as a part of proper qualification, the uniform familiarity with a standard set of precautionary measures and the uniform use of such measures should be required as a portion of this very qualification. Partly for this reason many rules cover practices, note of which, it might be at first thought, proper qualification would render unnecessary, but these rules have been shown to be necessary by a history of accidents due to the diversity in qualifications in different communities and in different classes of electrical work.

Many accidents might be avoided also from causes which upon thought are known to the employé to exist, but which dependence upon verbal instruction or general qualification has long prevented from being brought strongly to his attention. Such instructions, if followed, would in fact apparently avoid under existing American conditions at least 200 fatalities annually. The almost universal support of the simple precautionary rules, as well as the more specific ones, by American companies, has resulted from the fortunate experience of many large companies, in reducing this class of accidents by utilising their educational value.

Another feature notable in present American practice, is that isolation by elevation on poles, or above floors in stations, or by other methods is frequently depended upon for the protection of employés, where work necessarily occurs in the vicinity; as, for instance, upon other wires on the same poles and upon neighbouring equipment in stations. The opportunity for unsafe approach of the person or the implements he is using has frequently led to fatalities. A definite minimum for such approach has been thought to bring attention to the hazard, and to prevent taking chances at distances less than can be generally considered thoroughly safe.

It is hoped that adoption by the States and municipalities of reasonable and uniform construction requirements will greatly reduce the number of accidents which occur from unguarded parts which might be by better practice readily guarded, and will so reduce the necessity for so extensive personal precautions on the part of the workmen themselves.

Appreciating greatly your careful consideration of this set of rules, from which we have derived much of benefit for our future revisions.

E. B. Rosa,
Acting Director.

Department of Commerce,
Bureau of Standards,
Washington, *December 1st*, 1914.

Wonderful Accumulator Cells.

In the window of a firm specialising in ignition devices, in this town, the following notice is to be seen:—

"This Farady Hawdon improved storage battery has been standing totally discharged since April 9th, 1914. The plates are free from sulphate. This will appeal to you."

It does, immensely. The cell is a 10-ampere-hour in a celluloid case, and appears to be fitted with kaolin separators.

The positive plate is *now of normal size.* The colour?—spare me this. It reminds me of an advertisement that I saw in a South Coast local paper, many years ago—a motor-car man again—offering to "cure permanently" sulphating.

A. W. B.

Newcastle-on-Tyne.

London Electricity Supply Scheme.

The London electric supply companies seem especially fertile in causing complicated situations. Just recently, when the London County Council brought forth their comprehensive power scheme, it certainly looked as though they were coming to a settlement. The same day as the L.C.C. Bill appeared, out comes another pair of Bills promoted by a partial group of the London supply companies as a rival measure. *Prima facie*, it would certainly seem somewhat discreditable that the London electric supply companies should have had so many years to bring forward a scheme, and should, after blocking as much as they conveniently could the London County Council scheme, have the audacity, so to speak, to bring out at this juncture a partial and incomplete scheme of their own.

It is not as though the whole of the London companies were represented. The group is practically comprised of the West End companies, who have their own "fish to fry" in the Central Co., who, we notice, also figure amongst the promoters. It is surely ridiculous to think that a group of companies who have at present limited areas and absolutely the pick of London, and who are mostly earning what they think are satisfactory dividends, will go out of their way to develop outlying areas which mean much work and little profit. Certainly we have no reasonable cause to think they have any such beneficent motive. The more reasonable conjecture is that they are afraid of the London County Council Bill, and have simply promoted this as an emergency measure to try and get hold of the powers and then do as little as possible. Certainly they do not commit themselves over their present Bill, except to improve the supply of electrical energy; and, moreover, there is a ludicrous provision that the new company shall, within three years, submit to the Board of Trade a "scheme." Anything more lacking in obvious *bona fides* it is difficult to imagine. At the same time, we must congratulate them on their boldness in attempting in such an obvious way to throw the London County Council scheme off the track.

Parliament should certainly look to it that whoever takes over these London electric powers should be people who actually mean to begin work at once, and whose clear interest it is to do such work and not temporise, under cover of submitting scheme after scheme, a line of policy of which everyone is now heartily sick.

Onlooker.

Advertising Methods.

I have often wondered whether advertisers consider to what extent their advertisements are likely to *repel* customers. There are many articles advertised in an aggressive, vexatious, or annoying manner. For example, one takes up *Punch* with the object of being amused, and one comes across a whole page whisky advertisement which affords one no amusement whatever, but rather the contrary, and tends to prejudice one against the article advertised. Scores of instances could be mentioned of advertisements which are calculated to annoy and repel quite as many persons as they attract. The disfigurement of rural districts traversed by our main lines of railway for example. The war has at any rate relieved us for the present of the occulting electrical advertisement nuisance.

The castigation administered by your editorial remarks a fortnight ago, is fully deserved, and I trust it will have the effect of making advertisers realise that some methods of advertising are not only illegitimate, but being vexatious to the public, are injurious to their interests.

Consultant.

London, *December 19th*, 1914.

Rear Lights on Vehicles.

Your suggestion to affix rear lights on those people who find a difficulty in describing a straight line from one point to another after dark, is a capital one, and should be immediately enforced, especially in view of the coming festivities.

The idea might, with every advantage, be extended to the Provinces, where farmers are continually endangering the lives of motorists by moving flocks of sheep along the road after dark.

I myself was the unfortunate victim of this habit last week, but thanks to the yielding nature of the obstacles, little personal injury was suffered.

Wishing you every success and the compliments of the season.

Julian G. Thain,
Chief Engineer and Manager.

Stratford-on-Avon,
December 24th, 1914.

From the Front.

I can assure you that my comrades and myself are most grateful to you for being so kind as to send us your valuable paper. It makes it seem as though we were back in the office again when we can keep in touch with the electrical world like this. There is quite a scramble for turns among the boys here to read the contents of the REVIEW, and I think we will have to draw lots for turns. I don't know whether it will interest any of you to have a few lines from the front, but, as you know, owing to the Censor, it won't have to contain very much information.

As you will see, I am attached to the Wireless Section. We are having some terrible weather over here—wet, cold, raw and muddy; it is wicked, especially with our work, which is, of course, worked by shifts of 6 hours on and 12 off, day and night. Still, we are getting quite used to this kind of life now, and I am very pleased to say that there is not a single case of illness amongst us, which speaks very well, seeing that most of the men are Post Office operators, and others from offices, &c., and not used to the open-air life.

Wishing the ELECTRICAL REVIEW staff a very merry Christmas and a bright and prosperous New Year, with all good luck for the valued ELECTRICAL REVIEW.

Arthur Maugham.

First London Wireless Co. Royal Engineers,
General Headquarters, British Expeditionary Force,
December 23rd, 1914.

"We Can't Take the Risk."

With reference to the article entitled "We Can't Take the Risk," we feel, as electrical manufacturers, that we cannot let such an indictment pass unchallenged. We must admit that on the surface it would appear that we manufacturers are not doing much to capture the trade which our war with Germany will undoubtedly give us an opportunity of doing, but we will not admit that this apparent neglect is in any way due to nervousness or want of enterprise on the manufacturers' part. We believe that our troubles are the same as those of almost every manufacturer in the country. Every paper that we read tells us that now is the time to get hold of German trade, and no one would be better pleased than we should to do so; but, so far from being able to do so, we are having the utmost difficulty to retain our own trade. This difficulty, however, is in no way connected with fear to take the risk, but purely absolute inability to get men.

Since the war commenced we have lost 70 men and have not succeeded in replacing a quarter of these. The men who are left have made a splendid effort, but, of course, have been unable to maintain our turnover, and we at the present moment find ourselves inundated with orders and fairly considerably behind in deliveries.

This shortness of men has not, however, in any way discouraged us, and we some months ago placed a contract for an extension to our factory, which will, we hope, be complete in a few weeks, when we hope, on the return of more normal times as regards labour, to find that we can not only keep our own customers, but capture some of the German trade.

The Crypto Electrical Co.
J. G. Shaw.

London, N.W., *December 24th*, 1914.

German or British?

Under the above heading there appears a letter in your last issue dealing with the nationality of the representative of this company in Australia. As stated in that letter, Mr. Hentz is German, but he is not in our permanent employ; his services were placed at our disposal temporarily last spring, when the representative whom we were sending out died suddenly a few weeks before the date when he should have sailed. Mr. Hentz was at the time travelling in the East on behalf of the German Tudor Co., and, in view of the fact that in former years he had represented the German Tudor Co. in Australia, we were glad to find this temporary solution of a difficulty.

When war broke out, realising that the position was unsatisfactory, we arranged with an Australian engineer, who had previously been in our employ over here, to represent us for a few months, and one of our engineers who has been with us for many years is proceeding to Australia in January to represent us definitely.

I admit that, in stating that we had no Germans in our employ, I had overlooked Mr. Haggemann, who is a battery inspector, and also had overlooked a second inspector in Australia; this error of a fraction of one per cent. of the staff does not seem very serious.

In regard to the country of manufacture of Tudor batteries exported to Australia, for many years the German Tudor Co. and ourselves did business there concurrently. Whenever batteries were ordered from us, they were invariably manufactured at our works at Dukinfield: when the batteries were ordered from the German Tudor Co., they were sometimes manufactured in Germany, but they were frequently manufactured at our works to the order of the German Co. An agreement, however, was made between the two companies some two years ago, by which we have now the sole rights of supply in Australia and all other British Colonies, except in cases where the purchaser expresses a wish to have a German-made battery, which, of course, may occur when the battery is a sub-contract and the main contract is placed with agents representing German electrical firms.

I am sorry to have troubled you with such a lengthy explanation, and trust that your correspondent will now be reassured that all batteries purchased from us are manufactured in this country.

E. Jacob, *Managing Director*,
Tudor Accumulator Co., Ltd.

London, S.W., *December 29th*, 1914.

Our notice has been drawn to a communication received by you, and printed by you in your "Correspondence" column of your issue of December 25th. Without wishing to enter into a lengthy correspondence, we think the following facts will be of interest to you, namely:

This company has been duly registered under the English Companies' Act, and over two-thirds of the capital issued is held by British subjects resident in this country. Moreover, all our directors are British, and likewise are resident in this country. Further, all the hands we employ, which number many hundreds, are of British nationality.

In conclusion, the "Wirum" lamp, which we make, is, and always has been, manufactured in this country, at our works at Brimsdown, from inception to completion.

The Brimsdown Lamp Works, Ltd.
(Leslie Hayes *Director*)

London, W.C., *December 29th*, 1914.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Ironclad Switch.

Messrs. J. H. Tucker & Co., of King's Road, Hay Mills, Birmingham, are introducing a new ironclad D.P. switch for 25 amperes at 600 volts, which embodies some valuable features. It has a quick make as well as a quick break, and the blades cannot be held in an arcing position, both movements being positive and independent of the operating handle. The blades are firmly held in the on and off positions, independently of any spring, and the breaking of the circuit is not wholly dependent on the action of a spring. The blade is so shaped as to ensure a perfect contact; the clips are well recessed on a substantial base of vitreous porcelain, and are screened from dead metal. An interlocking device is provided to prevent switching on while the cover is open, or opening the cover while the switch is on.

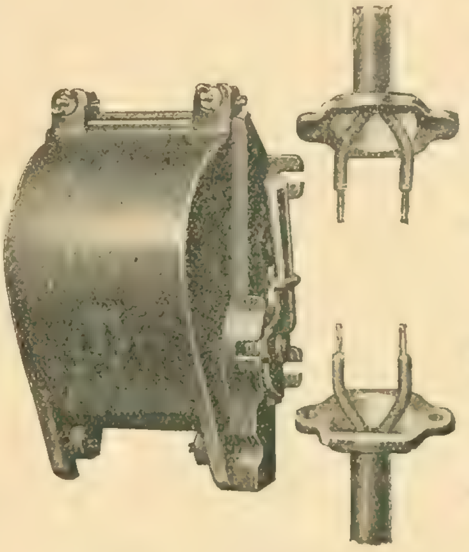
Fig. 1.—New Ironclad Switch.

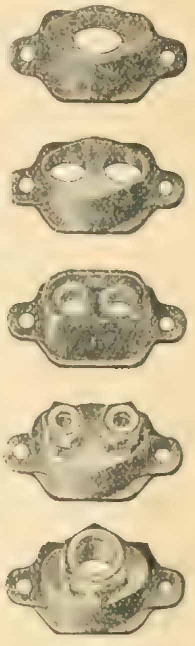
Fig. 2.—Adapters for use with Tucker Switch.

Special attention has been given to the wiring of the switch; the cables lead directly into the terminals, and various forms of adapters have been designed, fitting on the top and bottom of the switch case, which facilitate wiring and enable the switch to be taken down without disturbing the conduit or casing; some of these are shown in fig. 2.

The insulation consists of micanite alone, and the case is watertight, lined with the company's special silicate paint, enamelled outside and stoved.

The switches are subjected in the works to a flash test of 2,000 volts, and one of them has been mechanically operated over 250,000 times without breaking down.

Holophane "Refractor" Globe.

In a pamphlet just issued by Messrs. Holophane, Ltd., of 12, Carteret Street, S.W., a new type of their well-known scientific glassware is described which has been specially designed to carry out the requirements of a correctly installed street-lighting system.

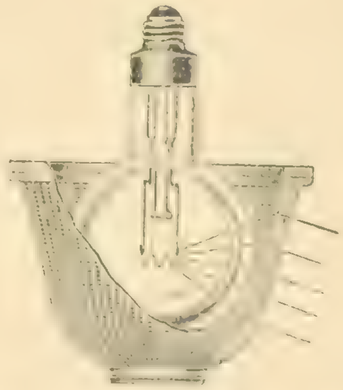
Fig. 3.—Section of Holophane "Refractor" Globe.

Hitherto, mechanical difficulties have prevented the designing of a unit which would embody all the advantages of Holophane prismatic glassware, and at the same time be smooth both on the outside and inside, so that undue accumulations of dust cannot collect, and also be easy to clean. These mechanical difficulties have now been overcome by the new Holophane "Refractor" globe, which consists of two pieces of glass provided with horizontal and vertical prisms respectively, one piece being placed inside the other.

By the use of the "Refractor," the maximum light is sent out at an angle of 15° below the horizontal and the intrinsic brilliancy of the filament is reduced whilst the absorption is practically negligible; the lamp is weather protected; the enclosing glass unit allows for ventilation, and is not a collector of dirt; the light is distributed evenly over a wide area, as shown by the characteristic curve, fig. 4.

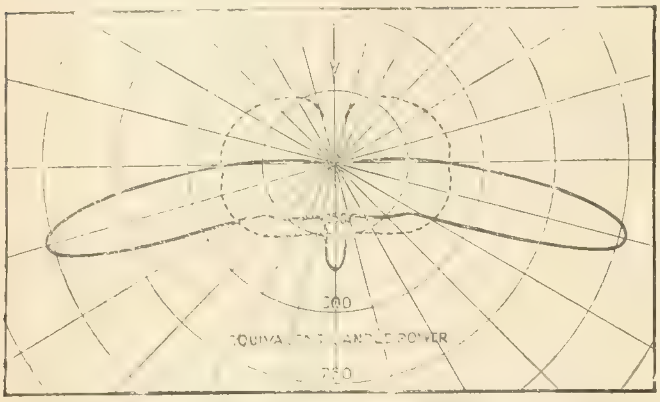

Fig. 4.—Light Distribution Curve of Holophane "Refractor" Lantern.

The curve illustrates the great advance which the Holophane "Refractor" unit makes in the uniform illumination of streets.

The firm draws special attention to the value of this development in these days of restricted lighting, which, under present methods, results in patchy illumination.

New Lamp Suspension.

The London Electric Firm, of George Street, Croydon, has brought out a new type of "lyre" or harp-shaped carrier, with lowering gear to enable the lamp to be trimmed from the ground. The entire absence of projections and the unobtrusiveness of the contact-suspension gear are noteworthy features. No winch or rope is outside the standard, and the gear further embodies a one-part device which performs a three-part function, viz., a contact maker, a weight reliever and a lock for the canting inner harp—all performed simultaneously by one operation. This also ensures safety, as the lamp cannot be lit until the rope is relieved of the weight and the harp is locked.

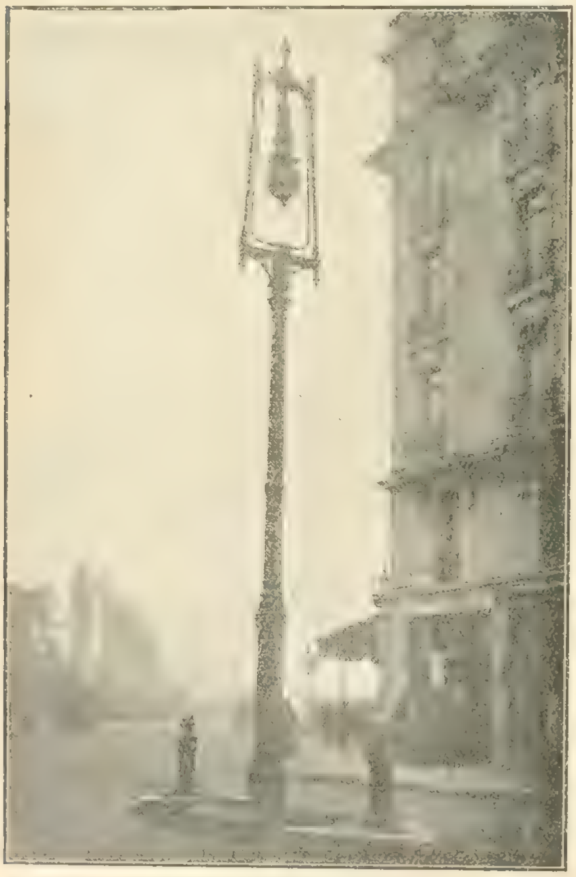

Fig. 5.—New Lamp Suspension.

Unit System of "Salford" Switches.

The General Electric Co., Ltd., of Witton, Birmingham, has developed an attachment which enables its "Salford" switches to be connected up on the unit principle; this consists of a cast-iron box containing horizontal copper bus-bars, so constructed that they can be connected up easily and solidly with the bus-bars of adjoining switches so as to form a solid run of bar throughout the whole length of the bank of switchgear. In this way any number of "Salford" switches of the same or different capacity can be connected or disconnected in a short space of time. The attachments are constructed so as to fit easily together, and the principle enables considerable economies to be effected in the cost of wiring up.

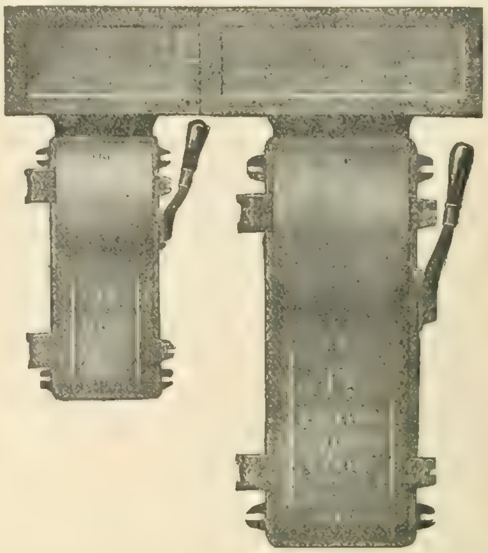

Fig. 6.—G.E.C. "Salford" Switches with Unit System of Attachment.

LEGAL.

Arbroath Electric Works Appeal.

The Valuation Appeal Court on December 19th decided an appeal by the Arbroath Electric Light and Power Co., Ltd., against an entry of £1,215 in the valuation roll in respect of their works and mains. The appellants asked that £500 should be substituted in the roll. The Valuation Committee by a majority fixed the valuation at £1,100. The grounds of appeal were that the method of valuation adopted by the Assessor in taking only one year's accounts was not in accordance with the proper application of the revenue basis; that an average of at least three years' accounts should be taken; and that prior to this year the Assessor based his valuation on an average of three years' accounts, and 1913 was an abnormally good year for the company. For the Assessor it was stated that in 1913 additions were made to the plant and machinery to the amount of nearly £8,000, increasing the value of the subjects by a third, and that the profits earned in 1911 and 1912 did not reflect the earning capacity of the undertaking in its present state, while the profits of 1913 did more nearly represent that earning capacity.

The Court (Lord Johnston differing) adhered to the determination of the Valuation Committee.

Lord Salvesen, who gave the leading opinion, said that the Committee had acted with conspicuous fairness.

Lord Cullen concurred.

Lord Johnston thought three years' average would be fair.

Dewsbury Corporation v. Wilby.

At the Dewsbury Police Court on December 22nd, Councillor Fred. Wilby, a member of the Dewsbury Borough Council, was summoned in respect of the non-payment of £1 14s. 4d., electricity rent for the use of current at his stand in the covered market-place.

According to the evidence, it appeared that the account referred to the period from April 25th to June 3rd, last year, and the defendant stated that during that time there were only two occasions when current could be consumed—the two weekly market nights. He maintained that the sum was an abnormal charge, and it was important to bring this matter forward publicly, because he could not mention it in the Council meetings, as it affected his own interests. The same thing had happened in other cases, though more particularly with regard to gas than electricity. He had allowed the matter to come before the magistrate in order that the public might know whether there was any proper method of checking the meters or not. He gave figures showing that in December, 1912, he would use a great deal more electricity than he did in May, but the account then was only for £1 5s. 8d., whilst in December, 1913, it was only 18s. 8d., and in April last 4s. 8d.

The Magistrates deferred their decision for one month, and suggested that in the meantime the defendant and the Electricity Committee should take an opportunity of meeting together to discuss the matter.

WAR ITEMS.

Melbourne City Council and Messrs. Siemens.—From Australian newspapers just to hand it appears that the Melbourne City Council had before it on October 26th a report by the Electric Supply Committee recommending that authority should be given to purchase plant and materials required for extensions of the electric supply undertaking, at an estimated cost of £71,289. Special advice was asked in regard to the purchase of a 1-5000 kw. 3-phase turbo alternator for the power-house, to cost £9,800. The committee asked for the instructions of the Council as to whether it should negotiate for the Willans and Robinson plant with Siemens generator, or invite tenders for the supply of the plant. A report from Mr. H. R. Harper, city electrical engineer, said it was very necessary that immediate steps be taken to procure this additional generator for the winter of 1916. Allowing for the unsettled state of the engineering trade, owing to the European war, it was difficult to say how long it would take an English manufacturer to manufacture and export a plant of this size. It would be wise, therefore, to place an order as early as possible, in order to minimise the risk of having a shortage of plant for the winter of 1916. There were two ways of dealing with this matter—one was to call for tenders in the usual way, and the other was to obtain a duplicate of the two last plants from the makers, Messrs. Willans and Robinson. The latter course seemed to him to be preferable, as the two plants recently installed by this firm were proving to be excellent, being economical in steam consumption, with a considerable margin of capacity above that specified. Further, it was a great advantage to have all plant in a power-house of uniform size and make, for it cut down the amount of spares to be carried and rendered the operation and maintenance of such plant a simpler task to the staff. The town clerk read a lengthy communication which had been received from Mr. A. L. Herbert, general manager in Australasia of Siemens Bros. Dynamo Works, Ltd., explaining the position of the Siemens companies. This is printed in extenso in the "Melbourne Age" for October 27th, together with the following report of the meeting. A letter from Sir E. Grey (dated August 27th) authorising the Siemens companies to continue trading as made in the House of Commons by the Attorney-General, were read. In submitting the report, Cr. Treadwell said his committee had an open mind on the matter, but realised that it was its duty to insist on the plant which it purchased being of a high standard of efficiency. Cr. Morell thought that the Council would be wise to accept the tender. It would mean a saving of money in spare parts, and, besides, the machines were made in England. Cr. Smith moved that the Council call for tenders. There was no question but that Siemens was a German firm, and they wanted something purely British. Cr. Atkins said they would have to give some direction to the Electric Supply Committee as to how it was going to guarantee that no money would go to Germany. Cr. Cabena said that, taking a purely business view of the matter, they should accept the tender, but there were other points of view, and it was not for the committee to dictate to the Council on a matter of patriotism. He wanted to emphasise the fact that this contract was a matter of expediency and a matter of business. They could place the order for the alternator with Willans and Robinson, and stipulate for a generator made by Kerr & Co., a Scotch firm, or any all-British concern. Cr. John Gardiner said the Council should stick to its policy of calling for tenders. He was not going to be a party to what was practically giving preference to German capital. He trusted that members of the Council would rise to a sense of their obligations in this matter. The motion of Cr. Smith that tenders be called for, excluding German and Austrian manufacture and capital, was carried.

Australia and German Trade.—A Melbourne telegram to an Australian newspaper states that an anti-German League, to be formed in Melbourne, is assured of good support. Its object is to prevent trade with the enemy, and information will be obtained on the following points:—(a) The source from which their tradesmen obtain their goods; (b) the nationality of the proprietors, managers, and employés of firms; (c) the nationality of local agents for British firms; (d) what German or Austrian firms are trading under English names. The League hopes to gain the co-operation of the British Board of Trade. It intends to encourage in every possible way the purchase of Australian products.

At the end of October last the Minister of Customs, Mr. Tudor, received a deputation at Melbourne, representing the Australian Protectionist Association, a newly-formed organisation formed with the object of impressing on the Government the necessity for providing an effective tariff against foreign goods, and extending to Great Britain trade preference for goods unobtainable in Australia. The deputation, which was introduced by Mr. C. C. Salmon, president of the Association, represented iron, machinery and various other trades. Other speakers supported his views. In reply, Mr. Tudor (according to a report in the "Melbourne Age") said he agreed that the first thing of importance to obtain was employment for the people. That fact was brought home to them more to-day than ever. But he did not agree that employment should be fought for first and conditions for the workers after. If the manufacturer got protection, the worker should also be guaranteed protection. He believed in protection to encourage the supply of raw material. The deputation was anxious to look after its own country, and if there were any differences of opinion among the people (who all had the same wish), it was as to the best way to do it. Some people thought things ought to be left alone. Others thought employment should be provided for the people. It was not customary for a Minister to give notice as to when a new tariff would be introduced, and he was not going to do it. The Governor-General's speech had promised action this session in regard to Tariff Reform, and the promise would be kept. How long the session would last he did not know. He urged manufacturers to supply the Inter-State Commission or his department in the meantime with all information required. Manufacturers were lax in supplying statistics. Until uniform statistics were supplied there would be a difficulty in granting effective protection. It was impossible to get the production figures for Australia for 1913, despite the fact that customs statistics for 1913 were available in February last. Until the production statistics were supplied by manufacturers to compare with the customs import figures it was impossible to know where they stood. The question of British preference would be a matter for the Cabinet to settle. He would certainly bring it before the Cabinet, although he was not keen on it. Neither was he keen on extending preference to nations assisting us at the war.

The Runaway Bombardment.—During the naval bombardment of the Hartlepools on Wednesday, 16th December, from about 8.5 to 8.45 a.m., the West Hartlepool Corporation tramways suffered slight damage. We are indebted to Mr. Charles Burgess, the general manager and engineer, for the following particulars as to the extent of the damage:—Offices: Roof of part of offices struck by shell and carried away. Remaining portion of office slightly damaged. Depôt: Flagstaff on top of depôt splintered. A shell fell a few yards to rear of depôt and buried itself in the railway embankment. Overhead Line: Wires brought down at two points on Hartlepool route and one point on the Park route. Total length down, approximately 300 yards. No poles damaged. Permanent Way: No apparent damage. Rolling Stock: Several cars in service had the windows shattered, and one car standing in the depôt had a controller struck by a piece of shell which came through the window of the depôt. Injuries to Staff: One member of office staff sustained scalp wound (slight). No other members injured, though the depôt staff were on duty when the firing commenced. Delay to Service: About an hour after the bombardment ceased the service was resumed on three routes, and on the remaining route at about 5 p.m., by which time the overhead line was repaired. For some months the department has been engaged in building considerable extensions to the depôt, and these works, which are now approaching completion, fortunately escaped any damage.

Messrs. Richardsons, Westgarth & Co., Ltd., of Hartlepool, write as follows:—"As it has been reported that during the recent bombardment of Hartlepool our works were seriously damaged, we desire to inform you that although unfortunately a number of our workmen were killed, our works suffered very slight material damage. The actual damage was confined to a few roofs, which were partially destroyed, and a great number of broken windows. No work in progress or machines were damaged, and we are working in a normal way."

German Electrical Machinery Dumped in Australia.—We quote the following from the "Melbourne Age" for October 26th:—"For some years past German manufacturers of electrical machinery and appliances have been making strenuous attempts to capture Australian trade in their special lines. Though this is in keeping with an onslaught on the markets of the world in that branch of trade—in the year 1912 Germany exported £8,034,000 worth of electrical goods—the competition of German firms has nowhere been so keen as in respect of Australian business. The imports from Germany in 1912 amounted to £195,000, and while the British percentage of trade was declining that of Germany has rapidly increased. The methods by which Germany has been capturing this trade are not such as should commend themselves to Australian importers, even if that country had remained friendly to the British Empire. She has sought to gain business not by honest competition, but by schemes that suggest some of her ethics of the battlefield. In the first instance the standard of certain German machinery and appliances is appreciably lower than that of British lines. Candle-power, according to Germany, is not equal to British candle-power. From a comparative point of view, therefore, the German products are inferior. Evidence is available, too, to show that German manufacturers have dumped goods on the Australian market, content to lose money in the hope that, on capturing the trade, they can recoup themselves with interest for their calculated and profitable generosity. In view of the difference in standards this temporary generosity is illusive. It is not very creditable to the purchasers that 'dumped' German goods are being utilised by them for the supply of public services. The community has at least the right to expect that public concessions to commercial concerns should not be utilised for the benefit of foreign countries at the expense of the British Empire."

German Private War Allowances to Workmen's Families. [illegible] particulars concerning the financial allowances which have been made by various manufacturing firms to the dependents of workmen who have been called up for military service in Germany. The Schuckert Electricity Co., of Nuremberg, for instance, which does not enumerate the number of men called up within the circle of its various undertakings states merely that considerable provision had been made for the staff and the workmen. In the case of the A.E.G., the number of men requisitioned by the army authorities by the middle of December was 14,000, and the company had expended £25,000 per month, or a total of £100,000 in the first four months, in supporting the men's families. The cost has been defrayed out of current funds without touching the provident fund which is intended for use in normal times. The position of affairs, however, is set forth much more distinctly by the Siemens & Halske Co., for itself, and also on behalf of Siemens-Schuckert Works, in which the former is joint proprietor with the Schuckert Co. Down to the end of the first week in December the number of officials and men called up from the two companies concerned was 13,526, and the allowances which are being made to the families in the case of men hitherto employed by both firms have been fixed as follows until further notice:—Half of the monthly salary to the wife of an official, and an additional 5 per cent. of the salary for each child under 14; and 6s. per week to the wife of a workman, and a further sum of 1s. per week for each child under 14. The total amount paid by the two firms during the first three months, including special allowances in the first month, is reported to have exceeded £75,000.

Competition with Germany and Austria-Hungary.—In connection with the special arrangements made in the Commercial Intelligence Branch of the Board of Trade for dealing with enquiries in regard to the above subject, lists are being prepared and circulated of articles which enquirers desire (a) to purchase, and (b) to sell. The sixth list is now ready, and may be obtained by United Kingdom manufacturers and traders, together with copies of the previous lists, on application to the Branch. British firms interested in any of the goods mentioned, either as buyers or sellers, should communicate with the Director of the Branch.

Lancashire Tramway Employés and the War.—In consequence of so many of their drivers and conductors having joined the colours, certain tramway companies and municipal tramways committees in central, south and south-east Lancashire are now advertising for both drivers and conductors.

BUSINESS NOTES.

Consular Notes.—SPAIN.—Valencia, with its 250,000 inhabitants, and its wealth derived from the shipment of rich fruit and vegetable crops, is, in the opinion of the United States Consul there, a good centre for conducting a campaign to capture the German electrical trade. He believes that permanent results can be obtained only by following previously adopted methods of personal representation, taking orders by sample, quoting net prices delivered in Valencia, and advancing reasonable credit. If these methods are not adopted and accompanied by low prices, only a transitory trade can be expected. The establishment of a joint agency and sample room is suggested (by the President of the United States Steel Corporation) as a practical means for increasing sales of articles which are not manufactured in sufficiently large quantities to warrant the expense of special propaganda by a single manufacturer. This would result in putting Valencia and district in direct communication with foreign markets. It would make them as commercially independent in import trade as they already are in export trade, and as they ought to be, having regard to the size, population and wealth of the territory. An alternative plan, but probably one less satisfactory, would be to appoint as an agent a Spanish house in Barcelona or other commercial centre, having experienced travellers already available. The goods in greatest demand and the approximate retail prices at which they must be sold are as follows:—Lamp sockets (bayonet), 9d. each; push buttons, 1s. 10½d.; wall switches, 1s. 1½d.; fuse boxes, 3s.; cleats, from 2d. per pair; shade holders, 5d. each; glass shades, up to 4s. 6d.; metal and porcelain shades, up to 1s. 1½d.; metal-filament lamps with maximum of 75 c.p. up to 1s. 10½d. These are the prices at which the better grades of German makes have been selling, but much cheaper goods have a larger sale. It should be remembered that the secret of success in this, as well as in other lines, is the willingness and ability of manufacturers to furnish an article at the price the trade is willing to pay. The Germans have not attempted to educate consumers to demand better quality at higher cost, and many merchants assert this cannot be done, at any rate until a permanent footing has been secured in the market. Valencia importers are not accustomed, nor will they agree, to cash terms. The correspondence method of trade-getting is not popular in this market, but the personal element, the periodical visit of a representative of the exporting house, with samples, prices, guarantees, &c., is very influential if not all-important. Merchants who have recently been interviewed find it necessary to repeat the warnings to exporters (1) to prepay full postage on their correspondence; (2) to correspond in the Spanish language; and (3) to make use of the international return-postage stamps.

SOUTH AFRICA.—Whilst urging his countrymen to maintain their activities in the South African market, the U.S. Consul at Port Elizabeth admits that English and German manufacturers made the greatest progress in selling electrical material last year. Electrical machinery from America showed a decided increase over 1912 in the face of a decrease in the total amount of imports. In a short time, he adds, all municipalities of any consequence will be lighted by electricity, and the use of power for manufacturing, heating and lighting is rapidly becoming popular. American goods are slowly but surely increasing in public favour, and it is only necessary for exporters to study a little more carefully the needs and customs of the country to make that increase more rapid. In attempting to do business in South Africa, a new man should make a careful study of business conditions and local customs. Any little courtesy that is extended to a possible purchaser is fully appreciated. Many representatives of British firms make a point of asking the head of the department or purchasing agent to luncheon or dinner at least once on every trip. No promises that the firm will not sanction should be made, and plenty of time should be taken to work each town with care. Once a customer is secured, it is comparatively easy to keep him if his requirements receive prompt attention. In packing goods for Port Elizabeth it must be remembered that, during unloading, articles, unless extremely bulky, are placed in large rope slings or hammocks in the vessel's hold, hoisted out over the side and transshipped into lighters alongside. Consequently a parcel is frequently upside down or on its side. Strap fastenings and blockings should have direct bearings on the contents of the case at every angle.

SIAM.—*Tungsten.*—The United States Consul at Bangkok calls attention to the deposits of wolfram found in Nakon Sri Tamarat, on the east coast of the Siamese portion of the Malay Peninsula. Here the wolfram ore had been left in great heaps as valueless material after having been separated from the tin ore by the Chinese miners. The amount of wolfram recovered during the fiscal year 1912-13 was 309 tons, against 119 tons for the previous year. The output of this ore is likely to diminish soon, as the surface workings are nearly exhausted. For the working of the deeper deposits on proper lines, special knowledge and considerable capital would be needed. Wolfram in moderate quantities has also been found at Puket, on the west coast of the Siamese Malay Peninsula, and this mineral is said to be fairly widely distributed throughout the Peninsula.

CHINA.—According to the U.S. Consul at Chungking a business man connected with a large German electrical company, which recently underbid all competitors, stated that his house was willing to wait 25 years, if necessary, for the profits which it hoped to get eventually by selling now at about cost price. Although the expediency of such a campaign remains to be proved, the example set in principle affords encouragement to firms to extend their activities, although, perhaps, by less costly methods.

Book Notices.—*Whitaker's Almanack for 1915* (2s. 6d.), is the 47th annual appearance of this well-known book. It is as valuable as ever, indeed at such times as these perhaps one has even more occasion than usual to refer to it, for it contains much information regarding the Navy and the Army, and their prominent *personnel*, and, of course, chapters relating to the great war. A great deal of matter is also available regarding the various colonies, foreign countries, University and educational matters, the Civil Service, railway matters, &c. But *Whitaker's Almanack* requires little commendation at this date.

Aluminium: Facts and Figures.—The pocket-book of data concerning aluminium, issued by the British Aluminium Co., Ltd., of 109, Queen Victoria Street, E.C., has evidently filled a want, and the appreciation with which it was received has prompted the company to produce an enlarged edition, in the form of a neat binder containing 56 pages, and distinguished as Publication No. 147. This has the advantage that any pages containing matter in which the user is specially interested can be withdrawn and the remainder kept on file, and additional pages can be inserted when available. The particulars are of great variety, covering all usual shapes of aluminium parts, special sections, rods, tubes, cables, overhead lines (regulations, sags, &c.), and a list of other publications issued by the company. Users of the metal will find it invaluable.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII. No. 12. December, 1914. New York: The Institute. Price $1.

"Circulars of the Bureau of Standards," No. 6: "Fees for Electric, Magnetic, and Photometric Testing," and No. 31: "Copper Wire Tables." Scientific Papers of the Bureau, No. 227: "Measurements on Standards of Radiation in Absolute Value"; No. 228: "An Experimental Study of the Koepsel Permeameter"; No. 229: "Various Modifications of Bismuth-Silver Thermopiles having a Continuous Absorbing Surface." Washington: Government Printing Office.

Hindley Gas Engines.—In Messrs. E. S. Hindley and Sons' advertisement appearing in the last few issues of the Review, the illustration shows a 4-cylinder engine, whereas the letterpress describes it as a six-cylinder. Lest any reader should think that the firm does not make sets above four cylinders, we are asked to state that the letterpress was correct, but a wrong block was sent for use.

Trade in 1914.—Messrs. Richardsons, Westgarth and Co., Ltd., report that in their turbine department, at Hartlepool, their output of ships turbined in 1914 was 43,000 I.H.P. The output of complete sets of marine engines and boilers at the Middlesbrough works was less than usual, comprising only four sets, having a total of 6,000 I.H.P. On the other hand, the output of marine boilers was the highest on record. In addition to the nine boilers required with the complete marine sets supplied, the firm have supplied other nineteen, varying in diameter from 15 ft. down to 11 ft., and representing a total of 13,950 I.H.P. for the boiler shop output. To this are to be added six of their "Nesdrum" water-tube boilers for land work, having a total of 2,000 I.H.P. In land work they have been kept fully occupied, and for the last few months have had to work double shift upon urgent orders for Government and other work required for early delivery. In addition to other plant they have supplied three large surface condensers each capable of condensing 80,000 lb. of exhaust steam per hour for the new turbine power station being erected for the Buenos Ayres suburban system, also one surface condenser to deal with 150,000 lb. of steam per hour for the Newcastle-on-Tyne Electric Supply Co.'s extensions at the Dunston power station, and another similar condenser for the Manchester Corporation Stuart Street power station. In iron and steel works plant, Messrs. Richardsons, Westgarth & Co. have completed a number of large metal mixers, including one having a capacity of 500 tons of molten metal for a Midland firm, one of 400 tons capacity for a local works, and another of 175 tons capacity, also for the Midlands. Two large sets of hydraulic plate shears have also been supplied to a local steel works.

Messrs. Mirrlees, Bickerton & Day, Ltd., Hazel Grove, Stockport, Diesel oil engine makers, state that the year 1914 was a record one as far as output of engines was concerned, their last completed extensions having been available and fully occupied. As in former years, orders were obtained from practically all parts of the world, and repeat orders have been consistently sent by old customers; the placing of an engine in a new district has resulted in further orders from the same district. During the year the firm have been engaged on a large number of engines for the British and Foreign Governments, and although since war was declared there has been a falling off in orders from private customers generally, the large amount of work the firm have in hand for the British Government has enabled them to keep their works fully employed. They state that contrary to what would have been expected the high price of fuel oil ruling at the early part of the year did not cause any falling off in orders for Diesel engines, and it is significant to note that since the declaration of war the fall in the price of fuel oil, which commenced about midsummer, has still continued, and there appears to be no danger whatever of an increase in price. There seems no doubt that orders, which are being hung up owing to the war, will be placed immediately after its close, and that a continued period of prosperity may confidently be anticipated.

Messrs. Mather & Platt, Ltd., of Park Works, Manchester, report that under the circumstances they have had a very satisfactory year's business in all their branches. During 1914 they have completed and delivered a number of high-speed enclosed self-lubricating vertical duplex gas engines. The electrical department has been exceptionally busy, especially in connection with the electrification of mines, collieries and textile factories, both at home and abroad. Many other industries have also seen the advantages of a clean and economical source of power, notably the flour millers, and they have just completed the electrification of a flour mill, where the power required is in the neighbourhood of 2,000 B.H.P. During the past year the firm have supplied turbine pumps for increasing duties. Large numbers of their multi-chamber type pumps have been installed in collieries, where the duties have frequently been in excess of 1,000-ft. lift. They have further installed pumps of similar type for hydraulic purposes, generating a pressure head of 1,800 ft. (800 lb.). This firm's textile department, which specialises in the complete equipment of works for bleaching, calico printing, dyeing and finishing, has felt the effects of the war more than any other department, but until the outbreak of hostilities the business had been quite satisfactory.

Messrs. W. C. Martin & Co., of Glasgow, report that the year was a very busy one in the fitting of electrical installations for marine work. The principal installations of the year have been those on the Q.T.S.S. *Aquitania* and the T.S.S. *Transylvania*, both for the Cunard Line, and the Royal Holland-Lloyd liner *Tubantia*. During the year no fewer than 20,000 electric lights have been installed, together with electric motors of approximately 3,500 H.P., varying in size from ½ H.P. to 50 H.P. each, also about 3,000 electric bells. Other activities are shown by the fact that some 300 telephones, 110 electric clocks, and 500 fire alarms have been installed, and a beginning has been made in electric heating and cooking, which is now past the experimental stage. The prospects for 1915, while satisfactory, are unsettled owing to the war, but a busy period is looked forward to.

Half-Watt Lamps.—We remarked some months ago that we expected the life of half-watt lamps to exceed the average period guaranteed by the makers. Some particulars have come to hand with regard to an installation of 14 110-volt, 500-watt Osram half-watt lamps in a large paper mill, where large temperature variations were experienced and the lamps were subjected to considerable vibration. Only two of these lamps had a life of less than 1,200 hours, and 10 were still in use after burning from 1,300 to 1,870 hours. The average life of the 14 lamps was over 1,500 hours, and the candle-power had not diminished appreciably. If these results are attained in the early days of the half-watt lamp, we may look forward with confidence to future records.

Calendars and Diaries.—Messrs. C. Isler & Co., Ltd., Bear Lane, Southwark Street, London, S.E., have issued a large illustrated show-sheet with calendar for 1915.

From the Electric Construction Co., Ltd., of London and Wolverhampton, we have received a handy little vest-pocket calendar and diary for 1915, with daily engagement space. It is exactly similar to that issued by the company last year.

Messrs. Pope's Electric Lamp Co., Ltd., have prepared an attractive calendar for 1915. A block of daily slips with large and clear figuring is fixed to a cardboard base which takes the form of a lighthouse in which a British-made "Elasta" lamp lights the way. The firm have also published a series of coloured picture postcards, each of which advertises some particular quality of these lamps.

Mr. H. J. Hawkins, of 42, Cheapside, E.C., sole representative for Messrs. Horace Green & Co.'s motors and dynamos, has sent us some telephone reminder pads, and he offers similar sets to any electrical contractor applying for same. Owing to the great demand for his firm's machines, Mr. Hawkins has opened a London stockroom, from which delivery can be given of any standard size motor up to 15 H.P. for the usual London voltages.

Messrs. Alfred Herbert, Ltd., of Coventry, have sent us one of their wall calendars for 1915. It is in the now familiar size and style, with clear figuring, on monthly sheets, each of which has a half-tone illustration of the firm's machine-tool manufactures.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have sent us one of their very useful desk blotter wallets; also a set of 1915 engagement slips for use on the file provided a year or two ago.

Messrs. McClure & Whitfield, of Stockport, have sent us as usual one of their handy pocket diaries for 1915, with insurance coupon. The opening pages contain descriptive matter and tabulated prices relating to the "Mersey" generators and motors.

Messrs. Mather Bros., of 35-36a, Farringdon Street, London, E.C., have sent us a wall calendar with monthly sheets for 1915.

Messrs. Venner & Co., of 6, Old Queen Street, S.W., have sent us as a Christmas souvenir a neat leather "sovereign purse" for bank notes, which we shall be glad to carry about in the hope of being able to use it some day. We understand that similar gifts have been dispatched to all the usual recipients, and the stock is now practically exhausted; but if any have gone astray, the senders will be glad to be informed of the fact. The customary *jeu d'esprit* is this year omitted in view of the exceptional circumstances, but the hope is expressed, in which we share, "by this time next year to have good reason for being extra funny, to make up for lost time."

Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E.—The desk blotting-pad issued by this firm, now a hardy annual, has just been received. Each sheet of blotting bears a complete calendar for 1915.

Catalogues and Lists.—Messrs. Bagshawe & Co., Ltd., Dunstable.—Illustrated leaflet showing their chains for elevators, conveyors, &c.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—Illustrated price leaflet relating to motor-starters. A number of blotter cards showing their motor starters, conduits, fuses and other specialities.

The Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—Twenty-four-page catalogue of Sun electric luminous radiators, fires, convectors and factory type radiators, of British manufacture. All types are illustrated, and prices are given. Copies of the list can be obtained on application.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C.—"Surprise" envelope advertising the Osram lamps, and neat folder giving prices. The company will supply these to contractors over-printed with name and address.

Arc Lamp Lowering Gear Co., Railway Appliances Works, Darlington.—Four lists for insertion in their catalogue, showing several new designs of arc and metal-filament lamp-lowering gears for span wire service in streets, and a low-priced gear for works, yards, picture houses and theatres. A light No. 4 gear is intended to take the place of Continental gears not now available on the English market. The lists are illustrated and priced.

Messrs. Crompton & Co., Ltd., Chelmsford.—20-page illustrated descriptive list (No. A 2) dealing with their standard A.C. polyphase induction motors. Detailed particulars and prices are tabulated for motors designed to work on two or three-phase 40, 50 or 60-cycle circuits, at pressures from 100 to 600 volts. Dimensions and shipping information are also tabulated. A separate list contains particulars of motors and generators in stock.

Russia.—H.M. Consul-General at Moscow (Mr. C. Clive Bayley) reports that an Englishman established in Moscow wishes to get into touch with United Kingdom manufacturers who would be willing to send representatives to Russia. He is prepared to do introductory work free of charge and to accompany such representatives on visits to buyers in other important commercial centres in Russia. Electric lamps and fittings are in great demand at the present time. Communications should be addressed to the British Consulate-General, Moscow.—*Board of Trade Journal.*

Holidays.—The works and offices of the Phœnix Dynamo Manufacturing Co., Ltd., Bradford, will be closed to-day and to-morrow, January 1st and 2nd, for the New Year holidays.

The works and offices of Messrs. Ferranti, Ltd., at Hollinwood, are closed from last night until Monday morning next, for the holidays.

Dissolutions and Liquidations.—DRYERS, LTD., Manchester.—The affairs of this company are now in the hands of a Receiver (Mr. A. H. Chalmers, Fenwick Street, Liverpool), but we understand that an arrangement will probably be made under which creditors will not suffer.

NATIONAL ENGINEERING CO., LTD.—This company is winding up voluntarily, with Mr. W. B. Ransom, of 52, Queen Victoria Street, E.C., as liquidator. A meeting of creditors was held on December 29th.

STREET LIGHTING CO., LTD.—A meeting will be held at 8, Fenwick Street, Liverpool, on January 29th, to hear an account of the winding up from the liquidator, Mr. W. Blease.

FELGATE INSTALLATION CO., LTD.—This company is winding up voluntarily, with Mr. A. G. West, of Market Place, Reading, and 95, Cannon Street, E.C., as liquidator.

REDGLO, LTD.—This company is winding up voluntarily, with Messrs. E. J. Walker, of 5, Castle Street, Liverpool, and P. Hutchinson, of 89, Chancery Lane, Ardwick, Manchester, as liquidators. A meeting of creditors is called for January 5th.

MELDRUM, BROS., LTD., Timperley, Manchester.—Last day for proofs for dividend, January 12th. Liquidator, Mr. T. Gregory, Parr's Bank Buildings, 3, York Street, Manchester.

ELECTRO STEEL FOUNDRIES, LTD., Darlaston.—First meeting of creditors and contributories, January 8th, at Carey Street, W.C.

Private Arrangements.—W. B. PARKER, 21, Bond Street, Leeds, electrical engineer.—The creditors interested herein were called together recently, when a statement of affairs was presented which showed liabilities of £1,805. The indebtedness to the trade was £1,039, and there were cash creditors for £267. There were also partly secured cash creditors for £571, the securities held being estimated at £73, thus leaving £498 to rank. In addition, there were fully secured creditors for £240. The assets were estimated to realise £1,561, from which had to be deducted £19 for preferential claims, leaving net assets of £1,542, or a deficiency of £263. The debtor commenced business in 1901 at his present address. After some four or five years the business was taken over by the Standard Engineering Co., Ltd. In 1909 that company was wound up, but all the creditors were paid in full, and there was a surplus of assets remaining. Since that time the debtor had continued the business on his own account. The turnover of the business had averaged £3,000 per annum, upon which a profit of from £200 to £250 a year had been made, exclusive of the drawings. An offer was made of a composition of 13s. 4d. in the £, payable by four quarterly instalments. No security could be offered outside the estate at the moment, and the offer therefore was not accepted. Owing to pressing creditors a deed of assignment had already been executed, and that deed it was decided to confirm. A committee of the principal creditors was also elected, and it was stated that the trustee and committee would endeavour to obtain a guaranteed offer of a composition.

War Turbine Contracts.—MESSRS. BOVING & CO., LTD., report that the volume of their orders for water turbines and turbo pumps has been well maintained. Recent orders include the following :—

One double-wheel spiral Francis turbine of 2,500 H.P., 300-ft. head, for the Nichi-Ei Electric Co., Japan.

One 900-H.P. impulse-wheel, 510-ft. head, for the Simla Municipality, with two exciter turbines of 30 B.H.P. each, and pipe line of 16-ft. diameter (repeat order).

Three spiral double discharge Francis turbines, 3,850 H.P. each, under a head of 400 ft., and two of 170 H.P., for the Kyushu Electric Light and Railway Co., Japan (repeat orders).

Mount Lyell Mining and Railway Co., one impulse turbine, 170 H.P., 260-ft. head (repeat order).

Orders for Boving "Victoria" turbo pumps include :—

One of 200 G.P.M., 197-ft. head, one of 600 G.P.M., 900-ft. head, through Bruce Peebles & Co. (sixth and seventh repeat orders), for the Lothian Coal Co.

Two pumps, 500 G.P.M., 350-ft. head, for Hurriladih Colliery, India (through the British Westinghouse Co.).

One pump, 1,100 G.P.M., 13½-ft. head; one pump, 2,280 G.P.M., 62-ft. head; one pump, 184 G.P.M., 775-ft. head, for Willans & Robinson.

Two vertical shaft-sinking pumps, 1,000 G.P.M., 60-ft. head, and a repeat order for two similar pumps for Dick, Kerr & Co.

Two pumps, 330 G.P.M. each, 475-ft. head, for the British Westinghouse Co., also for Hurriladih Colliery.

One pump, 5,500 G.P.M., 45-ft. head, for Okura & Co., London.

Trade Announcements.—MR. JOHN W. MAYALL has resigned his position of Birmingham branch manager for the A.E.G. Electric Co., Ltd., and is commencing business from to-day as electrical factor under the title of Mayall & Co., at 32, Corporation Street, Birmingham (Telephone: 3498 Central). Manufacturers' lists and factors' terms are invited.

THE WORTHINGTON PUMP CO., LTD., are removing from Queen Victoria Street to India House, Kingsway, W.C., on January 4th. Telephone Nos. 3048, 3049 and 3050 Holborn.

MESSRS. H. HARTJEN & CO., of 35-37, Noble Street, London, E.C., ask us to state that regular supplies of their insulation leads are now being resumed by them.

Bankruptcy Proceedings. — WM. WALKER, lately trading as David Smith & Co., at 2 and 3, Red Lion Court, Fleet Street, E.C., electrician.—This application was again before Mr. Registrar Linklater last week at the London Bankruptcy Court. The case was reported in the ELECTRICAL REVIEW, of the 4th ult., and it will be remembered that the Registrar then granted an adjournment to enable the Osram Lamp Works, Ltd., to consider an offer submitted by the bankrupt. Mr. Tindale Davis now appeared for the company, and intimated that his clients declined to accept the offer. His Honour remarked that the fact that an offer had been made was some evidence of means, and he should suspend the discharge for two years with liberty to the bankrupt to apply within one year for an amended order if he could show 10s. in the £, when the discharge would be granted subject to that condition.

Meter Approved.—The B. of T. has approved of the E.A.C. single-phase watt-hour meter, type H.T. motor pattern, deposited on March 2nd by the ELECTRICAL APPARATUS CO., LTD. The company will send full particulars of the instrument to any reader.

LIGHTING and POWER NOTES.

Aldeburgh.—STORM DAMAGE.—During the recent storm the roof of the local electricity works was blown off, falling into a private garden.

Arbroath. — RATING APPEAL. — The appeal of the Arbroath Electric Light and Power Co. against the amount of the valuation of the works and mains was held at the Court of Sessions last week. The Court upheld the judgment of the Valuation Committee, fixing the valuation at £1,100.

Aylesbury. — POWER SUPPLY. — The U.D.C. has arranged to supply current to the printing works of Messrs. Hazell, Watson & Viney at 1¾d. per unit, with a minimum annual payment of £200, the charge to be subject to increase or decrease proportionate to the price of oil being above or below the standard price of £3 10s. per ton. To meet this demand and that of any additional power consumer a power cable is to be laid, at an estimated cost of £670.

Ballyconnell (Co. Cavan).—Mr. Arnold, of Slieve Russell House, recently inaugurated the new electric lighting system. The contractor was Mr. J. C. Cave, electrical engineer, of Belturbet.

Ballymena (Co. Antrim).—The B. of G. has installed an electric plant for lighting the board room and the infirmary.

Barking.—PROPOSED LOAN.—The electrical engineer is to report upon the question of an application being made for a further loan on the electric lighting account.

Belfast.—WORKHOUSE LIGHTING, &c.—The Council has instructed the Tramways and Electricity Committee to consider the desirability of reorganising the electrical department and to report thereon to the Council.

The B. of G. at its last meeting adopted the recommendation of the Finance and Works Committee that electric light be the illuminant for the Workhouse premises. The engineer's report respecting the equipment of the Workhouse, at an estimated cost of £23,000, with the object of effecting an economy in expenditure and improvement in the lighting and heating was deferred, the present time not being opportune; any alteration in the meantime is to be carried out by taking current from the Corporation, and the cables laid so as to form part of any future scheme.

Bispham.—The U.D.C. has decided to increase by £60 the amount which the L.G.B. has been asked to sanction for electric lighting mains along Blackpool Road to "Greenlands," this being the difference between overhead work and underground cables.

Brentford.—INFIRMARY LIGHTING.—The experiment of substituting electric light for gas in two blocks at the Brentford Infirmary is considered to have shown very good results.

Burton-on-Trent.—The Gas and Electricity Committee has opened showrooms for fittings and appliances at the corner of Station Street and Guild Street.

Canada.—The Hydro-Electric Power Commission of Ontario is taking steps to ascertain the consensus of opinion among people now engaged in electrical work as to the advisability of introducing legislation requiring that only licensed electricians shall install wiring, and that only approved material shall be sold.

Cheltenham.—ANNUAL REPORT.—The accounts of the Corporation electricity undertaking for the year ended March 31st showed that the revenue was £24,826, and expenditure £10,241, leaving a gross profit of £14,585, as compared with £13,595 in the previous year. After payment of interest and other outstanding charges, the surplus available was £1,944. The units sold were 2,063,938, against 1,905,134 in the previous year.

Croydon.—The Corporation has granted permission to the County of London Electric Supply Co., Ltd., to supply certain premises in Hermitage Lane, Upper Norwood. The borough electrical engineer reported that the premises are so situated that it is extremely difficult for the Corporation to give the supply.

Earlestown and Newton-in-Makerfield. — E.L. SCHEME.—Messrs. R. Evans & Co., Haydock, having intimated their inability at present to supply electricity to the Council, the latter has decided to confer with Mr. Lacey, with a view to pushing on with its own scheme.

East Ham.—Restricted Lighting.—On the suggestion of the engineer and manager the Electricity Committee has decided to make no charge to the hirers of arc lamps during the period such lamps are not in use owing to the police restrictions, but to extend the agreement from the date upon which it would ordinarily expire for a similar period to that for which no charge is to be made.

Finchley.—There was a debit balance of £2,116 on the last year's working of the electricity undertaking.

Hawarden.—Proposed Loan.—The R.D.C. has applied to the L.G.B. for sanction to borrow £5,840 for the purpose of installing electricity plant.

Hebburn-on-Tyne.—Gas-Driven Plant.—At Messrs. Palmer's shipbuilding yard an installation is being made of a large gas-driven power plant, in connection with which the National Gas Engine Co., Ltd., has secured the contract for six 1,500-H.P. gas engines to drive alternators, and one engine of 1,000 H.P. to drive a direct-current generator. All the engines will be of the tandem vertical type.

Ilford.—The Electricity Committee has decided to fit two boilers with air bridges, the trial of this apparatus having given satisfactory results in the reduction of smoke.

Llandudno.—Proposed Plant Extensions.—The U.D.C. has considered a report by the electrical engineers on extensions at the Council's electricity works. The engineer recommends the installation of a 200-KW. Diesel set, and estimates a saving of ½d. per unit on the additional supply, if it is installed. The matter was deferred to a special meeting of the Council.

London.—Islington.—Loan Sanction.—The L.C.C. has sanctioned the borrowing of £4,975 by the Borough Council for the electricity undertaking.

Hampstead.—The B.C. has decided to contribute £10 towards the cost of the appeal against the Ilford and Long Eaton cases, and the engineer and manager has been authorised to attend the case and to give evidence if desired.

Southwark.—The Electric Light Committee has had under consideration the advisability of revising the rates for the supply of energy with the view of increasing the revenue of the undertaking, and although it is aware that the present may not be considered an ideal time for increasing prices, it proposes to make certain slight variations in the scales for lighting and power, to take effect as from January, 1915. It is estimated that this proposal will augment the revenue of the undertaking by from £450 to £500 a year.

Manchester.—Effect of the War.—The Electricity Committee reports that since the commencement of the war the output of electricity has increased from 3 to 5 per cent. over the corresponding periods of last year, which is attributable to increasing demands for power required in executing Government contracts. The highest load recorded in one hour, being the maximum simultaneous demand on all the generating stations, reached 50,310 KW. on the 18tb. The greatest output for one day was 670,070 units on the 22nd.

Despite increased burdens due to the war, the Committee will maintain its rate-aid contribution of £30,000 as promised. Rather over 20 per cent. of its employés have joined the Colours.

Richmond (Surrey).—Cinema Installation.—On December 24th the New Royalty Cinema at Richmond was opened. The electrical installation is supplied from the mains of the Richmond Electric Supply Co. at 220 volts for lighting and power purposes, duplicate sets of motor-generators being installed, each with an output of 100 amperes at 70 volts. Two bioscope machines and a lantern are provided in the bioscope chamber, the operating switches being centralised on a polished slate switchboard. The lighting of the auditorium is on the inverted system, with 10 300-C.P. suspended bronze bowls; a dome in the roof is illuminated by 60 concealed lamps, while three-light flambeau torch fittings are provided for side lighting. Inverted lighting has been adopted in the foyer and entrance, and candle fittings in the lounge and tea rooms, the lighting scheme harmonising throughout with the decorations. The contractors for the whole installation were Messrs. G. Weston & Sons, Ltd., of Fenchurch Street, E.C.; the fittings were supplied by Messrs. Peyton & Peyton, Birmingham, and an electrical vacuum cleaning plant by Messrs. Stott, of Oldham.

Morecambe.—The T.C. has authorised the purchase of new condenser for the electricity department.

New Zealand.—Owing to the increased demand for lighting and power in Auckland, the City Council is increasing its generating plant at the city power station, practically doubling its capacity; the first sub-station for the distribution of power in the suburbs is to be erected at Newmarket.

Tamworth.—The T.C. has granted the Co-operative Society permission to run an electric cable underground from their premises at Colehill to newly acquired property, subject to an annual payment of £1, and an undertaking not to sell electricity or to permit it to be used on the premises other than those in the Society's own occupation, and to remove the cable on six months' notice.

Tarporley.—An electric plant for lighting and power has been installed at the premises of Messrs. Cluett. This is the first introduction of electricity in the town.

Tynemouth.—Workhouse Lighting.—The Works Sub-Committee of the Guardians has under consideration the question of wiring the administrative block at the workhouse.

Walthamstow.—The Public Lighting Committee has decided to urge the L.C.C. to postpone the introduction of the London Electricity Supply Bill.

Willesden.—There was a surplus of £1,606 on the working of the electricity undertaking for the year ended March 31st last, and the Electricity Committee has decided to transfer this amount to reserve account. The District Council has been recommended to renew its contract with the Tudor Accumulator Co. for the maintenance of the Salusbury Road sub-station battery for a further period of 10 years, at the rate of £116. The Electricity Committee has decided to make an allowance for energy not consumed by the public electric lamps, owing to the restricted lighting, based on the average cost per unit as given in the accountant's report for 1913-4. Reporting in connection with the proposal of the local Board of Guardians to discontinue the use of energy supplied by the District Council and to use its own generating plant, the Electricity Committee states that although it considers the Guardians to be bound by the contract, it does not think any action should be taken to enforce it. The Committee, however, recommends the Council to give the Guardians a stand-by supply. It is proposed to light the new Small-Pox Hospital by electricity.

TRAMWAY and RAILWAY NOTES.

Australia.—Electric Vehicle.—The Sydney Municipal Council has purchased an electrically-driven motor lorry, fitted with an Edison battery, for £620.

Belfast.—The revenue account of the Corporation tramways for the eight months ending November 30th shows a credit balance, after allowing for fixed charges, of £17,783.

Colwyn Bay.—Tramway Extension.—The extension of the electric tramway line from Station Road to the Queen's Hotel, Old Colwyn, is being carried forward, and one of the tracks is already completed.

Continental Notes.—Germany.—Of the 288 companies operating tramways on March 31st, 1913, with a total mileage of 3,116 miles, 155 were operated and owned by private companies, and 133 were operated under public ownership. According to the *Railway Review* (U.S.A.), the mileage was distributed in the Empire as follows:—Rhine Province, 783 miles; Westphalia, 332 miles; Province of Brandenburg (including Berlin), 274 miles; Saxony, 234 miles; Bavaria, 116 miles; Alsace-Loraine, 85 miles; Grand Duchy of Baden, 81 miles; distributed through other parts of the Empire, 1,161. Of the 2,221 miles of railways in Prussia, 1,113 miles ware broad gauge and 1,108 were narrow gauge. Electric traction has been slowly displacing the other systems. While in 1901 there were 101 miles of horse-car lines, in 1912 this had decreased to 25 miles. In 1901 there were 83 miles of steam-car lines, and in 1912 only 44 miles.

Liverpool.—Tramway Reconstruction.—In connection with the proposed reconstruction of the Prince's Road tramway, a further report has been submitted to the Committee by the city engineer, in which he estimates that the cost of the scheme recommended would be £11,990, as compared with £11,100 for relaying the lines in their present position. In his previous report the engineer suggested that the track should be relaid so as to adjoin the west footwalk of the boulevard. The adoption of the scheme recommended would reduce the noise to a minimum and give facilities for attaining a speed of 20 miles an hour.

London.—L.C.C.—The Local Government Records and Museums Committee recommends that an appeal be made at the Quarter Sessions against the fourth supplemental valuation list of the Borough of Islington, as a comparison of the values of the tramways in Islington for 1912-13 and 1913-14 showed a reduction in the rateable value in the latter year, and that application should subsequently be made for the case to stand over pending the decision of the House of Lords against the judgment of the Court of Appeal in regard to the assessment of the Council's tramways in Islington.

The Highways Committee proposes to equip the Balham car-shed to accommodate 48 trailer cars; the three petrol-electric cars recently tried by the Council are to be altered for use as tractors for shunting the trailers at the depôt, which is not electrically equipped.

It is proposed to electrify, on the underground conduit system, the horse tramways in Grange Road, Southwark Park Road, and Rotherhithe New Road, at a cost of £62,500 for track work, £6,650 for cars, £5,450 for cables, ducts, &c., and £100 for substation plant.

Manchester.—Effect of the War.—The general manager (Mr. McElroy) of the Corporation tramways, has submitted a report as to the effect of the war upon the finances of the department. Since the first four months of the war there has been a large decrease in the receipts, as compared with the previous year, and it is anticipated that at the end of the financial year the income will be £900,000, or £50,000 below the estimate.

Notwithstanding the increased expenditure owing to allowances to the men who have joined the Colours, and the engaging and training of a new staff, and the reduced revenue, Mr. McElroy considers that the Tramways Committee will, at the end of the year, be in a position to pay £100,000 in relief of the rates, and place £50,000 to renewals, &c., fund, instead of the estimated £102,000.

Stoke-on-Trent.—Tramway Accident.—Last week a serious accident was caused by a car which ran away down Porthill Bank, eventually leaving the rails and coming to a standstill against a shop. The driver died almost immediately as the result of his injuries, and the conductor and two passengers were also injured. The cause of the accident has not been ascertained, but it is suggested that the driver suddenly became ill, and that possibly he was struck by the brake handle.

TELEGRAPH and TELEPHONE NOTES.

Illicit Wireless Installations.—A motor-cycle expert named A. G. Cocks, who was court-martialled on December 5th at Hull and sentenced to six months' imprisonment for the unlawful possession of wireless telegraph apparatus at Filey, was released on December 24th, after serving only two weeks of his sentence.

A lady inspector employed by the Liverpool Corporation, in the course of her duties, noticed something suspicious in the fireplace of a private house and gave information to the police, who found that unauthorised wireless apparatus had been concealed in the chimney.

Storm Interruptions.—During the violent storm which took place on Monday evening much damage was done to telegraph and telephone lines, and communication was temporarily interrupted in many districts. It was reported that two-thirds of the provincial telephone wires were blown down, the worst effects being experienced in the North and Midlands. Serious interruptions took place on the Continent: all the Dutch wires were broken, and communication with France and Belgium was very much hampered.

Telegrams in Code.—Permission to use the four codes originally authorised will probably be extended to telegrams to the Dominion of Canada and the British West Indies at an early date, when the Censors throughout the Empire have received copies of the codes.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—January 5th. 1,000 tons of pea coal, for the Electricity Department. Particulars from the Electrical Engineer.

Australia.—Sydney.—March 15th. Municipal Council. Transformer testing apparatus. Specification from City Electrical Engineer. A copy can be seen at the Board of Trade C.I. Branch in London.

Adelaide.—January 27th. Accumulators, and power board, for Postmaster-General. See "Official Notices" December 18th.

February 10th. Testing instruments, for Postmaster-General. See "Official Notices" to-day.

Birkenhead.—January 12th. Twelve months' supply of electric motors and motor-starters, from ¼ to 15 H.P., for the Corporation electricity supply. See "Official Notices" Dec. 18th.

Croydon.—January 25th. General stores, for the Corporation Tramways Department, for a year. The Manager, Thornton Heath.

Dublin.—January 8th. Tenders for electric light wiring for the new Metropolitan Police Barracks, Great Brunswick Street. Office of Public Works.

Edinburgh.—Corporation. Tenders for the electric lighting installation at the new workshops, King's Stables Road. Mr. F. A. Newington, engineer, Dewar Place.

Glasgow.—Mr. Lackie, the electrical engineer, has been instructed by the Electricity Committee to prepare specifications and tenders for the plant required for the first section of the new power station at Dalmarnoch.

Hemel Hempstead.—The Joint Hospital Board will shortly invite tenders for the installation of a telephone system at the new hospital.

Hong Kong.—January 15th. Two 1,500-KW. (2,000 K.V.A.) turbo-alternators with condensing plant and switchboards, E.H.T. cable, sub-station switchboards and transformers, for the North Point generating station. See "Official Notices" Dec. 18th.

Leeds.—January 22nd. Overhead electrically-driven travelling crane, coal and ash-conveying plant, for Electric Lighting Department. See "Official Notices" December 11th.

Leyton.—U.D.C. Repairs, &c., to cooling tower, for Lighting Committee. See "Official Notices" December 18th.

London.—L.C.C.—January 26th. Platelaying, &c., for electric tramway, Grove Road and Burdett Road, &c. Specifications, &c., from Mr. G. W. Humphreys, County Hall, Spring Gardens, S.W.

January 12th. Two steam turbo-generators of 8,000 KW., with auto-transformers, &c., for Greenwich generating station, for tramways. See "Official Notices" to-day.

Manchester.—January 19th. Tramways Committee. (*a*) Permanent way special track work, and (*b*) permanent way points, tongues, and hardened steel centres. Specifications, &c. (£1 1s. returnable), from Mr. J. M. McElroy, general manager.

Shanghai.—January 12th. 68 three-phase induction motors, various sizes between 5 and 60 B.H.P., with slide rails and liquid starters, for Municipal Council. See "Official Notices" December 25th.

Spain.—Tenders have lately been invited by the municipal authorities of Palenzuela (Province of Palencia) for the concession for the electric lighting of the town during a period of six years.

Tunbridge Wells.—January 26th. Cooling tower and pipework, two water-tube boilers, economisers, mechanical stokers, pipework, and feed heater, for Borough Electricity Works. See "Official Notices" to-day.

CLOSED.

Atherton.—The U.D.C. has accepted the tender of Messrs. G. Hanshett, Barratt & Co., of Pendleton, for the supply of three 275-K.V.A. transformers.

Barking.—The U.D.C. Electricity Committee has accepted the tender of Messrs. Babcock & Wilcox, at £235, for fitting a chain-grate stoker to a boiler.

Belfast.—Messrs. Johnson & Phillips, Ltd., have secured the contract for the supply and erection of main three-core paper-insulated lead-covered and armoured cable for power purposes, V.I.R. cables to motors and starters, power distribution boards, and the lighting installation in connection with the complete electrical equipment of the new works at Magheramorne, near Belfast, of the British Portland Cement Manufacturing Co., Ltd.

Bolton.—The Tramways Committee has accepted the tender of Mr. John Crook for laying steam pipes at the new tram-car shed in Shifnal Street, and that of Messrs. H. Bessemer & Co. for the purchase of scrap metal.

Canada.—A contract has been placed with Messrs. Escher, Wyss & Co., of Zurich, for two 2,250-H.P. turbines for the new hydro-electric power station of the Hydro-Electric Power Commission of Ontario, at Eugenia Falls, Ont. The machines will work at a speed of 900 revs. per min., and under a head of 540 ft.

East Ham.—The T.C. has been recommended to accept the tenders of Messrs. Allen & Son at £620 for an electric motor, and at £60 for fixing the same.

London.—Fulham.—The London Education Committee has received the following tenders for installing electric light in connection with the remodelling of Star Lane School, Fulham:—

Defries & Goldman, Ltd. ..	.. £2[illegible]5	Harrison & Co.	.. £341
Tyler Apparatus Co., Ltd.	.. 284	A. Newman	.. 351
A. Hawkins & Sons ..	.. 290	G. Weston & Sons, Ltd. ..	.. 363
R. H. & J. Pearson, Ltd.	.. 312	Johnson, O'Sullivan & Co.	.. 386
Kent & Co.	.. 327	A. C. France & Sons ..	.. 483
Foote & Milne, Ltd. ..	.. 334	H. Dakin & Co., Ltd. ..	.. 761

Preston.—The contract for the erection of new car-sheds at a cost of £4,416 has been let to Messrs. Croft & Sons.

Stafford.—The T.C. has accepted the tender of Messrs. Siemens Bros., Ltd., for a motor-driven centrifugal pump for the electricity works, at £54.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, January 1st. At Holborn Restaurant. Smoking concert. (See "Notes" to-day.)

Association of Engineers-in-Charge.—Saturday, January 2nd. Social.

Association of Mining Electrical Engineers (Warwickshire and South Staffordshire Branch).—Saturday, January 2nd. At 5.30 p.m. At the Imperial Hotel, Temple Street, Birmingham. Paper on "Automatic Protective Devices," by Mr. C. Jones.

Royal Institution of Great Britain.—At 3 p.m. At Albemarle Street, W. Juvenile Lectures by Prof. C. V. Boys, F.R.S.
Saturday, January 2nd. On "Fluids in the Home."
Tuesday, January 5th.—On "Heat in the Home."
Thursday, January 7th.—On "Electricity in the Home."
Saturday, January 9th.—On "Light in the Home."

Rontgen Society. Tuesday, January 5th. At 8.15 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Continuation of discussion on the "Localisation of Foreign Bodies by X-Rays."

Greenock Electrical Society.—Thursday, January 7th. At 7.45 p.m. At 21, West Stewart Street. Paper on "Developments in the Electrical Industry," by Mr. D. McDougall.

NOTES.

The War—Telephones Wanted.—We have pleasure in publishing the following letter, and we hope that there will be an immediate response to the request which it contains :—

"I have had the following letter from a major of the Royal Field Artillery, at present training new units at Farnborough :—

"As perhaps you are aware, this war consists of the employment of the three T's, namely, Trenches, 'Tillery and Telephones. We are very good at trenches ; in time we shall make good Artillerymen, but they will never make good Telephonists unless they get Telephones, of which I see no likelihood in the immediate future. Can you suggest any means by which we could be lent, or given, any telephones or buzzers, preferably of military design, to further the training of our men? They would be returned to the owners on receipt of the proper telephone equipment from the military authorities, but, as I have already stated, they have none at present to spare. I should be very grateful if you could suggest any means of obtaining these necessary instruments.

"I rather feel if you could insert this letter in your 'Correspondence' columns as an appeal, there might be some of your readers who have unsaleable, but useful, instruments which they could offer to lend, or give, under the circumstances. I shall be very glad to have any offers which you may receive. My 'phone number is Victoria 977.

"R. MacLeod, *Secretary*.

"National Service League,
"72, Victoria Street, S.W.,
"*December* 30*th*, 1914."

"Electrical Review" Index.—The Index for Vol. 75 of the Electrical Review will be published with our next issue.

Electrical Development Committee.—The first meeting of the Development Committee of the Incorporated Municipal Electrical Association was held at the Institution of Electrical Engineers, on December 11th, 1914. The Committee was formed as a result of a resolution moved by Mr. W. A. Vignoles (chief engineer, Grimsby electricity department), at the Annual Convention held in Birmingham in June last, its object being to deal with any matters tending to encourage the use of electricity from public supply mains. The membership of the Committee, as originally constituted, was as follows :—Messrs. F. Ayton, J. W. Beauchamp, A. S. Blackman, R. A. Chattock, A. C. Cramb, Councillor Crowther, J. E. Edgcome, S. E. Fedden, F. M. Long, Ald. Pearson, H. Faraday Proctor, H. Richardson, T. Roles, A. H. Seabrook, Ald. J. P. Smith, and W. A. Vignoles.

The Council of the I.M.E.A. had appointed Mr. W. A. Vignoles as hon. secretary, but on account of his absence on military service, this work was taken over, *pro tem.* by Mr. J. W. Beauchamp.

At the meeting held on December 11th. Mr. S. E. Fedden (general manager, Sheffield electricity department) was elected chairman. Mr. S. T. Allen (Wolverhampton) and Mr. H. F. Street (Southampton) were also elected members of the Committee. It was decided, if possible, to co-opt members representing the various associations connected with the supply of electricity, and allied interests, and the secretary was instructed to approach these bodies with regard to the election of representatives. It was decided so soon as practicable to form certain sub-Committees to deal in a specialised manner with various questions of interest at the present moment.

Following a suggestion in a communication from Mr. F. Ayton (Ipswich), it was proposed to form Technical sub-Committees with the object of investigating problems of interest which might arise during the year, and with a view, if possible, to presenting the results in the form of reports, to be discussed at the Annual Convention of the Incorporated Municipal Electrical Association. Informal discussions were also held with regard to the future policy of the Committee and the objects to which primary attention should be directed.

The next meeting will take place in January next, when it is hoped that work upon some of the above objects may be put in hand. A brief report of the operations of the Committee will be communicated to the Electrical Press from time to time.

International Engineering Congress, 1915.—The Committee of Management of the Congress informs us that some confusion seems to have arisen in the minds of some engineers between the International Electrical Congress, which it was proposed to hold in San Francisco in September, 1915, and the International Engineering Congress, which is to be held during the same month.

We are asked, therefore, to repeat the statement which we have already made, that owing to the unfortunate situation existing in Europe, and the impossibility of convening the International Electrotechnical Commission, under whose authorisation the Electrical Congress was to have been held, it has been decided by the governing body of the American Institute of Electrical Engineers to postpone indefinitely the holding of the Electrical Congress. This does not affect the International Engineering Congress, which goes ahead as originally planned. Full information may be obtained by inquiry at the following address : International Engineering Congress, 1915, Foxcroft Building, San Erancisco, Cal., U.S.A.

Inquiries.—Makers of "Grimshaw's" tape, and "Buttner" regulating switches are asked for.

Electro-Harmonic Society.—This Society holds a smoking concert to-night, at the Holborn Restaurant (King's Hall), commencing at 8 o'clock. The preliminary programme is as follows :—Mr. John Collett (tenor), soloist, St. Paul's Cathedral ; Mr. Allen Engles, baritone ; Mr. Wilfred Alderton, handbells ; Mr. Rupert Hazell and Mr. Fred Rome, humorists ; Mr. Alec Chentrens, Anglo-French comedian ; Mr. Arthur Thomas, musical clown ; Mr. George Bolton, entertainer at the piano ; solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

Portable Electrical Workshops.—In a letter published in the *Times*, a member of the A.S.C. Mechanical Transport says :—"Our company consists of 98 lorries, and this includes two store wagons, three first-aid lorries (breakdown cars), one office, and two repair workshops. The two travelling workshops are wonders, and are in duplicate. They are fitted with electric light and have on board lathes, drilling and boring and slotting machines, electric riveters, forges, anvils, and everything required in a workshop, even melting pots for running in Babbitt's metal in the worn-out bearings before being turned up afresh. The machines are driven by a motor which is driven by a small motor engine. There are other wagons which carry heavy stuff such as portable forges, two or three grindstones, spare springs for cars, crow-bars, jacks and heavy tools, and hundreds of other things."

The Norwegian Aluminium Industry.—According to present prospects, the production of aluminium in Norway is going to make great progress in the near future. The Anglo-Norwegian Aluminium Co. has just completed new works at Vennesla, Christiansand, which will have an output of 2,000 tons of aluminium per annum, the percentage purity of the metal being as high as from 99—99½ per cent. At the present time the company is engaged upon the manufacture of carbon electrodes for its own requirements.

Another company, in which chiefly French capital is interested, has bought the works of the Hardanger Electrical Iron and Steel Co. for the purpose of turning them into a manufactory for aluminium cables. The same buildings are to be used, with extensions. Electrical energy will be derived from the Tysse Waterfalls Co., which had a contract with the previous owners of the works, that has been transferred to the new company.

The Norske Nitrideaktieselskab, which has a capital of £555,555, has completed its plant and works at Eydehavn, in the neighbourhood of Arendal. The work has been pushed on with all possible speed, but still it does not seem to have kept pace with the development and progress of that particular manufacturing branch, with which it was going to start, viz., the fixation of atmospheric nitrogen, as this has been considerably improved during the comparatively short building period. The new process which was to have been employed has in the meantime been greatly improved, and a new type of electrical furnace has been invented, which seems to possess great advantages in comparison with the old type. This has caused some delay and induced the company to wait for the results of a long series of experiments, which are now being carried out, before the manufacturing is started. This was quite unforeseen, and it has therefore been decided in the meantime to organise the works and use the plant and energy for the production of aluminium.

The reason why this course has been followed is that a group of financiers, who have a large interest in the Nitrideaktieselskab, own some aluminium patents, which will thus be turned to account.

The Electric Vehicle : British Experience.—A valuable feature of the Electric Vehicle Committee's official journal, of which the first number was recently noted in these columns, is the inclusion of the opinions of actual users of the electric vehicle in this country. The lack of British experience and data has been a great drawback in the past. It is, therefore, interesting to note that Messrs. Harrods, Ltd., who now use a number of electrics for business purposes, state that these vehicles are all giving entire satisfaction ; they are used to replace horses on town deliveries, and have been found much cheaper for that purpose. Again, Messrs. Liberty & Co., after a trial of an electric delivery van, state that, compared with a petrol car doing similar work, their experience was that, besides economy in tire mileage and lubricants, its running cost was two-thirds less.

Messrs. J. Pullar & Sons refer to the reliability and low running costs of an electric vehicle used in London during six months. Another 2-ton van used in Scotland was found to be quite satisfactory, especially when its running cost was compared with petrol cars doing the same work.

The Stratford Co-operative Society have used a 2,000-lb. electric van for some time, and state that the monthly mileage is 1,500 ; energy cost 871d. per mile (electricity, 1d. per unit) ; tires, 33⅓ per cent. advantage compared with petrol-driven car tires ; maintenance practically *nil* ; speed, 12-15 miles an hour.

Further particulars are also given regarding the experience of Mr. W. T. Robson, of the South Shields tramways, with Edison battery 'buses. Mr. Robson lays stress on the reliability of the electric 'bus, and adds his experience that petrol 'buses were always liable to fail at an awkward time. The electric 'buses easily run 50 miles in the day on one charge, requiring 1·3 units in fine weather and from 1·4 to 2 units per 'bus-mile in dirty weather.

The Glasgow electricity department's 1 ton Edison van is running about 900 miles a month, at a cost of some £240 per annum ; previously, a petrol van doing the same mileage was costing £400 per annum.

Appointments Vacant.—Junior assistant electrical engineers (15s.) for Newcastle-upon-Tyne Electric Supply Co.; shift engineer (£84) for Dover Electricity Department; fitter-driver (35s.) and switchboard attendant (30s.) for Clacton U.D.C. (this appointment is open to British and Belgian subjects); temporary engineer-in-charge (£2 2s.) for Borough of Bermondsey. Particulars are given in our advertisement pages.

Educational Notices. — Northampton Polytechnic Institute, St. John Street, E.C. A course of six lectures on "Transformer Design" will be given by Mr. W. C. Kennett, at 8.45 p.m. on Wednesdays, beginning January 6th. Particulars are given in our advertisement pages to-day.

A Large Gas Power Plant.—The directors of Messrs. Palmers Shipbuilding and Iron Co., Ltd., have put in hand extensive improvements and additions to the iron and steel works at Jarrow, with the object of effecting large savings in the cost of steel production. The improvements already undertaken include a large gas-driven power house, in which will be installed approximately 15,000 B.H.P. of gas engines, all driven by the waste gases from the blast furnaces; and a new lay-out of the heavy cogging mill, which it is intended to drive electrically, together with the conversion of all the steel works auxiliaries from steam to electricity, by which large savings in the cost of coal will be effected.

The installation of gas engines and gas-cleaning plant is the largest hitherto ordered in this country. There is every reason to believe that some of the plant will be in operation after midsummer.—*Financial Times.*

Institution Notes.—Institute of Marine Engineers.—On December 14th Mr. F. L. Martineau read a paper on "Power Steering Gear." The author stated that actual experiment under comparable conditions had shown that sensitive gear saved as much as 6 per cent. in the distance travelled, as compared with ordinary steering gear; the Hele-Shaw-Martineau electro-hydraulic system ensured immediate response to the slightest movement of the wheel, and in smooth water the rudder could be set so accurately that the compass showed no deviation for as long as ten minutes at a time, without moving the rudder. On the same boat, with steam steering gear, the gear was moved 20 times a minute on the average. In the new gear lubricating oil was the operating medium instead of water, doing away with wear and corrosion and preventing trouble from freezing. Some gears had run for three years without needing attention except occasional cleaning of the commutator and lubrication of a few pin joints.

In future all meetings will be held at the new premises of the Institute on Tower Hill.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. T. S. WALLIS, late of Stuart Street station, Manchester, who has just returned from Sweden, wishes to communicate with Mr. Frank Nicholls. Will the latter send us his address?

The staff of the Stretford U.D.C. has presented a pair of Royal Crown Derby vases to MR. ROBERT ROWLAND, resident engineer of the electricity works, as a wedding gift.

General.—The *Times* correspondent at Rome states that among the Italian Senators who are to be nominated on New Year's Day is SIGNOR GUGLIELMO MARCONI.

Obituary.—We regret to learn of the death which occurred on December 1st at sea (near Port Said) of MR. CHARLES WHEUSA-NICHOLL, A.M.I.E.E., of Teddington, aged 38 years. The deceased gentleman was on his way to take up an important appointment at Bombay.

MR. FRANK SUMNER, engineer to the City of London Corporation, passed away on Saturday last, at the age of 49 years, after several months' illness.

MR. J. F. ALBRIGHT.—We deeply regret to learn as we go to press that Mr. J. F. Albright passed away on Wednesday last at his residence, at Woking, at the early age of 57 years. The funeral takes place early to-morrow, Saturday, at St. John's Church, Woking, at 2.30 o'clock. Mr. Albright's connection with electrical engineering matters dates back over nearly 35 years, to when he was associated with the Swan and Edison Companies, and, subsequently, the amalgamated Edison & Swan United Co. Later he was prominently identified with the firm of Crompton & Co., the Drake & Gorham Power Co., and was actively interested in various electric supply schemes at home and in the Colonies. In recent years ill-health had prevented him from taking any very active share in business affairs, but he held at the date of his death the chairmanship of the British Electric Transformer Co. and the Kent Electric Power Co., and was on the board of the Melbourne Electric Supply Co., Ltd., Gravesend and Northfleet Electric Tramways, Ltd., and the Midland Electric Corporation for Power Distribution, Ltd.

NEW COMPANIES REGISTERED.

Acton Battery Co., Ltd. (138,700).—This company was registered on December 21st, with a capital of £300 in £1 shares, to carry on the business of manufacturers of, and dealers in, electric and other batteries, electric appliances, machinery, accessories, apparatus, incandescent lamps, &c. The subscribers (with one share each) are:—L. E. Tucker, Broad Street House, E.C., clerk; W. Fuller, Coleridge House, Crouch End, N., gentleman. Private company. Table "A" mainly applies. Registered office, 99, Churchfield Road, Acton, Middlesex.

Gwalchmai Electricity Supply Co., Ltd. (138,726).—This company was registered on December 22nd, with a capital of £1,000 in £1 shares, to take over from W. E. Parry and E. S. Lance the business of producers and suppliers of electric light and power carried on by them at Gwalchmai, Anglesey, as the Gwalchmai Electricity Co. The subscribers (with 25 shares each) are:—W. E. Parry, 31, High Street, Menai Bridge, cabinet maker; E. S. Lance, 23, Mostyn Street, Llandudno, engineer. Private company. The number of directors is not to be less than two or more than five; the first are W. E. Parry and E. S. Lance: qualification, £25. Solicitors: Chamberlain & Johnson, Llandudno.

Standard Woodwork Manufacturing Co., Ltd. (138,718).—Registered December 21st, by Jordan & Sons, Ltd., of 116-17, Chancery Lane, W.C. Capital, £50,000 in 5,000 8 per cent. cumulative preference shares of £5 each and 25,000 ordinary shares of £1 each. Objects, to take over the business of woodworkers, cabinet makers and manufacturers, carried on by the Standard Woodwork Co., Ltd., at Park Royal, Willesden, to carry on the same and the business of woodturners, joiners, sawyers, carpenters, cabinet makers, manufacturers of toys and games, switchboards, bell-cases, electric batteries and other accessories for telephones and electric bells, and telegraph apparatus of all kinds, gas and electrical engineers, &c., and to adopt an agreement with L. Godsell. The subscribers (with one preference share each) are:—J. Goodland, 9, King's Bench Walk, Temple, E.C., barrister; L. Godsell, Hunstanton, Norfolk, gentleman. Private company. The first directors (to be not less than two or more than six), are L. Godsell (permanent) and J. Goodland; qualification, £1,000; remuneration of chairman, £150 per annum; of other directors, £100 each per annum. Solicitor, E. J. Howard, 12, The Common, Ealing, Middlesex.

Britannic Electrical Co., Ltd. (138,743).—This company was registered on December 23rd, with a capital of £5,000 in £1 shares, to carry on the business of patentees, manufacturers, and repairers of, agents for, and dealers in engines, machines and mechanical instruments and inventions, whether driven by gas, steam, petrol or electricity, and tools, dies and castings, cycles, motor-cycles and motor and cycle cars, &c., and to enter into an agreement between H. Dare, C. A. Wareing, E. Radnall, J. Satchwell, R. Satchwell, and F. H. Alston. The subscribers (with 250 shares each) are:—E. A. Radnall, Ashgrove, Ward End, Birmingham, manufacturer; C. A. Wareing, 12, Gladstone Road, Gravelly Hill, Birmingham, sanitary engineer. Private company. The number of directors is not to be less than two or more than five; the first are E. A. Radnall (chairman), J. Satchwell, H. Dare, C. A. Wareing and F. H. Alston (manager); qualification, 250 shares; remuneration as fixed by the company. Registered office, 33, Newhall Street, Birmingham.

J. Barwell & Co. (Lighting), Ltd.—This company was registered on December 22nd with a capital of £5,000 in £1 shares, to carry on the business of manufacturers of and dealers in lamps, brackets, globes, films, shades, glasses, burners, meters, carbons, switches, stoves, pipes, wires, electric light and gas fittings, &c. The subscribers (with one share each) are:—F. H. Barwell, Worcester Works, Clement Street, Birmingham, manufacturer; H. Barwell, Worcester Works, Clement Street, Birmingham, manufacturer. Private company. The number of directors is not to be more than three: the first are F. H. Barwell (permanent managing director), and H. Barwell; remuneration of F. H. Barwell, £5 per week. Registered office, Worcester Works, Clement Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Cunningham, Ltd.—Second mortgage dated December 16th, 1914, to secure £1,200, charged on company's undertaking and property, present and future, including uncalled capital, subject to a certain debenture. Holder: E. H. Hawkins, 4, Charterhouse Square, E.C.

Electrical (Installations), Ltd.—A memorandum of satisfaction to the extent of £100 on December 10th, 1914, of debentures dated December 5th, 1906, securing £2,000, has been filed.

Pernambuco Tramways and Power Co., Ltd.—Issue on December 1st, 1914, of £550 debentures, part of a series of which particulars have already been filed.

Coatbridge and Airdrie Electric Supply Co., Ltd.—Further charge on company's undertaking and property, present and future, including uncalled capital and the Coatbridge and Airdrie undertakings, &c., dated December 14th, 1914, supplemental to charge dated October 17th, 1906, to secure £1,250. Holders: County of London Electric Supply Co., Ltd., Moorgate Court, Moorgate Place, E.C.

CITY NOTES.

Costa Rica Electric Light and Traction Co., Ltd.

THE annual meeting was held on December 23rd at Dashwood House, E.C.

The CHAIRMAN (Mr. W. F. LEESE) said the company had been passing through a very anxious time, and no doubt they had an anxious time in front of them, but looking at the effect which the war had had on the world generally, they had reason to congratulate themselves that, so far, they had not suffered greatly. The net profit last year had amounted to £26,351, against £23,875 for the previous year; an increase of £2,476. On the other hand, there had been increased expenses which absorbed all but £719 of the increased net profit. The net surplus was £8,056, and it was proposed to carry the whole of that amount to the credit of discount and commission on debenture issues account. The lighting revenue had kept up fully, and the cooking and heating part of the business was very satisfactory. They were making about £3,000 a year out of that, and owing to the shortage of fuel in the country electrical cooking was an absolute necessity. Their manager fully anticipated that in the near future they would obtain at least £5,000 a year from that source of revenue. He (the Chairman) believed that as time went on that figure would be increased. With regard to competition, that was still in *statu quo*, but should they have to meet a competitive supply he was convinced that there was enough business in the country for both.

Mr. **Frederick Davies** seconded the motion, and the report was adopted.

International Light and Power Co., Ltd.

The directors' first report for the period from February, 1913, to June, 1914, states that the results obtained, considering the depressed financial conditions, have been in the circumstances satisfactory. The net profit for the period, after payment of interest on debentures and London and Canadian administration charges, is £23,714. The available balance is £19,053. The preference dividend has absorbed £15,166, and £3,887 is to be carried forward.

Reserves for renewals and general purposes amounting, when converted, to a total of approximately £5,000, have been set aside by the subsidiary companies before dividends were declared by them.

The company owns all the debentures and shares of the following companies:—

Venezuela Electric Light Co., Ltd.—The absorption by this company of a competing undertaking in Caracas has had a beneficial effect on the development of the lighting business. Electric power is now obtained from two hydro-electric stations, the combined capacity of which is sufficient to take care of the expansion of business for some time to come. The possibility of exceptional droughts, however, makes the installation of a stand-by plant, using either coal or liquid fuel, desirable. The stability of political conditions in Venezuela has proved of advantage to the development of business, and although the European war has affected the economic resources of the country, a steady increase in the net returns of our undertaking is anticipated for the current year. Important renewals in sub-stations and distribution system have been carried out successfully.

Compañia de Electricidad de Mérida.—Although Mérida is outside the more disturbed districts, recent events in Mexico are responsible for an almost unprecedented drop in exchange, still further accentuated by the European war. This company, generating its own power, has to import, besides coal, a number of manufactured articles from various countries, and is therefore greatly suffering from the disturbed state of affairs throughout the world. The gross earnings in local currency continue to increase notwithstanding the unfavourable conditions prevailing, but the net returns in sterling have fallen considerably below our estimate, the loss on exchange account exceeding £10,000 for the period under review. The new installation for the power house has been unavoidably delayed on account of the European war.

Compañia Luz y Fuerza de Paraná.—Results from operating the Paraná (Argentine Republic) property have been satisfactory, showing an increase of 18 per cent. in gross earnings, and 46 per cent. in net earnings over the previous year. Additions to the power house have been completed, which will permit further development of the business and reduction in operating expense.

Mr. **Follett Holt** presided at a meeting of the shareholders of the company held on December 21st at 9, Cloak Lane, E.C. He said that as all the members of the board and the majority of the shareholders were resident in Great Britain, they had considered it desirable to hold the meeting in London, previous to the annual general meeting in Canada, in order that the report might be considered and proxies instructed to act in accordance with any resolutions passed. The Chairman made a brief statement concerning the three undertakings in which their capital was invested. The Venezuela Electric Light Co. served Caracas, the capital of Venezuela, and since the absorption of the undertaking, referred to in the report, theirs was the only distributor of electricity for lighting purposes in that city of about 80,000 inhabitants. The Merida Electricity Co. owned an electric lighting and power system in the city of Merida, Yucatan, Mexico, where the population served was approximately 52,000. With the exception of an insignificant plant of about 25 kw. theirs was the only supply company in that city. Their power-house, when taken over, required very considerable overhauling, and a new generating unit had been secured in Europe and would soon be in operation. The better economy of this generating unit should result in a marked decrease in the fuel consumption. The Paraná Light and Power Co. owned and operated electric light and power and gas works in Paraná, the capital of the Province of Entre Rios, Argentina. The population served was approximately 42,000. Electricity was generated there by means of producer gas engines, and the growth of business had been so rapid since the property was acquired that it had been necessary to add a new engine of 300 kw. capacity, which was now in operation. This would enable them to efficiently handle the large increase in business which had come during the past two years, and to take care of further increases which were expected in future. The gas branch of the business, although losing ground to the electrical department in the lighting field, had more than made up these losses by the expansion of sales for heating and cooking. The International Co. had received from Venezuela £23,084. This was made up of dividends at the rate of 4 per cent. per annum for eighteen months; debenture interest accrued since the date of the incorporation of the International Co., and the interest on the loan of £35,000 made by them. They had received also £1,347 from the Venezuela Co. for interest on its debentures accrued previous to the date of their incorporation, but they had taken what they considered the proper course and applied this towards writing down their preliminary expenses. With the exception of a small amount of interest on the total loan of £8,700, the revenue received from the Merida Co. of £8,802 for the period under review consisted only of debenture interest. The report indicated the serious effect on earnings which the very heavy fall in exchange in Mexico had caused, and served also to explain the absence of dividends from that company. The net currency earnings had been reduced by the largely increased cost of working, and the balance had been again cut into on conversion into sterling by the heavy fall in exchange. Profits from Merida had therefore been nothing like what they were expected to be, and what they should be. They could only exercise their patience and hope for a speedy solution of the difficulties in which Mexico was at present involved. Meanwhile, to compensate to some extent for the depreciation of the currency, a new tariff had been established and higher prices in currency were now obtained for electricity sold, and this was expected to materially assist in bringing the net receipts back to a more fair and normal standard. The sum received from the Paraná Co., amounting to £9,565, included interest on the total loan of £18,000, two years' dividends at 8 per cent. per annum on the shares, and one year's interest on the debentures. These latter were purchased in July, 1913, and they had therefore received only twelve months' interest thereon. Concerning the outlook, they anticipated that, notwithstanding the difficult economic conditions created throughout the world by the European war, their undertakings at Caracas and Paraná would show substantial progress during the current year. With reference to the Merida Co., the situation was more difficult. The profit in sterling, which principally concerned them, was bound up almost entirely with the rate of exchange, and they therefore sincerely hoped that the political and financial situation of Mexico had reached a turning point, and would show improvement during the current year.

Cape Electric Tramways, Ltd.

Mr. **Ludwig Breitmeyer** (Chairman) presided at the annual meeting, held at 1, London Wall Buildings, E.C., on December 23rd.

The **Chairman** said that the war had startled the world, and had disturbed business everywhere. It involved every state and dominion in the British Empire. Their industry could not hope to remain unaffected during this tremendous struggle, more particularly as South Africa had been called upon to play its part in the defence of the Empire by the expedition against German South-West Africa, and had, in addition, also found itself faced with local rebellion. This rebellion had now collapsed, and South Africa had escaped a very great danger. The war had, so far, not interfered with their tramway working, which up to latest advices was showing fairly satisfactory results, but there were signs ahead of some shrinkage of their revenue, and they must be prepared for possibilities in the future not now in evidence. The directors had, therefore, decided to recommend the payment of a 2½ per cent. dividend, instead of 5 per cent., with the hope that better prospects might justify an increase later on. He might tell them frankly that, in view of the strained financial conditions prevailing throughout the world, he and his colleagues felt that it would have been perhaps more prudent and conservative to have retained their cash resources and passed the dividend altogether. They, however, had to remember also the position of the shareholders in these hard times, and after careful consideration they had decided to pay half only. The net profit of £24,618 had been made after paying all fixed obligations, including debenture redemption, and also passing £8,000 to the reserve fund. They had spent considerable sums in the purchase and reconstruction and equipment of the Hout Bay Hotel; also a great outlay was incurred in the installation of a new unit of 500 kw. in the power station at Port Elizabeth, and additions to the rolling stock both at Cape Town and Port Elizabeth. This new unit would meet all the requirements of traffic on that system for some time to come. The general manager there reported most favourably on its running and the satisfactory results he had obtained in economy of fuel consumption. In addition to this expenditure on improvements, they also had to face a steady increase in working costs, due to higher prices of coal and all other materials. Further, the imposition of the new income tax at the Cape cost them roughly £3,000 per annum, and was another burden which the company had to bear. The several schemes of improvement in the Peninsula, contemplated by the Unified Municipality, had been checked by the war, but a municipal loan of £200,000 was to be floated locally in Cape Town to carry out sundry street and other improvements, and the tramways would, they hoped, participate to some extent in the general benefit. Notwithstanding all the unsettled conditions, the tramway operations had continued without interruption. They were working with a diminished staff, as it was the aim of the management to permit and assist every man who could be spared to take his part in the fighting line. The service was, however, well maintained.

Admiral Sir A. H. [illegible] seconded the motion, which was carried.

The Swiss Oerlikon Machinery Co.

The report of the directors of the Maschinenfabrik Oerlikon, of Oerlikon, for the year ended on June 30th, 1914, after referring to extensions of the workshops and plant, states that the course of business in the department for general electrical machines [illegible] was good. The apparatus branch produced a new series of oil switches. There was a lack of new orders for lifting appliances and electro-mechanical applications, but the small orders notably increased. In regard to turbo-machines, the company was abundantly [illegible] [illegible] generators of a total of [illegible]

KW. for the Baltic shipyard at Petrograd. A large number of repeat orders was also received. In electro-chemical apparatus, 14 electrolysers of a large type were sold. The department for electric railways was satisfactory both in regard to work carried out and the new orders which were booked, and important repeat orders were placed by a number of tramways for normal material. The sales companies abroad, with few exceptions, had been successful for the works. The accounts show gross profits of £130,000, as compared with £119,000 in 1912-13. After allocating £39,000 to depreciation, as against £40,000, the accounts indicate net profits, including the balance forward, amounting to £51,000, as contrasted with £43,000 in the previous year. The sum of £16,000 has been placed to a war risks' fund, £4,000 to the special reserve fund, and £8,000 to the provident fund for staff and workmen, and the balance permits of the payment of a dividend of 6 per cent. on ordinary share capital of £320,000, as compared with 7 per cent in 1912-13, the loan capital totalling £160,000.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

Major Leonard Darwin presided on December 22nd at the offices, 106, Cannon Street, E.C., over the annual meeting. He began his speech by reiterating the regret which the directors felt so keenly when presenting such a disappointing report to their shareholders. There had been no difficulty whatever in ascertaining the cause of the present troubles, and the cure of the disease, so far as it was curable, ought to present no insuperable difficulties. The first trouble to be mentioned was that due to the war, and here they were dealing with the only part of the disease which the directors could do nothing to alleviate. During the last two months of the year, often its most profitable period, the sale of goods normally supplied to the public considerably diminished, with, of course, a corresponding diminution of profit. But the war had caused them losses in a far more direct way. Not long after hostilities had broken out, it became apparent that the German army was likely to pass through Persan, and their managers at the works took prompt and effective action, largely on their own initiative. Recent events had given them further means of judging of the probable fate of an English manufactory in France if falling under the influence of German culture, and had confirmed the wisdom of the steps taken. The stores were bricked up; the documents were buried; and the managers left the factory when the Uhlans had come within a couple of miles of the works, and when the bridges across the Seine hard by were being blown into the air. Mercifully the German hordes swerved aside at the critical moment, and their French factory was now again a running concern, though hardly yet in thorough working order. Thus the war had resulted in a considerable diminution of profit. But he was bound to state that their worst troubles were those due to other causes. A careful comparison of the accounts of the year, with those of the previous year, showed a marked similarity in all the items except in two particulars. The first of these was the total sale of goods of different kinds. Here the diminution was not only that due to the war, but was also caused by a general slackness of trade in England, and a large and sudden diminution in orders from one important foreign country. Now it was impossible to make all the incidental expenses connected with the manufacture and sale of goods diminish in exact correspondence, and simultaneously with a diminution in the sales; and the result was that the whole profit made seemed to depend on the disposal of the last narrow margin of goods sold. If that margin remained unsold, a loss inevitably followed, and this state of things continued until the necessary readjustments of running costs or turnover could be made. Here then was the cause of a large part of their troubles. The second item in which their accounts showed up very badly was the profits made by their foreign agencies, as they called them. The deplorable conditions existing in South America were known to all, these being the result of commercial depression aggravated by heavy rains. In Australia trade had been bad, partly due to the opposite evil of long-continued droughts. And sales had diminished in both South Africa and India. But this was not all. Certain contracts for lighting towns in Australia, which had proved to be very unprofitable, were made some two years ago, the evil results of which had fallen on this year. It was no use making excuses, for no adequate excuse could be made. All that could be said was that drastic steps had been and would be taken to prevent its recurrence. There was a third item in the year's accounts which must be mentioned, where they hoped to have seen a change as compared with last year's figures, but where they had to admit a disappointing similarity, viz., the Persan account. Here again excuses were useless, and here again all that could be said was that radical changes in the management had now been effected. But cleaning up a stable was often a costly process, and in this case it had brought to light losses arising out of faulty manufacture in the previous year. They had hoped at all events to have done far better in the last six months of the year, that was in the period during which the war broke out; and they had now no reason to think that their anticipations would have been falsified if normal conditions had continued to exist. Now for the future. There had been, as he had said, a considerable falling off in sales in certain lines. In other directions, however, there had been material increases, notably in warlike stores, and in lines opened out to them by the cessation of the German export trade. The total orders on their books were now considerably greater than they were at this time last year, though it should be added that contract work for Government departments was, in many cases, not very profitable. This was, no doubt, partly due to the fact that, in the manufacture of these new lines, it took some time to get into thorough running order, new machinery often having to be made or bought. And he hoped that the meeting would note that this work of adaptation to the new conditions had thrown an immense strain on the staff, a strain which they had met in the most loyal manner. But would there be a profit declared and a dividend payable a year hence, he would be asked. He did not know. The price of rubber had been fairly constant, and had given them no trouble; and all had gone well with them with the exceptions which he had fully discussed, and which were, they believed, of a temporary nature. But who would venture to predict the results of this mighty war? Either the long continuation of this struggle, or the sudden cessation, might result in disturbances which no man could now foresee; and their company must be prepared to share in the troubles through which the nation as a whole would have to pass in the future. If no profit was made during the current year, then certainly no dividend would be distributed this time next year, for they would be unable to trench again on their reserves. But as their main troubles were, they hoped, things of the past, there seemed to the directors to be a sufficiently good chance of making a profit in the immediate future to justify the bold policy which they now recommended. Their proposal must, they thought, be in accordance with the wishes of those who had in the past so often advocated the equalisation of dividends out of reserve funds. And he felt that in this time of stress some extra risk might be run to avoid the hardships always inflicted on shareholders by the complete passing of a dividend.

Mr. C. H. Gray seconded the motion.

Mr. Flint, who spoke at considerable length, said the one comfort to be found in the report was that it showed some mental progress on the part of the board, in that they recognised for the first time that the reserve fund was available for the purposes of dividend. On one previous occasion, when they had a bad year, £50,000 was taken from the reserve, but they had no dividend, although the directors took their fees from the reserve fund. Now they had again resorted to the reserve fund, and the directors had again taken their fees from the fund. Mr. Flint proceeded to quote from the *India-rubber Journal* the results attained by a number of other companies, doing a somewhat similar business, before the war, and also gave extracts describing the booming conditions of the same companies since the start of the war. Coming to the report before the meeting, he asked what had been their progress with regard to their home trade? They were told that the losses were due to the war, to faulty organisation of the French factory, and to foreign agencies; and then they were carried to Australia, South America, Africa and Japan, and told that there had been certain unprofitable contracts. Apparently their difficulties arose from foreign contracts. Another curious thing was that the gentleman who was supposed to be responsible for the Persan works had been made an extraordinary director. He made no comment upon Mr. Smith's management, because he did not know whether he was responsible, and after all, the responsibility for all these difficulties lay on the board. Year after year they had been told that the French factory had not been satisfactory, and now he took it that Mr. Smith had been brought over on the homeopathic principle that like cured like. Whilst he was generally in favour of homeopathy, he did not think this step was likely to be beneficial to the board. He would like to know whether the prosperity enjoyed in the home trade by kindred businesses had been shared in by their company. They had not heard of what had become of the insurance money received from the loss of their ship, but he presumed their losses would have been bigger but for that money having come in. Further, he would like to know something about the Palmer Tyre Co., as he had always protested against the method of secrecy with which that concern was conducted. Another point was that there was no item in the accounts for income tax, although surely on the three years' average they must have paid something. Last year he moved a resolution with regard to the directors' fees, as he felt strongly it would be more inducement to the board if they were paid on a sliding scale, but the directors took alarm at the proposal and regarded it as a vote of want of confidence. He still adhered to the view that this was the best principle for them, and he would like the question reconsidered. Mr. Flint quoted from the Articles of Association regarding the directors' remuneration, and said that in 1881 a resolution was passed giving the board £2,000 a year with an additional remuneration of 10 per cent. if the net profits were in excess of £31,200 a year. Such remuneration, however, was not to exceed £5,000 a year. Since 1881 the capital had largely increased, and in 1904 a special resolution was passed to the effect that the existing Articles of Association, and all the other existing regulations of the company, should be repealed, and that the Articles of Association submitted to the meeting should be adopted. That resolution was not confirmed, and, technically speaking, he supposed the directors were not entitled to any fees at all until some resolution had been passed. He felt that this subject should receive attention, although he agreed that, owing to all of them being more or less engaged by the war, the present was not an opportune time.

Mr. W. THOMPSON asked how the £50,000 was to be drawn from the reserve fund, seeing that they were told that the whole of the reserve was invested in the business.

Mr. WINKLEY said that all the contracts made abroad appeared to have been failures, more or less, and he would like to know who was responsible for them if the contracts were taken at prices which did not pay, why were they sanctioned by the directors on this side? They were now told that drastic steps were to be taken, but in what direction would they be taken? If they had been unable to keep a fair hold on the business, someone was to blame; and if they had not done this up to now, how were they going to do it in the future? He did not see how they were going to take £50,000 from the reserve fund unless they borrowed from the bank. Although they had £750,000 share capital, £400,000 debentures and £350,000 reserve fund—which was profit sunk in the business—yet they had also £158,742 debts and loans from the bank owing by the company. It seemed to him as if a sort of rake's progress had been going on, and they wanted to fix responsibility on the person who was responsible and who had created this trouble. No man in business for himself would ever have allowed such a state of affairs to have arisen without going thoroughly into the matter.

Mr. BLAKE remarked that it was common knowledge that the company was too conservative, especially in regard to its procedure at the works. Many representatives of manufacturers went down to the company's works to see the buyers, who, however, refused to see them. It was well-known in the trade that the company was buying materials at prices much above what their competitors were paying.

The CHAIRMAN said that, with regard to Mr. Blake's remarks, he could only say he really did not think this was the case. He himself had always seen very great care exercised in this matter. As to Mr. Smith, if the shareholders knew the whole story he thought they would take a very different view of the situation. Mr. Smith joined the works in France 55 years ago. For 50 years he had worked for that company, and for 45 years was their manager. About two years ago his health began to break down, and they began to take steps to relieve him of his responsibilities, which ceased entirely in April. Now Mr. Smith's health had completely broken down. They had always regarded the position of extraordinary director in the case of Mr. Smith as a small pension for 50 years' service with the company, and also to give to the board the chance of getting a certain amount of information due to his many years' experience. Although it was perfectly true that the Persan factory had been a bad venture for the past few years yet, on the whole, they had gained very much from the French factory, and after Mr. Smith's many years of faithful service he did not think the shareholders would grudge him the small pension in his retirement and broken health if they knew the whole story. It was true that the board had sometimes refused to use the reserve to pay dividends, and that was a question which depended to a certain extent on the cash state of the company. If cash was difficult to get then they could not use the reserve fund. The ship they had lost had been well written down in their books, with the result that the insurance more than covered the loss incurred. Their total loss would have been greater but for the loss of the ship, but it was not advisable to state the exact ratio of their book values to their insurance policies, for reasons which would be quite appreciated by those who did business in this line. Their Silvertown works had done well up to the beginning of the war, but it was difficult to say whether it was doing well or not now. Although they had lots of orders, yet, like other companies mentioned, it was difficult to estimate the profits in view of all the new machinery and the new circumstances which had to be taken into consideration. They were introducing entirely new manufactures, and anyone who had to do with the introduction of new manufacturing methods knew how difficult it was to estimate the whole profit at once, but so far as he could say they were making a good profit. There was no mystery about the Palmer tire business; it was a separate department, and it was not advisable to make public all the details of each of their separate departments. It paid 12½ per cent. last year, but that was only a book entry, as they held practically all the shares. The reserve fund was built up out of undivided profits, and as he had already said, it depended on the cash state of the company as to the extent to which they could use the fund to pay dividends. They would no doubt have to borrow from their bankers in order to pay the dividend. As to the contracts entered into abroad, of course the Board were solely responsible. If anything went wrong they were to blame. Their agents were acting under their orders, and if they did wrong the directors had to answer to the shareholders. They could only put the matter right possibly by getting rid of individuals, and also in making stricter rules in settling where their activities should lie. There might have been slackness in that respect in the past, or it might not be right to trust their agents abroad to the extent they had done, but that matter would be carefully looked into, and he felt convinced that there was no chance of such difficulties occurring again.

Mr. C. H. GRAY (joint managing director) said he did not know that there was much more to say from the general point of view. For the last three years he had been intimately connected with what he might call the reorganisation of Persan, and to reorganise a factory was not an easy thing, especially when they had to keep it running at the same time. The personal equation always came in, and one came up against very rough corners, some of which had to be removed. The condition of Persan practically arose from the fact that Mr. Smith was getting older, and could not give the same personal attention to things. Things spread out a little, and touch was lost with details which were so necessary to keep within one's grasp in order to make a thing successful. He was afraid a little more time was taken up in discussing personal equations than in looking after the work. It was his business to try and smooth over the personal difficulties, and he had now got rid of them and arranged and systematised the factory in such a way as to have accurate knowledge of costs and sales, and all the details necessary to run a business. The war had to a great extent upset the organisation owing to so many of the men being at the front, but had it not been for the war he thought he could say with perfect certainty that the organisation was such as to carry on the business successfully. The losses they had sustained in France were greatly due to bad work during the past year which had overlapped on to this year. He was at the factory two weeks ago, and believed that under the present halting conditions they were working at a profit. How long that would last depended on the war and on many things, but if they continued as they were working they should show a profit. He regretted the matter as much as anyone, because his father had a great deal to do with bringing forward the French factory, and, therefore, from a personal point of view, he would not like to see the factory in a worse state than he found it.

Mr. LEGGETT replied to Mr. Flint's point as to director's fees, and pointed out that the remuneration was fully covered by Article 72.

The CHAIRMAN said the income tax was a technical point. The amount estimated on September 30, 1913, was sufficient to meet the income tax actually paid. There had been the same amount of tax paid.

Mr. FLINT said he understood from the Chairman's statement that the tax was paid from the reserve of the previous year, which showed that the profit and loss account was misleading.

Mr. THOMPSON said the shareholders would have the greatest sympathy with Mr. Smith, but they had not the same sympathy with the board. Was it right for them to have allowed Mr. Smith to remain at Persan?

The CHAIRMAN: All I can say is that we are responsible.

Mr. C. H. GRAY replied to Mr. Blake, and said they had at Silvertown one of the most efficient buyers he had come across. They might pay more for certain articles, but they did so knowingly because they wanted the best article. Their policy was to get the best article they could for the job, and although they might pay more for some things, they could also buy very cheaply when they wanted to.

The report was then adopted.

On the motion for the re-election of the retiring directors, Mr. FLINT wished to propose an amendment to the effect that the matter be postponed until a further report had been received by the shareholders, showing what class of business had been carried on by the company at a profit, and also containing recommendations as to what should be done in regard to the foreign agencies.

The CHAIRMAN ruled the amendment out of order, but pointed out to Mr. Flint that it was open to him to move the adjournment of the meeting.

The motion was then agreed to.

Melbourne Electric Supply Co., Ltd.

MR. J. B. BRAITHWAITE (Chairman) presided on December 21, at Finsbury Pavement House, E.C., over extraordinary meetings of the holders of the consolidated ordinary stock and of the holders of the 7 per cent. first cumulative preference shares of the Melbourne Electric Supply Co., Ltd., when resolutions were passed sanctioning the creation of a further £20,000 7 per cent. first cumulative preference shares of £5 each.

Mr. BRAITHWAITE also presided at the 15th annual general meeting of the company which followed, and in moving the adoption of the report said he had to congratulate the shareholders on a year of continued progress and success. Last year he told them that their progress was a record, and it seemed unlikely then that that record could have been surpassed, but the record before them that day was an even better one from whatever point of view they looked at it. One of the most satisfactory features was the increasing way in which the small municipalities outside Melbourne were coming to them for bulk supplies. The proposals for the creation of fresh stock would raise the share capital from £450,000 to £750,000, and would carry with it automatically the right to issue a further £250,000 of debenture stock. The total capital expenditure during the year had been £185,115, as compared with £160,029 last year, and as their profit had increased by £27,247 it represented a return of about 15 per cent. on the expenditure, although, of course, some of the expenditure had not so far been productive. A great portion of the capital had been spent in connecting new customers to their mains, and in this direction their progress continued to be almost phenomenal. Supplies were now available on 482 miles of streets, there having been an increase of 72 miles during the year. They had put on 5,495 new customers, as against 4,975 last year. He believed the addition of 5,495 new customers in a year was an absolute record of any company anywhere in the world so far as he knew. That brought up the total number of consumers connected up to August 31 to 19,040, an increase of 40 per cent. during the year, and last year showed an increase of 56 per cent. on the previous one, so that the increase was really phenomenal, and at the present moment the number of consumers connected was over 20,000. To this remarkable increase all classes of business had contributed. The lighting supply had increased very considerably. Last year he told them they had introduced a new power tariff which would enable large consumers of power to obtain it on very reasonable terms, and they looked forward to the new tariff bringing a very large increase of business. He was glad to say the forecast had been fully justified. Last year they had the equivalent of 9,581 horse-power on their mains, whilst on August 31 they had 12,444 horse-power connected, and to-day they had 15,000 horse-power on the mains. Thus they were gradually obtaining a very important power load, and those who knew anything about the technical part of electrical supply undertakings would know what an important factor a good power load was in enabling them to supply units at a reasonable price and with efficiency. Taking the connections altogether they had increased 32 per cent. per year, as against 38 per cent. last year. Not quite the same rate of progress, but on the other hand the total units sold had increased by 43 per cent., as compared with 37 per cent. last year. That was due to the large number of units taken by the new power consumers. The gross revenue had increased by 30 per cent., as compared with 36 per cent. last year.; so that from every point of view they had reason to be satisfied with the progress made. At Melbourne their lighting income had risen from £66,403 to £81,758; the power and heating revenue from £31,403 to £37,466; public supply from £4,623 to £7,017; and supply to municipal tramways from £8,339 to £16,836, which was nearly double. The item of bulk supply, £322, appeared for the first time, but that would considerably increase during the current year owing to the supplies they were now giving in bulk. Meter rents had increased from £4,198 to £6,117; and the total result was that the revenue from Melbourne had risen from £115,288 to £149,959. On the other side, to earn that additional revenue the cost of generation of electricity had only risen from £22,988 to £27,125. The cost of distribution had risen from £948 to £1,695; repairs and renewals from £7,297 to £9,233; carbons, lamp renewals, etc., from £4,471 to £4,773; and the total result was that the expenses had risen from £46,707 to £56,757. The net revenue had, therefore, increased from £68,580 to £93,202. At Geelong they had the same pleasant story in a modified form. There was an increase in the lighting supply from £6,660 to £7,401, and in the power and heating supply from £3,503 to £4,119. The public lighting supply had increased from £1,133 to £1,837; and the current supplied to the tramways had increased from £11,905 to £14,927. The total revenue had increased from £23,935 to £29,161, with the result that the balance carried to profit and loss account was increased from £8,511 to £11,137. This large increase in their consumers had not been obtained without them considering their interests at every turn. His opinion was that the best way to develop a business was to consider the interests of the consumers. Last year he mentioned that they had introduced a new power tariff, which made it possible for large users of power to obtain power on good terms, and during the year they had further modified that tariff in the direction of the very large power consumers, so that they were now getting their current at less price than from any company or local body in Australia. In the same way they had introduced a new graded tariff, which enabled their large lighting consumers to obtain their current on very reasonable terms. They had been anxiously awaiting the time when the company would be in a sufficiently solid position to make a reduction in the price to those consumers that in a certain sense did not deserve it—he meant the small consumer, who was not a profitable customer in the ordinary way, since his demand was very small, and the company had to pay for mains and plant and connections, whilst the consumer would, perhaps, only use the light one or two hours a day, and sometimes not at all. At the same time, they had always had it on their mind that as soon as possible they would give such consumers some benefit; and now, owing to the economy in generation which they had been able to effect, they thought they were justified in giving them something, and so they gave the local board discretion some time ago to reduce the flat rate from 5½d. to 5d., which was really 10 p.c. The local board felt that they were in a position to do so, and so the new rate would come into force about Jan. 15th of next year. So they were not only improving their earnings and their profits, but they were giving benefits to their consumers all round, owing to the economies which had been effected by putting down this modern type of plant. With regard to the profit and loss account, their revenue was £104,885, against £77,140—an advance of 35 per cent. They had anxiously considered the way to deal with that revenue in a most conservative way, and in a way likely to be for the most permanent interests of the company. After providing for the first debenture stock sinking fund, which is a fixed sum of £2,500, they had an item which appears for the first time, viz., £2,609 9s. 6d., which they had applied to a sinking fund for the consolidated debenture stock. The income certificate sinking fund of £1,500 remained the same. During the year they had reduced a further £1,796 income certificates, leaving the amount outstanding on Aug. 31st of £21,675 out of the original £30,000. Then they proposed to add £5,000 to the general reserve, raising it to £65,000; to carry £5,000 to the suspense account to meet the cost of writing-off sundry items of plant at Melbourne and Geelong which had become obsolete; and to clear up the balance sheet by writing off the expenses of the issue of the 1913-14 debentures, £10,560, instead of spreading the item over a number of years. Then it was proposed to put £10,000 to a dividend equalisation account, so as to do their best to secure the shareholders on a 10 per cent. basis, and, in addition, they increased their carry-forward by £3,300. In conclusion, the Chairman referred to the excellent services of the local board in Melbourne and of Mr. F. W. Clements, the local managing director, and the other members of the staff.

Mr. R. **Percy Sellon** (managing director), in seconding the motion, remarked that the year had been one of very exceptional activity. He knew something of the progress of electrical supply undertakings in the country, and in many countries in the world, and so far as he was aware there was no undertaking which had shown for the period under review the progress their Melbourne undertaking had. Mr. Sellon also alluded in eulogistic terms to the good work of the Australian staff and of Mr. W. E. Lane, the secretary, and the staff in London.

Mr. **Shead** congratulated the board on the admirable report, but suggested that the creation of debentures seriously affected the ordinary shareholders. He thought preference or ordinary shares should be issued instead of debentures. He also asked why a public issue of the last debentures was made, instead of the ordinary shareholders being offered them? He saw brokers' commission, advertising, etc., £1,800, and he presumed the Chairman's firm acted as brokers. He hoped the Chairman would not take the mention of that as a personal matter between them, but he had received letters of complaint from Colonial shareholders.

The **Chairman** said the answer to Mr. Shead was simple. A very few years ago their ordinary stock was not worth the paper it was written on, and the only way by which the company could be extricated from its serious financial position was to issue debenture stock. The ordinary shareholders could not take it up, and they had to do the best they could. The ordinary stock had simply been made valuable by the financial arrangements they made under great difficulty. They had issued the stock on the most favourable terms they possibly could, but to have offered it to the Australian shareholders would have been disastrous. With regard to his firm acting as brokers, there had never been any concealment, and one of the reasons why he had been asked to take the chairmanship of the company was that by reason of his connection with the Stock Exchange he might be able to extricate the company from its financial difficulties. He said without fear of challenge that the issues had been made on the most reasonable terms. Had more favourable terms been offered they would have been accepted.

The motion was then carried, and a hearty vote of thanks was afterwards passed to the board and staff.

Adelaide Electric Supply Co., Ltd.

The annual meeting was held on December 22nd at the offices, Finsbury Pavement House, E.C., Mr. J. B. **Braithwaite** presiding.

In proposing the adoption of the report (Elec. Rev., Vol. 75, p. 826), the **Chairman** said that the past year had seen nothing of a striking character, in connection with the company, but a steady continuance of prosperity which it had enjoyed for many years past. There was a growth in every item of net revenue. The lighting receipts had gone up from £58,200 to £74,824; power and heating from £21,800 to £25,067. Public lighting had increased from £4,578 to £5,941. There had also been increases in meter rents and dividends, and in all the total revenue had advanced from £89,591 to £111,985. He thought they would agree that, coming on the top of previous increases, the further increase of practically £22,000, or nearly 25 per cent., was very satisfactory. On the other side, generation of electricity had risen from £21,738 to £24,698, an increase of just under £3,000; distribution had risen from £3,168 to £3,385, an advance of only £200; and repairs and renewals had increased from £6,659 to £8,983. Interest on debenture stock had gone up a little, and the debenture stock sinking fund absorbed £5,360. The net result was that they carried down £40,492 against £37,857 last year. They proposed to pay a final dividend of 5 per cent. and a bonus of 2 per cent. on the ordinary shares, and a final dividend on the preference shares, which would raise their carry forward from £9,864 to £10,815, whilst leaving their dividend equalisation fund of £25,000 intact. They, therefore, started the new year with £35,815 in hand available for dividend account, which went a long way towards securing their dividend for the current year. The other items in the report were equally encouraging. They had added 59 miles of streets in which current was available, about the same as last year, when they added 60 miles; they had added 2,932 consumers—not quite so many as last year, when it was 3,486, but still a very satisfactory record—and the total consumers now connected were 13,192, as compared with 11,354, an increase of 16 p.c. as compared with the previous year. Their total connections, including lamps, had increased by 24 p.c., and the total units sold also by the same figure, and the gross revenue by 25 p.c. They would see that the expenditure of the new capital had continued to produce corresponding results. During the year they had expended £143,036, with the result that they had received additional revenue of about £22,000—approximately 15 per cent. on the capital expenditure, although, of course, the whole of that expenditure had not yet become fully productive. The capital required had been provided in the manner that he foreshadowed at the last meeting. They then obtained power to increase the capital from £400,000 to £500,000 by creating a further 20,000 6 per cent. cumulative preference shares. He told them that they would probably provide the additional capital required by the issue of a portion of those preference shares and by the sale of a further amount of debenture stock. That forecast had been borne out by the result. During the year the ordinary share capital had been raised to £250,000—the full amount. That issue of £50,000 was made at a premium of £3 per share, which gave them £80,000 additional capital, and the balance had been provided by the issue of another £25,000 debenture stock. Last year that stood at £175,000; it was now £200,000, and the further issue of preference shares they were now making would give them a further £25,000 debenture stock available, so that as far as they could see they had in hand sufficient resources to meet the capital expenditure during the current year, and they were not asking at present for any additional powers. Last year they placed £20,000 to general reserve, raising it to £58,000. They were not very anxious to increase that general reserve, for owing to the short tenure which they had there was the power of purchasing them every two years. That being the case, they were not particularly anxious to show large sums carried to general reserve. They had got a sum which was quite adequate for all contingencies, and in addition they wrote off from the plant items that might have become obsolete. Already they had written off £12,074 on that account. They would continue that policy as portions of their plant became obsolete, by substituting units of more modern construction. At the present time they had in their power-house a good supply of perfectly modern plant of the most economical kind. That was shown by the fact that, although their production of units had increased by 25 per cent., their generating costs had only increased from £21,738 to £24,678, rather less than £3,000. The extraordinary progress which the company was making was shown in the table which appeared in the report, from which it would be seen that from 1904 to 1914 the number of consumers had grown from 585 to 13,192, and the total units sold from 729,821 to 6,740,991. They had had the advantage of a visit during the year from Mr. Clements, their engineer and a member of the local board in Adelaide, and they had been able to confer with him on several matters of importance. With regard to the current year, it was difficult to say what effect the war might have upon their business, or the drought from which Australia was suffering, but they thought that in going forward into the new year with their dividend equalisation account of £25,000, and their carry forward of over £10,000, they were taking all reasonable precautions against any temporary set-back in their prosperity. He was glad to say that there had been no signs of decrease in the first three months of the present year; on the contrary, they had exceeded what they did last year in the corresponding period.

Mr. Percy Sellon seconded the motion.

Replying to a question, the Chairman said that the investments were definitely against the dividend equalisation account. The general reserve was in the business in the form of plant, mains, etc.

The report was adopted.

Following the re-election of the retiring director and the auditor, a vote of thanks was accorded to the local directors and the staff.

Manx Electric Railway Co., Ltd.

Sir W. H. Vaudrey presided on December 21st, at the offices, Finch Lane, E.C., over the annual meeting. He first apologised for the absence of the Chairman, Col. Sir Arthur G. Boscawen, M.P., who was at Chatham serving as Colonel of the 3rd Royal West Kent Regiment. The Chairman had intended being present at the meeting and had prepared notes for his address, which he (the speaker) proposed to read. Their colleague, Mr. B. E. Greenwell, was also serving his country as Major in the Hants Yeomanry. The war which broke out at the beginning of August, by keeping vast numbers of summer visitors from going to the Island, had played havoc with their receipts. Whilst previous to August they were well ahead of even last year's record takings, and the exceptionally fine summer promised a rich harvest, the months of August and September, which, of course, always provided their chief revenue, for the reason already mentioned, proved disastrous The passenger receipts amounted to £24,793, as against £36,642 in 1913 and £30,292 in 1912. Goods, live stock, quarries, etc., brought in £2,744, as against £3,518 in 1913 and £4,082 in 1912. They carried 496,568 passengers, as against 704,188 in 1913 and 547,187 in 1912. Their mileage this year was 305,731, as against 364,747 in 1913 and 325,647 in 1912. They earned 19.46d. per mile run from their passengers, as against 24.11d. in 1913 and 22.33d. in 1912, and they carried 1.62 passengers per mile, as against 1.93 in 1913 and 1.76 in 1912. The receipts per passenger carried were 11.98d., as against 1s. 0.52d. in 1913 and 1s. 0.73d. in 1912. The number of visitors to Douglas and Ramsey, as officially advised, between the months of May and September was 413,650, as against 629,617 in 1913 and 597,904 in 1912, the decrease being accountable entirely to the months of August and September; in fact, May to July showed an increase of nearly 15,000. Their gross revenue amounted to £27,537, as against £40,160 in 1913 and £34,375 in 1912. The working expenses totalled £17,391, as against £18,740 in 1913 and £17,669 in 1912. The ratio of working expenses to receipts was 63.15, as against 46.66 in 1913 and 51.40 in 1912. All these unfortunate statistical figures were clearly traceable to the lack of visitors during August and September, and he feared it was small consolation to tell them that in normal circumstances he had no doubt they would have been able to lay before the shareholders a fresh record in earnings. As it was, after providing for the debenture interest to 30th September, they were left with a balance of £3,325 (inclusive of last year's carry forward), and they were therefore obliged to forgo the payment of the preference dividend, a misfortune which had never before occurred to them since the formation of the company. The board thought it right and proper to apprise shareholders of this result of the year's trading at the earliest possible moment, and they therefore issued a circular to that effect in October. The balance of £3,325 they proposed carrying forward, and they could now only hope for a speedy termination of the war, a prompt resumption of normal conditions, and a more encouraging showing next year. Their colleague Mr. Ernest Schenk had changed his name to Ernest Remnant, he was born in England and had always resided here, but since the war broke out he had been troubled with so much correspondence that he determined to adopt his mother's family name.

Mr. Remnant seconded the motion, and the report was adopted without discussion.

Metalite, Ltd.

An extraordinary general meeting was held on Wednesday at the Institute of Chartered Accountants, Moorgate Street, E.C., for the purpose of confirming the resolution passed at the meeting held on Dec. 15th sanctioning the new reconstruction. Mr. E. C. Vincent presided.

Mr. Rosenthal said he had been asked to raise the question of the payment of the 1s. 6d. per share by the old shareholders. The point was that, however big the inducement might be, the present was a very inconvenient moment for such payment in view of the exceptional stress that people were passing through. It seemed unjust that people who had contributed should, as it were, be deprived by one stroke of the pen from any future benefit which might accrue. He considered it only fair that some resolution should be passed safeguarding the interests of the old shareholders, and he suggested that they might be allowed the alternative of getting so many fully-paid shares in exchange for their present holdings. If not that, then they might grant some certain definite period, such as three months after the termination of the war, for the payment of the 1s. 6d.

The Chairman said the position was that they were bound by the reconstruction scheme, the terms of which they were all fully aware of. Notice had to be given to the Liquidator, and after that it was up to the new directors to see what could be done, and he would put it to the new board whether in certain cases, where the terms appeared to be somewhat harsh, a short extension of time could not be granted. The suggestion of a date three months after the war was, however, quite an indefinite period. With regard to the suggestion as to old shareholders getting fully-paid shares, he would remind them that the property was the property of the shareholders, and they had agreed to certain mortgages and charges amounting to something like £30,000. These were in arrears, both as regarded principal and interest. They had eventually got the holders of these charges to waive their security and substitute another security. There was very great difficulty in getting the debenture-holders to take ordinary shares, but they had done so. The reconstruction had been acceded to by all parties and they could not depart one iota from it. As an act of grace the new directors might give an extension of time, but he doubted very much if they would, because if the resolution was not confirmed the Receiver would dispose of the concern, lock, stock and barrel. If that were done it meant that the shareholders and the unsecured trade creditors would not get a penny, and the holders of the mortgages and charges would get very little. As regarded the question of issuing fully-paid shares, he would point out that under the scheme the shareholders must put up certain money, and he did not think it was any question of throwing good money after bad.

Mr. W. Stewart said he also had received letters from shareholders, and in these trying times any little latitude which could be granted would be much appreciated. He considered the new directors gentlemen of exceptional business capacity, and he believed they would do the right thing when the opportunity was given them.

The Solicitor remarked that he was perfectly certain any application on the part of any shareholder would receive the greatest possible consideration.

The resolution confirming the previous resolution was then formally proposed by Mr. Stewart and carried.

STOCKS AND SHARES.

Tuesday Evening.

It would beggar the powers of Mark Tapley himself to write a cheerful letter on stocks and shares this week—that is, if he started comparing current prices with those which existed at the beginning of the year. It is not as though the early months were marked by any particular phase of buoyancy that would redeem the drabness of the picture as a whole; although, in this connection, one must recall the remarkable little burst of strength in gilt-edged securities which took place in January and February, when there was such a run upon all investments of this class as the Stock Exchange had not seen for several years. The mark of this, indeed, is left upon not a few of the best kind of securities up to this very day, in evidence of which we may point to the difficulty of obtaining certain electrical supply Debenture stocks of the first order, and to the avidity with which they are bought when they come—as they so rarely do—into the market.

Before attempting to review, through the medium of price variations, the net results of 1914, we may remark that the feature of the industrial markets since the Stock Exchange reassembled after its Christmas holidays is the notable strength of two or three shares connected with electricity supply. Edison & Swan shares have advanced rapidly, the £3 paid putting on 3s. 6d. to 12s., while the fully-paid at 50s. are 10s. higher than they were a week ago. British Westinghouse Preference rose to 2, and there has been a further inquiry for both sorts of Crompton shares. The other industrial companies which stand to benefit by the war are steady, armaments, for example, scarcely moving, though Rubber shares have gone ahead sharply and are a good market, with a fair amount of pressure to buy at prices which, though below existing levels, are substantially higher than those at which present buyers bluntly declined to look at the shares some weeks ago.

The Electrical Supply list contains no movements of particular significance. Westminster Ordinary are ⅛ higher at 8⅝, and Charing Cross Debenture hardened up to 87. A small seller of County of London 5 per cent. Debenture stock proved enough to put the price down a point. The interest with which London anticipates aircraft invasion is sufficient to still the murmurs that were beginning to arise with reference to the darkened streets and shops; but considerable interest is aroused as to what the next reports of the electrical supply companies will show.

Great Northern Telegraphs fell to 28, a drop of 30s., due to a few orders to sell from Paris, a good many of this company's shares being held in France. Eastern Telegraph Ordinary stock has also come in, as may be inferred from a fall of 2½ in the price to 120. "China" shares, however, maintain their figure of 12, so that the anomaly between the prices of the two companies' issues is redressed in this way, although Eastern Ordinary is still a little the cheaper of the two, because of the bonus which will no doubt be declared as usual, in company with the final dividend for the year. New York Telephone Bonds reacted to 96. Marconis are quiet at $1\frac{9}{16}$, and the subsidiaries are fairly well maintained.

For the purposes of our customary review, we will take the quotations as set forth in our weekly lists, these being representative of various markets connected with the electrical industry. The first place shall be given to the shares of the electricity supply companies :—

HOME ELECTRICITY COMPANIES.

	Now.	Jan. 2, 1914.	Rise or fall.
Brompton Ordinary	8¼	8⅜	— ⅛
Do. 7 per cent. Pref.	8¼	8½	— ¼
Charing Cross Ordinary	4¼	—	—
Do. do. do. 4½ Pref.	4½	—	—
Do. do. City Pref.	4	3¾	— ¼
Do. 4 Deb.	87	91	— 4
Chelsea	4¾	—	—
Do. 4½ Deb.	91½	95½	— 4
City of London	14½	17	— 2½
Do. do. 6 per cent. Pref.	13	13½	— ½
Do. do. 5 Deb.	114	116	— 2
Do. do. 4½ Deb.	98	—	—
County of London	11½	12	— ½
Do. do. 6 per cent. Pref.	11¼	—	—
Do. do. 1st Deb.	99	102	— 3
Do. do. 2nd Deb.	97	99½	— 2½
Kensington Ordinary	7½	8	— ½
London Electric	1¼	1⅜	— ⅛
Do. do. 6 per cent. Pref.	5	—	—
Do. do. 4 Deb.	89¼	91½	— 2¼
Metropolitan	3½	3⅛	⅜
Do. 4½ per cent. Pref.	4¼	4⅝	— ⅜
Do. 4½ Deb.	91½	96½	— 5
Do. 3½ Deb.	81½	79½	— 2
St. James' and Pall Mall	9	8¾	— ¼
Do. do. do. 7 per cent. Pref.	6¼	6⅜	— ⅛
Do. do. do. 3½ Deb.	83	—	—
South London	3	—	—
South Metropolitan Pref.	1⅛	—	—
Westminster Ordinary	8⅝	8½	— ⅛
Do. 4½ Pref.	4⅞	$5\frac{1}{16}$	— $\frac{3}{16}$

The Telegraph and Telephone list shall come next :—

TELEGRAPHS AND TELEPHONES.

	Now.	Jan. 2, 1914.	Rise or fall.
Anglo-Am. Tel. Pf.	104	106	— 2
do. Def.	22	24⅜	— 2⅜
Chile Telephone	7	$7\frac{7}{16}$	— $\frac{7}{16}$
Constantinople Tel.	4	4¼	— ¼
Cuba Sub. Ord.	8½	8½	—
do. Pf.	15½	15	— ½
Eastern Extension	12	12¼	— ¼
do. 4 Deb.	94	95	— 1
Eastern Tel. Ord.	120	125½	— 5½
do. 3½ Pf.	71½	76	— 4½
do. 4 Deb.	95	95	—
Globe Tel. and T. Ord.	10	10⅞	— ⅞
do. Pf.	12¼	12	— ¼
Gt. Northern Tel.	28	31½	— 3½
Indo-European	57	58	— 1
Marconi	$1\frac{9}{16}$	$3\frac{7}{16}$	— 1⅞
New York Tel. 4½	96	98½	— 2½
Oriental Telephone Ord.	2	1⅞	+ ⅛
do. Pf.	$1\frac{1}{16}$	1⅛	— $\frac{1}{16}$
Tel. Egypt Deb.	97	95	+ 2
United R. Plate Tel.	6	6⅜	— ⅜
do. Pf.	5	5⅛	— ⅛
West India and Pan.	1⅛	2⅜	— 1¼
Western Telegraph	12¾	12⅞	— ⅛
do. 4 Deb.	9[illegible]½	91	— 4½

Our third list is concerned with the stocks and shares of countries outside the United Kingdom. Here, the chief loss is that sustained by the Brazilian and Mexican concerns. In regard to Mexico, chaos continues to reign; and to deal in the securities of the country is all but impossible :—

FOREIGN TRAMS, &c.

	Now.	Jan. 2, 1914.	Rise or fall.
Anglo-Arg. Trams, First Pf.	4½	$4\frac{13}{16}$	— $\frac{5}{16}$
do. 2nd Pf.	4⅛	$4\frac{5}{16}$	— $\frac{3}{16}$
do. 4 Deb.	86½	89	— 3
do. 4½ Deb.	96	97	— 1
do. 5 Deb.	89	98½	— 9½
Brazil Tractions	58	83	— 25
Bombay Electric Pf.	11	11	—
do. 4½ Deb.	95	93	+ 2
Mexico Trams	45	63½	— 18½
do. 5 per cent. Bonds	70	78	— 8
do. 6 per cent. Bonds	65	77	— 12
Adelaide Sup. 6 per cent. Pf.	$5\frac{1}{16}$	5¼	— $\frac{3}{16}$
do. 5 Deb.	100½xd.	102	— 1½

The best that can be said about the Home Railway market is that things are not so bad now as they were at one time, soon after war was declared. There are, however, substantial falls left, as these figures illustrate :—

	Now.	Jan. 2, 1914.	Fall.
Central London, Ord. Assented	78	83	5
Metropolitan	31¾	46½	14¾
do. District	18½	31½	13
Underground Electric Ordinary	2	3⅜	1⅜
do. "A"	6/3	8/3	2/-
do. Income	80	90	10

Manufacturing shares alone survive the annual comparison with honour. Big jumps have taken place in some of the lower-priced issues. Edison & Swan partly-paid shares were virtually unsaleable at the beginning of the year: now they stand at 12s. Other movements are also worth noticing :—

MANUFACTURING COMPANIES.

	Now.	Jan. 2, 1914.	Rise or fall.
British Westinghouse Pref.	2	1⅛	+ ⅞
do. 4 Deb.	72	65½	+ 6½
do. 6 p. lien	98	101½	— 3½
Callenders	11½	11	+ ½
do. 5 Pref.	4½	—	—
do. 4½ Deb.	97½	96½	+ 1
Castner-Kellner	2¾	2⅞	— ⅛
Edison & Swan, £3 pd.	12/-	$\frac{1}{16}$	+ 10/9
do. do. fully paid	2½	1¼	+ 1¼
do. do. 4 Deb.	60	57	+ 3
do. do. 2 Deb.	60	65½	— 5½
Electric Construction	10/-	11/3	— $\frac{1}{16}$
do. do. Pf.	1	—	—
Gen. Elec. Pf.	10	9⅞	+ ⅛
Henleys	13	—	—
do. 4½ Pref.	4¾	4⅞	— ⅛
do. 4½ Deb.	97½	100	— 2½
Telegraph Con.	36½	38	— 2

Next Monday the Stock Exchange re-opens for dealing, after having been closed for a full five months. Such severe restrictions have been laid upon business by the Treasury that many members despair of being able to do any at all under the latest regulations. In all probability, the difficulties will adjust and compose themselves, as troubles have an occasional knack of doing. That they may, and by this operation conduce to the greater prosperity of every reader, is a New Year's offering to him as cordial as it is sincere.

Winnipeg Electric Railway Co.—A dividend at the rate of 3 per cent. for the quarter ending 31st ult., on the fully paid up capital stock is payable on January 2nd.

Victoria Falls and Transvaal Power Co., Ltd.—The directors, says the *Financial Times*, have declared a six months' dividend at the rate of 6 per cent. per annum, less income-tax, on the preference shares, bringing matters up to June 30th, 1913.

Waygood-Otis, Ltd.—The directors announce, says the *Financial Times*, that, in view of the disturbance caused by the war and the uncertainty as to future business, they do not think it advisable to consider the payment of an interim dividend.

HIGH-VOLTAGE DANGERS PRESENT IN STATIC TRANSFORMERS DUE TO ELECTROSTATIC CAPACITY OF THE WINDINGS.

By J. LINDSEY THOMPSON, M.Sc., A.M.I.E.E., and S. AUSTEN STIGANT.

The presence of high voltages on low-pressure windings of static transformers appears to the average engineer an improbability unless a breakdown of insulation occurs from high-pressure to low-pressure windings, and then only when the low-pressure winding is unearthed. This article is intended, however, to impress on the lay mind that high pressures may be present due to other causes and against which precautions must be taken.

The danger referred to is the direct outcome of operating conditions in conjunction with the electrostatic capacities of the windings to the core, and also to one another.

Single-Phase Transformers.—As is well known, in both core and shell type transformers the high-pressure and low-pressure coils are adjacent to one another and have considerable metal surfaces immediately facing each other, interspersed with a high dielectric. This condition of things immediately gives us a form of static condenser in which the high-pressure winding acts as one plate with the low pressure as the other, and since a dielectric of known specific inductive capacity is sandwiched in between, a high static pressure can exist between these two windings. Hence, since the low-pressure and the high-pressure windings again may be adjacent to the core, these windings have also a capacity to the core, and, as the usual practice is to permanently ground the core of all power transformers, therefore to ground. These conditions are shown diagrammatically in fig. 1, taking a transformer of 6,000/440-volt ratio. If K_1 = capacity between high and low pressure windings, K_2 = capacity between low pressure and core, K_3 = capacity between high pressure and core, then $K_3 = K_1 K_2/(K_1 + K_2)$.

Under normal conditions, with unearthed high and low-pressure windings and with both terminals of the transformer winding connected to the line at the same instant, the resultant distribution of potential across the high-pressure windings is zero, and, therefore, also is that of the low pressure as shown in fig. 2, curves A and B. The zero point will be at the centre of the windings if these are symmetrical, but if otherwise distributed, it will move towards that end of the windings having the lesser impedance, as shown by the dotted curves A′ and B′, fig. 2. If, however, on switching the transformer winding on to a live line, one terminal of the high-pressure winding makes connection before the other, then during that interval existing between partial and complete connection of the transformer, the whole of the high-pressure winding will assume the full line potential above earth, as shown by curve C, fig. 3. Now, due to the capacity of high pressure to low and low pressure to earth (or core) the whole of the low-pressure winding assumes a definite high static potential above earth, the value of which will be $V = V_1 \times K_1/(K_1 + K_2)$, where V_1 = high-pressure supply voltage. So that if we assume that K_1 and K_2 are in the ratio of 1·5 to 1, *i.e.*, assuming that—

capacity of high pressure to low = 1·5 × Z microfarads
„ „ low pressure to core = 1 × Z „

$$\text{then } V = \frac{6{,}000 \times 1{\cdot}5\,Z}{1{\cdot}5\,Z + Z} = \frac{6{,}000 \times 1{\cdot}5}{2{\cdot}5} = 3{,}600 \text{ volts,}$$

this value being shown in fig. 3, curve D. Thus we see that the low-pressure winding has been given a potential above earth of 3,600 volts due to the electrostatic capacity of the windings, combined with uneven switching. This is, of course, abnormally high for a 440-volt low-pressure winding, and so endangers the insulation that unless it is very liberally proportioned between the low pressure and core, a serious breakdown may eventually occur.

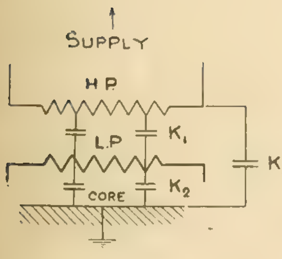

Fig. 1.

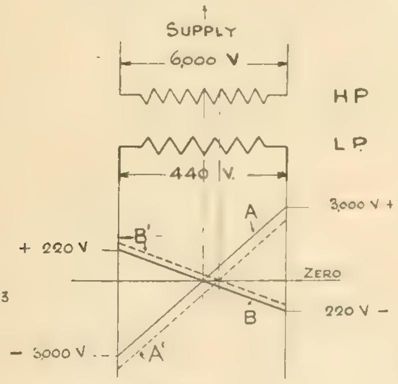

Fig. 2.

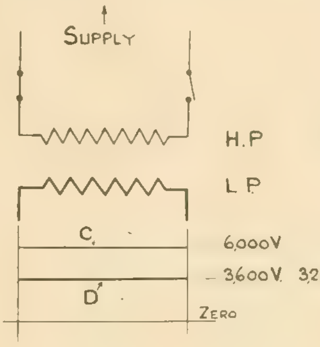

Fig. 3.

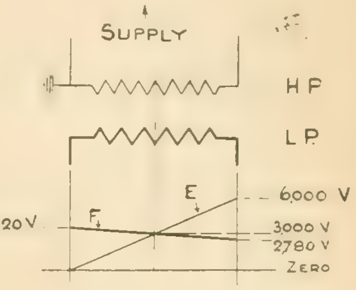

Fig. 4.

If the low-pressure winding happens to be connected to a motor or other apparatus, the pressure rise will depend on the resultant capacity of the circuit to ground, which will, of course, be lower or higher, as the case may be, but may still be of such a value as to allow abnormal potential to exist. The breakdown may occur due to this potential at any point of the low-pressure circuit, the whole of which is at the same abnormal static potential.

To take another case which is often met in connection with high-voltage transmission systems and "testing" transformers, where one terminal of the high-pressure windings is earthed, as shown in fig. 4. As soon as the one high-pressure terminal is earthed, the other assumes full line potential above earth, and the voltage distribution is as shown in fig. 4, curve E, thus giving the mid-point of the high-pressure winding a potential of 6,000/2 = 3 000 volts above earth. Therefore, due to the capacity between high and low-pressure windings, the low-pressure mid-point now assumes a potential equal to the mean potential of the high-pressure windings. Or, in other words, it is equal to the maximum high-pressure voltage to ground multiplied by the ratio of the capacity of low-pressure winding to ground and the sum of its capacity to high pressure and to ground. But since the high-pressure winding is earthed, the capacity of low pressure to high is the same as the capacity of low pressure to ground, hence this ratio is $1/(1 + 1) = \frac{1}{2}$, and therefore the static potential impressed on the low-pressure winding is equal to $6{,}000 \times \frac{1}{2} = 3{,}000$ volts. The low-pressure terminals will, therefore, rise to a potential of half the normal ratio voltage above and below this value, *i.e.*, one end will be at $3{,}000 + 440/2 = 3{,}220$ volts, and the other at $3{,}000 - 440/2 = 2{,}780$ volts, as shown at fig. 4, curve F.

Three-Phase Transformers.—In studying the electrostatic stresses induced in the windings of three-phase transformers, we will take for an example a simple core type star/star connected transformer of ratio 10,300/550 line volts, or 6,000/320 phase volts. The electrostatic capacities of the windings to each other and to earth bring about high static potentials in a similar manner to that already described for single-phase transformers, that is, under two conditions of (*a*) earthed high-pressure supply and unearthed low-pressure transformer windings, and (*b*) uneven switching. Before studying these two important conditions, however, we will glance for a moment at two other cases, which, though not directly involving electrostatic stresses proper, will materially assist in elucidating subsequent problems.

Consider the system in the first case as being totally unearthed, fig. 5*a*. If, as is assumed, the high and low-pressure phases are symmetrically balanced as regards their supply voltage, insulation resistance, capacity and distribution of windings, which usually prevail, then the neutral points of both high and low-pressure windings of the transformer will be at zero potential, as will also the core. As, therefore, the resultant potential of the transformer windings is zero, it follows that the electrostatic potential is also zero, and that the total voltage across the low-pressure windings is only that due to the winding ratio. These conditions are shown vectorially in fig. 5*b*.

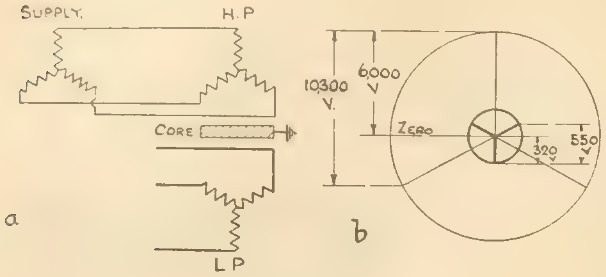

Fig. 5.

As previously stated, if the specific inductive capacity and resistance of the phase insulation is symmetrical, then the above conditions apply equally to any combination of earthed neutral and core.

(*To be continued.*)

RECENT ADVANCES IN ELECTRICAL CRANE AND LIFT DESIGN.

[communicated.]

(*Concluded from page* 867, *Vol.* 75.)

Some very interesting lift and crane controllers are built by Messrs. Laurence, Scott & Co., Ltd., two of which are illustrated in figs. 8 and 9. The former shows a reversing controller fitted with a single-pole overload and no-volt circuit-breaker, while the second shows a useful type of controller with a universal handle which is suitable for operating two motions on a crane at the same time, as, for example, in lifting and slewing simultaneously. It will be seen that the up and down movements of the handle can be made to correspond to speeds, to raise or lower, while the horizontal movement can be made to correspond with the slewing or travelling motion in either direction. In these reversing drum controllers for series-wound motors a very effective spring drive is adopted with a flat convolute spring, which, combined with a star wheel and spring roller, gives a very quick "make and break" action at each stop. The renewable contact fingers have locked adjustments, and they are given ample space with thick spark guards of asbestos material moulded under pressure. The magnetic blow-outs are very powerful, and are correctly designed so that the lines of force are actually at right angles to the arc, while the insulation adopted is entirely of micanite in the form of troughs or micanite covered bar. The controllers can be fitted either with handle or hand-rope control, the latter being especially useful for overhead cranes worked from below, and they are fitted with a fly-back arrangement whereby, owing to the action of a long convolute spring, a very even return action is obtained, which commences on the first contact in either direction, and returns the handle to the off position with certainty. Fig. 10 shows the standard connections for a reversing drum controller for series-wound motors, while the wiring diagram to the right of the illustration shows a modification which gives 30 to 60 per cent. extra torque, with half current, on every step but the last step, which requires that the motor should be specially wound.

In the reversing drum controllers for series-wound motors where rheostatic lowering is required, the control in lowering is obtained by making the motor generate on to the same resistance which is used for starting, and fig. 11 shows a controller diagram for this purpose. On the first lowering step from the off position the brake is lifted, and the armature is so connected up that the series winding with the lowering direction of rotation generates on to part of the starting resistance, which is then connected across the terminals to the motor, the motor being entirely disconnected from the mains. On the next two steps more resistance is inserted, while on the fourth step the whole of the resistance is inserted. On the fifth step this resistance circuit is opened, so that the motor runs freely, while on the sixth step the motor is connected up to the mains through the whole of the starting resistance, and on the seventh step some of this resistance is short-circuited. These steps are only required when the weight to be lowered is so light that it will not start the motor. If, however, the weight is started down on the sixth or seventh step, it will probably accelerate rapidly. If, then, the controller-handle is brought back on to the fifth step, the motor will be running quite freely. On the fourth step, however, it will generate through the resistance, and the speed will be checked. Coming back on the third step, a smaller ohmic resistance is in series, and the speed will be very much reduced, as a smaller voltage will be required to generate a considerable current, while, on the first step, the speed can be brought down to a creep. It is interesting to note that the lowering speed on each step is

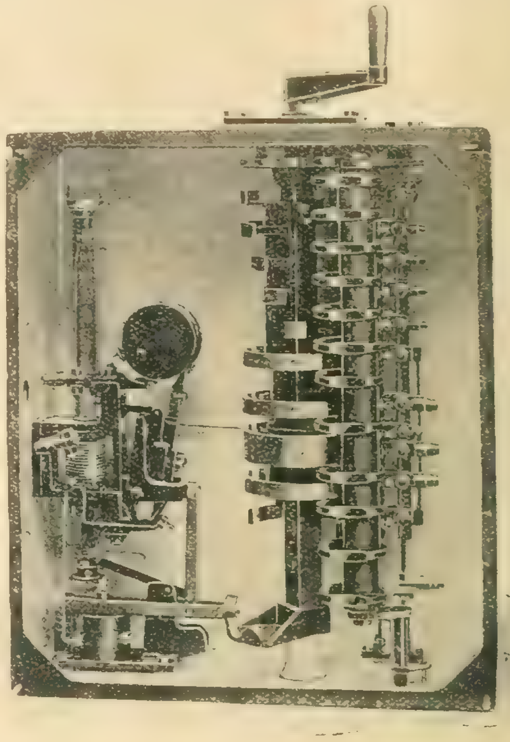

Fig. 8.

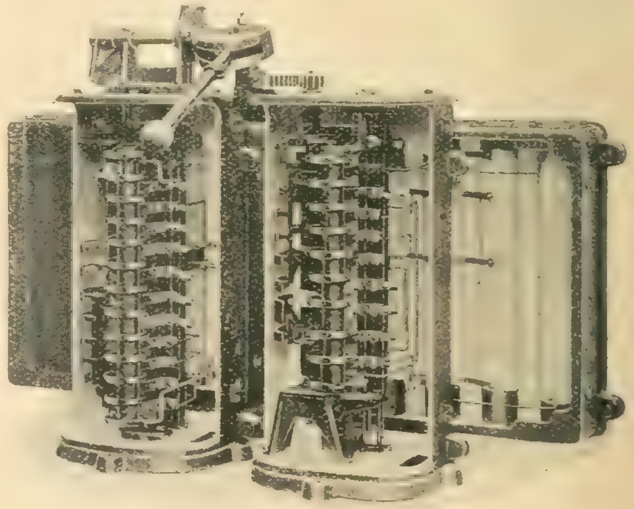

Fig. 9.

practically the same for all loads, while these lowering speeds can be readily adjusted within considerable limits after the controller is fixed, so that the best results can be obtained to suit actual running conditions. The great advantage of this type of controller is the very complete control that is given over the lowering speeds. One of these controllers, combined with the solenoid and centrifugal brake, makes a very fine combination for high-lifting cranes, as the centrifugal brake prevents the motor from damaging itself by running away, no matter how the controller is manipulated. The operator can lower at full speed on the last, or power, step, and can, by manipulation of the three rheostatic braking contacts, bring the heaviest load to rest gently and without shock. This controller is, of course, only applicable where efficient gearing is used, not being applicable where the efficiency of the gearing is less than 50 per cent. Therefore it is not used in conjunction with an automatic lowering brake, the flapper brake, or a series-wound brake.

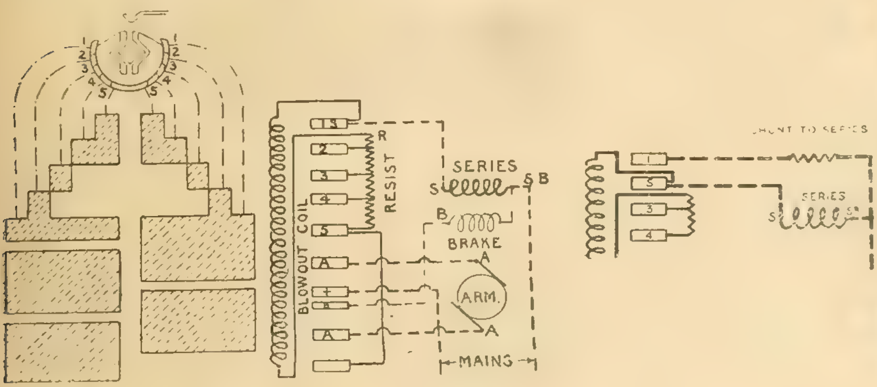

Fig. 10.

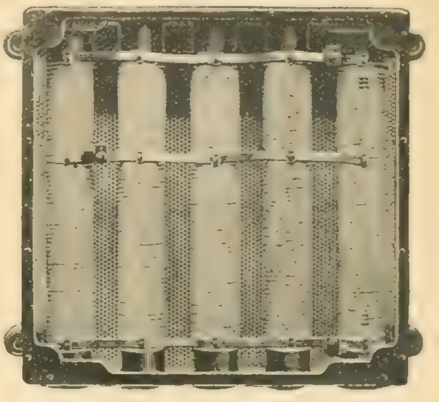

Fig. 12.

In connection with the design of apparatus for crane control, one of the most important features is the means taken to obtain an absolutely safe and reliable form of control resistance. It will readily be seen that the failure or short-circuiting of such resistance during operation might easily involve a very serious accident, and it is therefore highly essential that every means should be taken to see that the risks due to this cause are minimised. A word or two may, therefore, be given concerning a type of resistance which has been developed as a result of continuous experiment and practical application by Messrs. Laurence, Scott & Co., Ltd., and which is shown in fig. 12. It may be pointed out that this resistance does not depend to any appreciable extent on the absorption of heat by the substance contained in the resistance, as was the case in the earlier forms of resistance manufactured. It is now pretty generally recognised that the safest and most enduring type of resistance is that which depends on the heat-dispersion principle, that is to say, on bringing into active and organised contact with the material through which the current passes, a volume of air sufficient to carry off the heat as rapidly as it is generated, without allowing the temperature of the resistance to rise above, say, 200° F. This limit is suggested, inasmuch as it approaches within measurable distance of the melting point of solder, and as solder is very often used in connection with wire resistances, it is therefore a convenient value to adopt as a specification figure. Where, however, solder is not used, and where the material employed does not oxidise very rapidly at a red heat when exposed to the atmosphere, it is easily seen that this figure may be exceeded with safety.

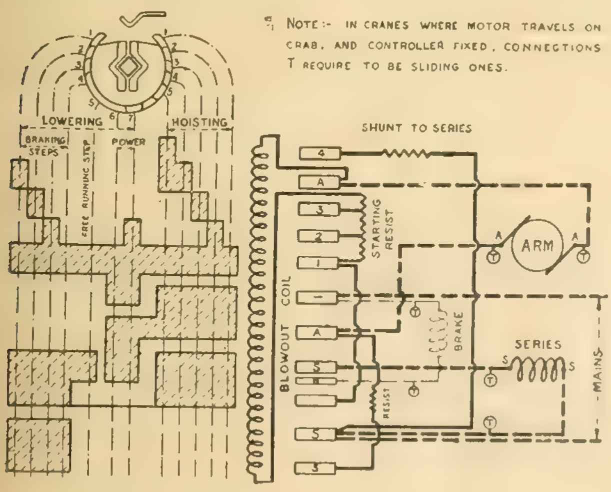

Fig. 11.

In addition to the necessity for good ventilation, it is also obvious that the resistance must stand up to continuous working from the point of view of mechanical strength and electrical insulation, having in mind that in crane work it is very often the case that the operator knows very little about the electrical plant under his charge, and therefore it is not treated with the best consideration, and, moreover, cranes and their gear are often installed in very undesirable situations with regard to climatic conditions. It must also be capable on occasion of taking a good overload. The usual resistance which is used in connection with such work is a cast-iron grid, but this has the defect that cast-iron is brittle and is liable to snap under the vibration which often accompanies crane work. The metal is, of course, cheap, and it can be made with a considerable amount of heat absorptive capacity, especially when the resistances can be fairly well spaced. Where, however, the resistances have to be placed one above the other in banks or tiers, the heat rising from the lowest bank will interfere with the capacity of those above it, especially if stress is laid in the design on dispersion capacity. Grids have also been made of stamped steel, and these are mechanically stronger than cast iron, but the strips require considerable support to avoid sagging when they are hot, and steel is notoriously liable to rust in damp atmospheres.

The resistance shown in the illustration consists of spirals of a suitable conductor wound upon cylindrical supports. These supports are made of metal tube covered with micanite insulation, over which a layer of soft asbestos is placed in order to keep the spirals in position. The metal tubes are mechanically fitted to the case, and are thus earthed, and it is found that the micanite acts as a thoroughly good and permanent insulator under these circumstances. Originally the tubes were mounted on porcelain insulators, but it was found that this precaution was unnecessary. The arrangement now adopted provides for thorough mechanical fixing, and at the same time for longitudinal expansion of the tubes under heat. Any tube can be removed without disturbing the others, and any connection can be made without interfering with the rest of the arrangement. No solder is used, and as the tubes promote a species of chimney draught, thorough cooling of the resistances is obtained, and it is evident that there are no concealed or hidden accumulations of heat. These tube resistances which have been developed under the most stringent conditions of practice are fixed either with the tubes vertical or with the unit made flat with the tubes horizontal, and when in the latter position it is found preferable to place the tubes so that their axes lie parallel with the direction of movement for travelling cranes and similar positions, so as to give a better draught through the tubes. Total enclosure reduces the rating of the resistance by about one-third, and if they have to be banked in tiers as much space as possible must be given between the banks in order to keep the heat dispersion factor as high as possible.

In concluding the above brief survey of modern methods of electrical crane control, it must be emphasised that no attempt has been made to cover the whole of the field of British practice, as this would be an almost impossible task, in view of the enormous amount of attention which has been paid in recent years to this important branch of electrical engineering. Enough has, however, been said to show that the work has been fully specialised, and that some important developments have taken place in recent times.

THE PROMOTION OF THE ELECTRICAL TRADE.

(*Concluded from page* 844, *Vol.* 75.)

Mr. H. M. Sayers, speaking from a number of years' experience in Portugal, Spain and Brazil, furnished some useful information concerning work in the last-mentioned country, where he was engaged as engineer to a lighting and traction company. His company, he said, was not anxious to carry out installation work, but it had to do so to a certain extent. The greater part of the work was done by contractors representing German, North American and, to some degree, English manufacturers. The Americans and Germans were very successful in obtaining installation work and orders for some large and small machinery and accessories, the principal reason being that their agents are resident personal representatives. Brazilians like to see and converse with the men to whom they give orders; to feel that they are friends upon whom they can rely and who are able to speak the language correctly and fluently. In making this statement the speaker confirmed the views expressed recently in the columns of an engineering contemporary, and since confirmed by German advices from New York. No doubt had time permitted, Mr. Sayers would have been able to have informed the meeting that not only Brazilians, but also the Argentines and other races in South America attach great value to the social side of business, and never expect business to be discussed at the first interview. He would, moreover, perhaps have been able to say that whilst this question, which is exceedingly important from the point of view of South Americans, is scarcely taken into consideration by the North Americans in endeavouring to do business with the South, the Germans had made a special study of accommodating themselves to the wishes and customs of the Southerners in this direction. Passing on from this digression, we learn from the speaker that the Brazilians prefer English correspondence to bad Portuguese, as they can get the former translated, whereas they laugh at the latter. The market there which requires personal resident representatives is good, and south of Rio electricity is being supplied both in large and small towns in consequence of the abundant water power available. Most of the work in the large towns has been done by North Americans, and nearly all the supply is three-phase, the arrangements being according to American standards. The grant of extended credit as given by the Germans is not necessary. Certain American firms have done good business, and they are not in the habit of giving as long credit as the Germans, and to this may be added a New York statement, whether it be right or wrong, of the American practice being either cash or payment at the end of 30 days. It is, however, uncertain whether this solely applies to the North or whether it also includes transactions with the South. Mr. Sayers made a good point when he explained that Brazilian Portuguese is somewhat of a dialect, and that catalogues and other literary matter must be prepared in technical Brazilian-Portuguese. The catalogues should have a technical style to a much larger extent than in England and complete equipment, as, for instance, motor, switch-gear and starter, should be all placed together, so that intending purchasers may see what they have to pay without referring to three lists. Turning to the climatic conditions of the country, the speaker stated that a wide range of temperature exists, and the only difficulty he had found in British apparatus was in respect to transformers. It was impossible for him to procure small (pole line) British transformers which were satisfactory, and they had, therefore, to be obtained from the United States. Most of the transformers have to bear the blazing heat of the sun on the one hand and heavy rainfall on the other. In some cases, the speaker concluded, British material is too heavy, but the people require wiring and fittings to suit their conditions.

Mr. Hartland Swan, who is associated with one of the motor-car manufacturing companies, remarked that if electrical engineers found it necessary to charge a higher price than German rivals and lost the business, there must be some reason. If the margin required by the former was higher than that of the latter it should be cut down so as to secure the business. One reason why foreigners obtained business was that they laid themselves out to convince purchasers that their goods were better, and therefore they got the orders. If the British firms intended to make money they must produce goods at the right price and they must employ up-to-date methods, and the salesman must be able to convince and satisfy prospective customers that they have the best manufactures to offer them.

Mr. J. E. Kingsbury expressed the opinion that salesmanship was only one degree removed from statesmanship. It might be that electrical firms did not understand their business, but the trade had suffered from drawbacks in the eighties, to which Mr. Scholey had referred, although Germany and the United States had been free from such disadvantages. As to the special conditions which it was sought to have brought about, the speaker could see no real possibility of suggesting anything. English business men were as good as any, and the speaker had known many. It was possible that English financiers had got into a groove. In France and Germany there was a financial link, and it was possible that that was a link which they ought to interpose with advantage. The electrical business was not in a bad way, and individual enterprise might be as effective in that as in other branches. The speaker doubted whether there was a better example of faith or enterprise than the work of the English submarine cable pioneers, and all they needed now was the same faith in individual enterprise, leaving alone adventitious aids, and there would be no occasion for pessimism as to the future.

Mr. F. R. Jones detected in the observations of the last speaker the sentiment that what had been done in the past could be done again. The conditions, however, had changed. Germany had been erected during the past forty years. The difference was that to-day they had Germany on one side and the United States on the other—progressive nations, highly trained, and real competitors in the business-field. If that competition was to be coped with it must be met by something real, practical and tangible. If they had the basis to sell there was nothing to prevent their goods from gaining the respect to which they were entitled. If they were real salesmen they would only get the price equal to that which their competitors received for inferior goods, but they should satisfy customers that when they paid 25 per cent. more they secured a better service.

Mr. E. J. Fox stated that so far as his knowledge of machinery was concerned the picture painted by Mr. Scholey was none too gloomy. The firm where he was employed found occupation for 15,000 workmen. The engineering trade sold through travellers and tradesmen. One of the principal points they had appreciated was that different types of salesmen were required for the different classes of material to be sold. The electrical industry was to a large extent outside of ordinary considerations of price. In the past manufacturers had had to compete with conditions in Germany which were entirely artificial. If a nation like Germany was able to and did grant heavy subsidies on the export of machinery, it stood to reason that that system was benefiting exports. Mr. Fox, who referred further to subsidies, is obviously mistaken. There are not Government subsidies on exports of machinery. The only Government subsidies, if they can be so called, have been very low railway rates for the transport of export manufactures in general to the coast, and very low combined rail and shipping rates to the Levant coast, and perhaps to certain other countries. The speaker evidently had in mind private export bounties granted by trade syndicates on coal and coke, pig-iron, semi-finished steel and joists used in the production of complete manufactures for the export markets. Leaving this particular point, Mr. Fox proceeded to remark that Germany was primarily a fighting nation and needed a large army. It was cheaper for her to maintain a large army employed in industries, and the country subsidised those industries in return for maintaining a large reserve army to be called upon when required. The German industrial banks had a great deal to do with the export trade, and, indirectly, they had been responsible, in the speaker's opinion, for bringing together various small firms and resolving the industry into two or three large groups. But surely the facts are otherwise. Is it not more correct to say that the large firms have destroyed the competition of the smaller firms, except the special works; that this policy of economic extermination has not yet been brought to a close; and that the special works have been complaining for the past few years of the continued monopolistic tendencies of the large groups? As small firms cannot compete economically with large makers, Mr. Fox asked why the 30 firms should not combine into two or three groups. It was, however, extremely difficult, and the vested interests were so divergent that it was almost impossible to bring them together. The speaker said they themselves were to blame to some extent, and would continue blameworthy if they did not realise that they must co-operate, and he entered a protest against German-owned companies being allowed to trade under the title of English companies.

Mr. McAlpin, who entertained the meeting with two or three events from his Colonial experience, said that he proceeded to one of the eastern colonies a few years ago to report on the development of lighting and power. Although nothing had been said of his intended visit, he had scarcely been in the colony a week before the managing director of one of the largest German companies came on the scene. Having arrived, he set to work and laid the foundation for the capture of business; he obtained it, and the bulk of the work went to Germany. Just before the speaker's arrival in the colony a concession had been granted for the construction of railways throughout the State. No British firms sent out a representative, but two German manufacturers did so, and they secured the whole of the trade. In a second colony, the local authorities were induced to get quotations for machinery from England, and they eventually placed their order, which was for oil transformers, with a shipping house. The latter divided the order, local quotations being obtained for lubricating oil. In due course the transformers arrived and were put together, being nearly ruined, but were eventually found to be of insufficient margin to stand the blazing sun. The remainder of the orders of that description went to Germany. The third instance related to another Colony where arc lamps were required for railway lighting purposes. It was found that, owing to crippling the position of the lamps in the lanterns, the light only spread over a space of about 16 ft. diameter. That would be a small matter in England, but it was simply fatal 7,000 miles from the base of supplies. Mr. Scholey had said they could not compete with the Germans in motors, but the speaker did not know the reason. Nevertheless, he had a case in point where a firm who made electrical cranes used to purchase the motors from an English firm, but the prices increased instead of decreasing. The crane makers then established a new branch and made their own motors, finding out at the end of twelve months that the cost was one-half of what they had been accustomed to pay as buyers.

Mr. T. C. Elder remarked that the electrical firms were always selling to expert buyers—or to those who believed they were expert buyers. In many cases the purchaser drew up the specification and told the maker not only what he wanted, but also how it was to be made. When sales manager for a leading company several years ago, they had a first introduction to American methods. The case was that of tenders for the plant for a London borough council, to which his company had delivered similar plant three years previously. The price quoted in a contract for about a total of £3,000 was £5 higher than the lowest tender. The borough electrical engineer said he would be delighted to have the machines, but that it would be useless to put before the council anything other than the lowest tender. The speaker went to see the chairman of the committee, whom he found in a public-house. The case was put before him, but the chairman said that they could do nothing but accept the lowest tender. If they did otherwise, the chairman declared, he would be accused of having been corrupted. Mr. Elder, whose office had been invaded by the advocates of American methods, who told him they could sell goods for him, put this borough council case before one of these experts. The latter did not know what remedy to suggest, but eventually said, "I think you might work the Press." The difficulty, however, the speaker stated, was that if the Press was worked in regard to one municipality, the firm would be black-listed throughout the country. His company did not receive the order. Turning to another question, the speaker observed that no attempt had been made in this country to arouse public enthusiasm in the spread of electricity. In the United States, however, the sum of £200,000 was subscribed some time ago by makers to "enthuse" the public, but British industry did nothing of the kind. The Institution of Electrical Engineers took no cognisance of business, and repeatedly refused to do so. The great difficulty arose from financial weakness, but they had not the money, and the speaker did not see how they would get it without some form of Protection. The electrical industry was one of the best in Germany. When travellers left that country they had the financial power of German banks and the diplomatic support of the Government, but British travellers had nothing of the sort, and the result was foreseen.

The meeting concluded with a few observations made by the introducer of the subject discussed.

It may be well to explain that the German banks which finance electrical enterprise nominate their own representatives on the boards of directors of manufacturing and other companies which they finance, and that the great financial strength which they possess confers upon the banks concerned much greater powers than are represented by the two or three directorships which they hold in each instance. In those cases where the banks take over a large block of shares or bonds (loans) there is, naturally, no intention of retaining them any longer than is necessary. If no market exists on the Berlin Bourse one is soon created after the Bourse Committee has sanctioned the introduction, and the Bourse representatives of the banks as a general rule soon dispose of the paper, leaving the banks in possession of their commissions and profits on the transactions. These observations apply both to single operations and to those of an underwriting character, so that any electrical company which is backed by a good institution has no difficulty in the flotation of fresh capital.

Patents and Alien Enemies.—Application for the avoidance or suspension of Letters Patent No. 5,198/08, granted to Miele, for metallic coating on metal articles, has been lodged by Messrs. W. T. Henley's Telegraph Works Co., Ltd., and the date of hearing has been fixed for January 14th, 1915.

TRADE STATISTICS OF AUSTRALIA.

The following figures, showing the imports of electrical and allied goods into Australia during the year 1913, are taken from the recently-issued official trade statistics; the figures for 1912 have been given for purposes of comparison and notes of increases or decreases have been added. Attention has before been called to the footing which the United States has gained in the trade. Although amongst the figures now under review there are some noticeable declines in the United States' share, these are not important when considered in relation to the general decline.

	1912. £	1913. £		Inc. or dec. £
Gas and oil engines.—				
From United Kingdom ...	127,000	148,000	+	21,000
,, United States	37,000	38,000	+	1,000
,, Germany	3,000	2,000	—	1,000
,, Other countries	8,000	4,000	—	4,000
Total	175,000	192,000	+	17,000
Portable and traction engines.—				
From United Kingdom	121,000	87,000	—	34,000
,, United States	50,000	56,000	+	6,000
,, Other countries	—	2,000	+	2,000
Total	171,000	145,000	—	26,000
Dynamo electric machines up to 200 h.p., static transformers, coils, etc.—				
From United Kingdon	186,000	168,000	—	18,000
,, Germany ...	50,000	48,000	—	2,000
,, Italy	10,000	5,000	—	5,000
,, Sweden	4,000	9,000	+	5,000
,, United States	113,000	154,000	+	41,000
,, Other countries	8,000	9,000	+	1,000
Total	371,000	393,000	+	22,000
Dynamo electric machines over 200 h.p. and parts.—				
From United Kingdom ...	30,000	56,000	+	26,000
,, Germany	2,000	3,000	+	1,000
,, United States	18,000	10,000	—	8,000
Total ...	50,000	69,000	+	19,000
Regulating, starting and controlling apparatus.—				
From United Kingdom ...	26,000	26,000		—
,, Germany	8,000	7,000	—	1,000
,, United States	50,000	39,000	—	11,000
,, Other countries	1,000	1,000		—
Total ...	85,000	73,000	—	12,000
Coal-cutting machines.—				
From United Kingdom	2,000	1,000	—	1,000
,, United States	13,000	19,000	+	6,000
,, Other countries	1,000	1,000*		—
Total ...	16,000	21,000	+	5,000
* From Germany				
Earth and rock cutting, excavating, etc., machines.—				
From United Kingdom ...	35,000	31,000	—	4,000
,, Germany ...	6,000	7,000	+	1,000
,, United States ...	8,000	18,000	+	10,000
,, Other countries	1,000	2,000	+	1,000
Total ...	50,000	58,000	+	8,000
Rotary and percussive rock drills.—				
From United Kingdom	5,000	3,000	—	2,000
,, United States	23,000	28,000	+	5,000
,, Other countries ...	2,000	1,000	—	1,000
Total ...	30,000	32,000	+	2,000
Machine tools.—				
From United Kingdom	81,000	78,000	—	3,000
,, Germany ...	17,000	11,000	—	6,000
,, United States	55,000	55,000		—
,, Other countries	5,000	4,000	—	1,000
Total	158,000	148,000	—	10,000
Steam turbines, [illegible] [illegible]cators, etc.—				
From United Kingdom	61,000	92,000	+	31,000
,, Germany	4,000	11,000	+	7,000
,, United States	5,000	5,000		—
Total ...	70,000	108,000	+	38,000
Electroliers, gasoliers, etc.—				
From United Kingdom	37,000	36,000	—	1,000
,, Germany ...	2,000	3,000	+	1,000
,, United States	2,000	2,000		—
,, Other countries	—	1,000	+	1,000
Total	41,000	42,000	+	1,000

Motor power machinery not elsewhere included.—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	260,000	263,000	+	3,000
,, France	10,000	5,000	—	5,000
,, Germany	22,000	20,000	—	2,000
,, Sweden ...	6,000	—	—	6,000
,, Switzerland	13,000	5,000	—	8,000
,, United States ...	103,000	80,000	—	23,000
,, Other countries ..	6,000	4,000	—	2,000
Total	420,000	377,000	—	43,000

High-speed reciprocating steam engines for coupling or coupled to electric generators or pumps.—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	21,000	26,000	+	5,000

Electric fittings, switches, fuses and lightning arresters.—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	45,000	51,000	+	6,000
,, Germany	10,000	11,000	+	1,000
,, United States ...	19,000	16,000	—	3,000
,, Other countries ...	4,000	3,000	—	1,000
Total	78,000	81,000	+	3,000

Electrical and gas appliances not included elsewhere.—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	130,000	90,000	—	40,000
,, Denmark	8,000	10,000	+	2,000
,, Germany	47,000	55,000	+	8,000
,, Holland	8,000	10,000	+	2,000
,, United States ...	45,000	36,000	—	9,000
,, Other countries ...	8,000	10,000	+	2,000
Total	246,000	211,000	—	35,000

Lamps and lampware, and incandescent mantles.—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	84,000	57,000	—	27,000
,, Germany	49,000	41,000	—	8,000
,, United States ...	53,000	47,000	—	6,000
,, Other countries ...	13,000	9,000	—	4,000
Total	199,000	154,000	—	45,000

Rails, fishplates, etc.—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	845,000	1,045,000	+	200,000
,, Belgium	125,000	12,000	—	113,000
,, Germany	90,000	57,000	—	33,000
,, United States ...	215,000	168,000	—	47,000
,, Other countries ...	25,000	—	—	25,000
Total	1,300,000	1,282,000	—	18,000

Telephone switchboards and appliances.—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	58,000	47,000	—	11,000
,, Belgium	19,000	25,000	+	6,000
,, Germany	6,000	7,000	+	1,000
,, Holland	3,000	—	—	3,000
,, Sweden	44,000	46,000	+	2,000
,, United States ...	30,000	47,000	+	17,000
,, Other countries ...	5,000	2,000	—	3,000
Total	165,000	174,000	+	9,000

Wire, iron and steel.—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	113,000	89,000	—	24,000
,, Germany	299,000	327,000	+	28,000
,, United States ...	304,000	219,000	—	85,000
,, Other countries ...	8,000	5,000	—	3,000
Total	724,000	640,000	—	84,000

Accumulators, carbons, measuring and recording instruments, arc lamps, etc.—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	587,000	109,000	—	478,000
,, Germany	59,000	43,000	—	16,000
,, United States ...	14,000	11,000	—	3,000
,, Italy	9,000	—	—	9,000
,, Other countries ...	8,000	4,000	—	4,000
Total	*677,000	167,000	—	510,000

* Included Cable and Wire (covered) in 1912.

Wire (copper).—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	—	175,000		—
,, Belgium	—	7,000		—
,, Germany	—	19,000		—
,, United States ...	—	11,000		—
Other countries ...	—	1,000		—
Total	*	213,000		—

* Not shown separately in 1912.

Electric heating and cooking appliances.—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	3,000	6,000	+	3,000
,, United States ...	1,000	3,000	+	2,000
,, Other countries ...	1,000	1,000		—
Total	5,000	10,000	+	5,000

Cable and wire (covered).—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	—	554,000		—
,, Germany	—	56,000		—
,, Italy	—	2,000		—
,, United States ..	—	20,000		—
,, Other countries ...	—	5,000		—
Total	*	637,000		—

* Included with Accumulators, etc., in 1912.

Arc lamp carbons.—

	1912. £	1913. £		Inc. or dec. £
From United Kingdom ...	1,000	—	—	1,000
,, Germany	18,000	17,000	—	1,000
,, Other countries ...	1,000	1,000		—
Total	20,000	18,000	—	2,000

ELECTRIC BELL SIGNALLING IN COLLIERIES.

By THOS. G. WATTS, B.Sc.

(*Abstract of paper published in the* Proceedings *of the* South Wales Institute of Engineers, *Nov. 24th*, 1914.)

Mr. R. V. Wheeler, Chief Chemist to the Explosions-in-Mines Committee, in a series of experiments on the ignition of methane and air mixtures by electric bells, has proved that the inductance of the circuit is of prime importance in determining whether the flash produced on breaking the circuit can ignite an explosive mixture, and that the amperage of the current is of more importance than the voltage.*

Dr. Wheeler made the general conclusion that: "If the current flowing round the signalling circuit could be reduced below 0.30 amperes by introducing suitable non-inductive resistances, there would be little risk of ignition by break flashes below 25 volts pressure. The use of Leclanché cells, therefore, owing to their high internal resistance, should afford greater comparative safety than the use of dry batteries."

With a view, not so much of determining the scientific features of electric spark ignition of explosive gaseous mixtures, as to find some safe system of bell signalling for underground use, experiments were commenced at the laboratory at the Great Western Colliery Co.'s Maritime Coke Works.

The investigations were directed to determining two points, viz.:—(1) The ignition of mixtures by the spark at the contact breaker of the bell. (2) The ignition by the spark at the circuit-closing contact, which may be at any point on the line.

A set of experiments were made by which it was determined that the most explosive mixture of the coke-oven gas used was 15.7 per cent. gas and 84.3 per cent. air. The gas was analysed and found to contain hydrogen, 45.50 per cent.; methane, 29.50 per cent.; nitrogen, 20.01 per cent.

Attention should be given to the large hydrogen and methane contents. All the further experiments were performed in a mixture of this quality.

Using similar methods with methane, experiments were made to determine the relative ease of ignition of explosive mixtures of oven gas and methane by the spark at the contact breaker of an ordinary unprotected colliery bell. It was found that as far as ignition by spark is concerned, coke-oven gas and air mixtures in explosive proportion are more easily ignited than methane and air mixtures; and, as a rider from this statement, that any system which proves to be safe in coke-oven gas and air mixtures is absolutely safe in methane-air mixtures.

Experiments were also made to determine the relative ease of ignition of explosive mixtures of oven gas and methane by sparks at a point of closing the circuit on the line; colliery bell outside chamber, "knocking wires" inside, contact made by rubbing wire with right angle bend against fixed wire. These experiments point to the fact that there is a real danger in electric bell signalling underground if gas is present to an explosive extent at the point of making and breaking circuit, and that systems of signalling with unprotected bells and the ordinary method of circuit closing with a knife or other tool across galvanised wires are distinctly unsafe in parts of a mine where gas is liable to occur.

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* These experiments were fully reported in the Electrical Review of July 31st, 1914, p. 191.

Attempts were then made to find some system which was safe in oven gas and air mixtures, this being a criterion of absolute safety in methane-air mixtures.

The first attention was directed to the bell. If by any means gaseous mixtures could be excluded from the contact-breaker of the bell by means of an absolutely flame-tight cover, perfect safety in this direction should be attained. A bell of this type has been made by the General Electric Company. The electromagnets, contact breaker, and hammer spring are enclosed in a cast-iron case fitted with a cover, which is screwed up to an india-rubber joint between face and face. The motion of the contact breaker is conveyed to the external hammer by means of an attachment passing through a case filled with vaseline, so that the only point where internal motion is conveyed to the exterior (which debars a tight joint) is through a clot of vaseline which is impervious to the passage of air or gaseous mixtures. Whether or not this vaseline clot, in the high temperatures sometimes found underground, would run out and so leave open a passage for gaseous mixtures to enter, remains to be investigated, and further experiments with this type of bell are still to be carried out. Between ten and twenty experiments, consisting of ringing this bell with from ten to fourteen Leclanché cells, failed to produce the explosion of a 15.7 per cent. gas (oven gas) and air mixture. The order of things was then reversed. "Knocking wires" of the type mentioned before were introduced into the circuit with the aforementioned bell and with four cells, and an immediate explosion occurred. With three other similar bells ignition was brought about at the "knocking wires" with two cells and three cells respectively.

Adopting the principle of the Ruhmkorff coil condenser—that is to say, connecting through a condenser the circuit containing the "make and break" of the bell used in the first series of experiments, which ignited the mixture of oven gas and air when rung by four Leclanché cells—it was found that absolutely no ignition was brought about, even when the bell was rung with twelve Leclanché cells.

We have, therefore, in response to the first query "What bell is safe in explosive mixtures?" two remedies. One is, as stated above, a flame-tight bell; the second an ordinary bell fitted with a condensing system across the spark-gap. As to which is the better system, several points arise in distinct favour of the condenser-fitted bell.

1. No alteration in temperature has the remotest effect on the sparkless condition brought about by the condenser.
2. The reduction of the spark to zero means a longer life to the platinum contacts.
3. Any bell at present in use can be converted into a safe bell by the mere introduction of a condenser into the spark-gap circuit, thus avoiding any outlay except in condensers.
4. No amount of "tampering" would alter the effectiveness of a condenser-fitted bell, whereas the removal of the outer casing of a gas-tight bell immediately destroys its effectiveness as a protected bell.

Attention was then paid to the lines of "knocking wires." Three bells—one of the old type, two others of the closed gas-tight type—were respectively connected up through a variable battery of one to ten cells outside the chamber, and the circuit-closing contact fitted inside the chamber. Galvanised wire was fixed through one side of the chamber and rigid, the other a piece of No. 8 S.W.G. galvanised wire passing through the same side and bent at right angles inside the chamber, so that by a half-turn it could make contact with the fixed and rigid wire. The cells were put in circuit one after another, and explosions took place even with only two cells in circuit.

The colliery bell (ordinary type) was then used with a condenser in the contact breaker as previously described, the only alteration in result being that five cells were necessary to produce an explosion at the knocking wires. Working on the theory that as a condenser connected across the spark-gap of the bell produces a safe-bell, the same effect should be produced by placing a condenser across the "knocking wires," the experiment was tried. Although with the same bell, ignition had occurred with two cells, no ignition, though repeated time after time, could be brought about by the two galvanised wires making contact with a condenser across them and ten Leclanché cells in the circuit. Apparently, therefore, the introduction of a condenser across the knocking wires had some peculiar physical influence on the spark; and one can only conclude it to be a matter of temperature.

Before this could be accepted as a safe arrangement, however, conditions had to be brought more into line with colliery conditions, and so the method of making contact was altered from the rubbing of two galvanised wires for making contact to that of a file making contact on galvanised wire. The variable battery was worked from one cell to two cells. Immediately on the introduction of the third cell an explosion occurred. The condensing system was increased from one microfarad by gradual increments to ten microfarads, but on each contact an explosion occurred on three or four cells being introduced into the circuit and the file being used for contact. The file was then removed and the contact made again with the galvanised wires, and no explosion occurred with even ten cells in the circuit. As a system of prevention, the condenser across the knocking wires is by these results proved to be useless.

The only other outlet occurring to the mind of the experimenters was the introduction of relays. This system depends upon the completion of the bell circuit by the action of a relay worked by a separate circuit. If, therefore, one can operate a relay by means of so small a current as to render the sparking at contact so mild that it will not ignite the gas-air mixture and also can reduce the sparking of the relay contact which closes the bell circuit to an inoperative condition as regards explosve mixture ignition, then, by the use of this system in conjunction with a bell fitted with a condenser, we have a safe system. The spark made by the relay in making contact for the bell circuit is entirely removed by putting a condenser across the two points of stud contact.

A system such as above suggested was then connected up. Each part was tried in turn. The bell, fitted with a condenser, was put in series with a variable battery and 10-ohm relay contact. The 10-ohm relay was for the time being operated by two cells and an ordinary bell push.

From one to ten cells were put into the bell circuit in turn and the bell rung by the relay. No explosion occurred, and the bell was therefore considered safe.

The relay itself was then placed in the chamber, and actuated by an external push to ring the bell (also external) with from one to ten cells in the bell circuit in turn.

Though a distinct spark was visible at the platinum contact of the relay, no explosion occurred. A condenser was then put across the spark gap of the relay; the spark disappeared and no explosion occurred. Finally, the two "knocking wires" were arranged as before in the chamber (no file) so as to complete the relay circuit containing a variable battery of one to ten cells and the relay. In the bell circuit, which was external to the chamber, were the bell, relay contact, and five-cell battery.

It was evident that with a relay the same danger of ignition arose as with the bell, for with three cells in the relay circuit ignition occurred.

A saving clause arises, however, in that the 10-ohm relay could be operated from anywhere in a pit of normal size by two cells only.

A relay was then obtained with ten times the resistance—namely, a standard gas-tight G.E.C. 100-ohm relay—and the above experiments repeated. No explosion took place until six cells were used.

The additional resistence, therefore, becomes a saving factor. No 100-ohm relay requires more than two cells to operate it, as, averaging 13 ohms resistance to the mile of wire, the relay was founid to be operative with two cells even when 100 ohms were placed as resistance in the relay circuit. We have thus a satisfactory and operative method for seven miles of wire.

The relay is safe in a coke-oven gas-air mixture up to five cells, so that, allowing for all extraneous resistance, we have an absolutely safe margin for working even with four cells, as an oven gas-air mixture was only fired by six cells in the circuit, and a methane-air mixture would not be fired when the relay was operated by six cells.

The whole system, with the relay circuit containing four cells and closed by a file contact on the "knocking wires," the bell (condenser fitted), and five cells in the bell-circuit, and the relay itself were placed in the chamber in a 15.7 per cent. oven-gas and air mixture. Although hundreds of contacts were made, no explosion occurred.

As there is no necessity to use more than three cells, there is a margin of three cells on the side of safety. To increase this margin, the investigation was taken a little further, using the suggestion that was made to the experimenters of introducing a method of limiting the inductance of the coils of the relay by introducing a shunt across the relay circuit. A resistance box, containing resistances of 3,000, 2,000, 1,000 ohms, was placed as a shunt across the relay circuit. On making contact with 2,000 ohms in the shunt there was an immediate diminution in the size and appearance of the spark at the contact of the "knocking wires" when using from one to ten cells to operate it.

With a shunt across the relay terminals, the relay is safe with ten cells in circuit in an oven-gas mixture, and, therefore, with a much wider margin in methane-air mixtures. With the shunt of 2,000 ohms and ten cells in circuit, hundreds of contacts were made and no explosion resulted.

The system described is safe even in oven-gas and air mixtures, and we can therefore recommend its use as an entirely safe system in the most gassy pits that can be selected

The author tenders his thanks to the colliery electrician for the use of apparatus and for the suggestion of using a relay

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Colonial Trade.—The Imperial Advisory Council of the Institute of Industry and Commerce has been considering the best means of approaching the various Dominion Governments with a view to abolishing the payment of licence taxes payable by British commercial travellers in the Dominions and Colonies, and also for the purpose of considering the best means of bringing about the standardisation of Company Law throughout Great Britain, the Dominions and Colonies in order to facilitate commerce within the Empire. The Council decided that a memorandum should be drawn up by the Institute after consulting with the leading specialised trade organisations, and that this memorandum be submitted to the Agents General of the Dominions and Colonies for submission to their respective Governments.

OUR LEGAL QUERY COLUMN.

"Anxious" writes :—"I should be glad if you could enlighten me, through the medium of your 'Legal Query' Column, on the following point. The company with which I am connected gives a supply of electricity under provisional orders. A prospective consumer made application to the company upon the usual form for a supply of electricity, and the service cables were laid in due course. A few weeks after, the owner of the property of which the consumer is a tenant gives the supply authority notice that, as his consent has not been obtained, the company must remove its supply cables from his premises, otherwise he will bring an action against the company for trespass. I shall be glad to know, therefore, what are the owner's powers in regard to this matter. I may add that I have been connected with supply undertakings, both municipal and otherwise, for the past 15 years, and this is the first case of the kind that I have come across, and I do not think it is usual for the supply authority to obtain the consent of the owner direct before proceeding to lay cables to a consumer who may not be the owner of the property for which he makes application."

*** The question raised is one which, curiously enough, is not discussed in books on the law relating to electric lighting, and it must be answered by reference to general principles. The action of trespass lies at the suit of the man in possession ; hence the proper plaintiff is the person in actual or constructive possession at the time of the trespass. The owner cannot, therefore, sue the company for trespass in the present case. That, however, does not conclude the matter, for it has been laid down that where the trespass is not merely of a temporary nature, but is injurious to the reversion, the owner or reversioner, although he cannot sue in trespass, may sue for the injury done to his interest. It has been held, for instance, that a reversioner may sue for structural injury to a house, cutting down trees, and placing the foundation of a wall in the plaintiff's land. It has not been decided whether the laying of mains amounts to such an injury that the reversioner may sue for it ; but while "a reversioner cannot sue for a trifling trespass which produces no substantial injury," it is apprehended that the laying of mains would not be regarded as trifling. "Anxious," however, may take comfort in this, that if he is sued by the owner he will probably have a right over against the tenant at whose instance he laid the mains. He should consult a solicitor.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

COMMONWEALTH OF AUSTRALIA.—The Board of Trade have received particulars of the import duties leviable on certain goods under the new Customs Tariff which came into force in the Commonwealth of Australia on December 3rd. Below are given the new rates on electrical goods, both under the general tariff and also under the preferential tariff accorded to manufactures of the United Kingdom. These rates having been received by cable, are subject to confirmation by mail. For purposes of comparison the old rates levied on manufactures of the United Kingdom are shown :—

	Old rates on manufactures of the U.K.	New rates. General.	New rates. On manufactures of the U.K.
Accumulators or storage batteries ...	Free	10 %	Free
Arc lamps	Free	10 %	Free
Cable and wire (covered)	Free	10 %	Free
Carbon in blocks of 12 sq. in. and over	Free	10 %	Free
Dynamos up to 200 H.P.	20 %	30 %	25 %
Dynamos over 200 H.P.	12½ %	30 %	25 %
Fans, electric	20 %	30 %	25 %
Instruments, measuring and recording	Free	10 %	Free
Insulating tape (prepared)	Free	10 %	Free
Switchboards (except telephone), regulating, starting and controlling apparatus	20 %	30 %	20 %
Telephones, telephone switchboards and appliances	Free	10 %	Free
Transformers (static) and induction coils	20 %	30 %	25 %

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED)

[illegible] Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

[illegible] "[illegible]" C. R. Belling. December 14th.

24,004. "Tilting pole or standard for high-candle power electric lamp or other illuminants" J. Willis & W. P. Taylor. December 14th.

24,010. "Process for coating metal upon metal or other conductive flat surfaces, and apparatus therefor, specially applicable to sound-reproducing records and the like." T. R. Harris. December 14th.

24,018. "Apparatus for removing barbed-wire entanglements." S. O. Cowper-Coles. December 14th.

24,024. "Manufacture of hydrochloric acid and apparatus therefor." Soc. Italiana di Elettrochimica. December 14th. (Convention date, October 30th, 1914, Italy.) (Complete.)

24,025. "Application of hydrochloric acid in manufacturing processes." Soc. Italiana di Elettrochimica. December 14th. (Convention date, October 30th, 1914, Italy.) (Complete.)

24,039. "Maximum-current or overload circuit breakers." W. J. Mellersh-Jackson. December 14th. (Soc. Anon. Movo, Switzerland.) (Complete.)

24,046. "Manufacture of electrical and other heaters." J. A. Chell. December 14th. (Complete.)

24,049. "Electric steering rims." R. S. Smith. December 14th. (Complete.)

24,055. "Means of regulation for petrol-electric cars and for other purposes." W. A. Stevens. December 15th.

24,056. "Apparatus for detecting the presence of electric conductors." A. W. Sharman. December 15th.

24,074. "Trolley poles or bows for electrically-propelled vehicles." G. Meyer. December 15th. (Complete.)

24,078. "Construction of laminated slot-keys for dynamo-electric machines." C. B. Burdon. December 15th. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

24,088. "Flexible electric cables." W. T. Henley's Telegraph Works Co., Ltd., & W. F. Bishop. December 15th.

24,094. "Electric lamps." R. W. Birkett & J. S. Wolff. December 15th.

24,098. "Aerials for wireless signalling." Marconi's Wireless Telegraph Co., Ltd., & C. S. Franklin. December 15th.

24,108. "Controllers for electric motors." Pickerings, Ltd., & J. Fothergill. December 15th.

24,121. "Electric illumination systems, more particularly for automobile vehicles." L. Renault. December 15th. (Convention date, April 3rd, 1914, France.) (Complete.)

24,151. "Electric plug contacts." J. Schuill, A. C. Reyrolle, & A. Reyrolle & Co., Ltd. December 16th.

24,169. "Electrical instruments." British Thomson-Houston Co., Ltd. December 16th. (General Electric Co., United States.)

24,170. "Electric heat radiators." A. F. Berry. December 16th.

24,212. "Magneto driving and adjusting mechanism." D. K. Fairweather & W. Fairweather. December 17th.

24,227. "Number instrument for automatic and semi-automatic telephone systems." Siemens Bros. & Co., Ltd. December 17th. (Siemens & Halske Akt. Ges., Germany.) (Addition to 14,614/13.) (Complete.)

24,231. "Receiving-system for continuous electric waves." E. H. Armstrong. December 17th. (Convention date, December 18th, 1913.) (Complete.)

24,235. "Manufacture of rubber-covered electric conductors." W. Geipel. December 17th.

24,259. "Apparatus for controlling the current in electric circuits." A. F. Sykes & S. Ford. December 18th. (Complete.)

24,293. "Electric starters, more particularly for use on motor-cars and the like." A. H. Midgley & C. A. Vandervell. December 18th.

24,310. "Electric alarms." J. R. Quain. December 18th.

24,326. "Electric fuse clip." R. C. Hall. December 19th.

24,335. "Electric arc lamps." G. A. Hughes (trading as London Electric Firm). December 19th.

24,338. "Switch-gear for electric distributing systems." J. F. Watson & Callender's Cable & Construction Co., Ltd. December 19th.

24,342. "Electro-mechanical thread-detector on the stretching-gear of spinning machines for the automatic interruption of the feeding of roving to the rollers in the case of the breakage of thread." H. Tschudy. December 19th. (Convention date, January 1st, 1914, Switzerland.) (Complete.)

24,343. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., & J. Savin. (Partly communicated by Automatic Electric Co., United States.)

24,350. "Electrical transmitting apparatus." H. K. Harris. December 19th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1913.

20,806. Apparatus for the Production and Radiation of Electrical Oscillations. F. Miller. September 15th.

23,247. Electrical Switches or Circuit Breakers. F. B. Holt & E. O. Moller. October 14th.

23,340. Means for Operating Gas Valves from a Distance. Marconi's Wireless Telegraph Co., & C. P. Ryan. October 15th.

25,780. Telephone Systems. Automatic Telephone Manufacturing Co., & A. B. Sperry. November 11th.

26,273. Supply of Current for Electro-medical and Therapeutical Purposes. J. P. Pullin. November 15th.

26,447. Cable-laying and Winding Apparatus. R. C. Freeman. November 18th.

27,734. Sleeve Insulators for High-tension Electrical Work. Akt. Ges. Brown, Boveri, et Cie. December 2nd. (December 9th, 1912.)

27,945. Method of Maintaining a Dynamo at a Constant Electro-motive Force. J. F. J. Bethenod. December 4th. (January 18th, 1913. Addition to 27,852/13.)

28,125. Apparatus for the Communication of Indications Electrically, on the Step-by-step System, from a Transmitting Station to a Receiving Station. A. Barr, W. Stroud, & J. W. French. December 6th.

28,159. Ringing Cut-off Relay Systems for Telephone Exchanges. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.) December 6th.

29,662. Electric Switches. British Thomson-Houston Co. (General Electric Co.) December 23rd.

29,782. Suspension for Mariner's Compasses. Kelvin, Bottomley, & Baird, Ltd., and M. B. Field. December 24th.

29,822. Electric Switches. G. Ellison & W. F. Jones. December 27th. (June 24th, 1914.)

29,984. Electrical Distribution Systems. British Thomson-Houston Co., J. Whitcher, & E. B. Wedmore. December 30th.

29,987. Production of Sodium and other Metals from Compounds thereof by Electrolysis. R. J. McNitt. December 30th. (January 2nd, 1913.)

1914.

570. Electric Induction Furnaces. J. Härden. January 8th.

1,169. Wireless Telegraph or Telephone Systems. W. H. Shephard & A. J. McKechnie. January 15th.

1,174. Combined Starters, Dynamos, and Ignition Timers for use with Internal-combustion Engines. G. R. Wadsworth. January 15th.

1,757. Electropathic Wearing-apparel. S. J. Ross & H. Schofield. January 22nd.

4,359. Starting of Synchronous Dynamo-electric Machines. British Thomson-Houston Co., & F. P. Whitaker. February 19th.

5,019. Electric Distribution Systems supplied by a Variable-speed Generator in conjunction with a Battery. British Thomson-Houston Co. (General Electric Co.). February 26th.

THE
ELECTRICAL REVIEW.

VOL. LXXVI. JANUARY 8, 1915. No. 1,937.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: January 8, 1915. [No. 1,937.

Page
Telegraphy and Telephony in 1914 33
Electrical Progress at Manchester 34
War Risk and Workmen's Compensation 35
Rubber 35
High-Voltage Dangers present in Static Transformers due to Electrostatic Capacity of the Windings, by J. L. Thompson (*illus.*) (*concluded*) 36
Automatic Protective Switchgear for Automatic Current Systems, by E. B. Wedmore (*illus.*) 37
Trade Statistics of New Zealand 41
Correspondence—
  Garage Heating 41
  From the Fleet 41
  German Agencies 42
  Advertising and Character 42
  A.C. *v.* D.C. for Lighting 43
War Items 43
Reviews 44
Business Notes 45
Notes 51
City Notes 54
Stocks and Shares 55
Market Quotations 56
Metal Market—Fluctuations in December 57
Trade of New Zealand 57
The Barton Power Scheme of the Manchester Corporation (*illus.*) 59
The Telephone Industry in Sweden and Elsewhere 62
New Electrical Devices, Fittings and Plant (*illus.*) 63
New Patents Applied For, 1914 64
Abstracts of Published Specifications 64
Contractors' Column ... ... Advertisement page xviii

THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 983; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

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WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

1915 EDITION
IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

TELEGRAPHY AND TELEPHONY IN 1914.

WHILE no startling discoveries or inventions in the field of electrical communication marked the past year, it was a period of steady progress and development. In January the International Conference on Safety of Life at Sea concluded its labours, and a Convention was signed, requiring the provision of wireless telegraph apparatus on all merchant ships that carried 50 or more persons on board; an Act was passed in August to give effect to this provision, which probably will be extended some day to all sea-going vessels.

The importance of wireless telegraphy in the service of the State was further recognised in the report in June of a Committee appointed towards the end of 1913, which recommended the establishment of a National Committee for Telegraphic Research, and of a special Research Laboratory under the control of the Committee, for the promotion of progress in telegraphy and telephony. Good progress was made with the first stations of the Imperial Wireless Chain, and the Marconi Co. completed ready for operation the powerful station at Carnarvon for trans-Atlantic communication, the corresponding station being erected in New Jersey, U.S.A. The State Service has not yet commenced work, but fortunately, as our Navy retained command of the seas, communication with all parts of the Empire has been maintained without interruption. What might have happened, however, in other circumstances was well exemplified by the destruction of the Pacific cable station at Fanning Island by a German cruiser in September, and the cutting of the cable to Jamaica on August 3rd, as well as the raid on the station at Cocos Island, which proved the undoing of the *Emden*; or by the interruption of the whole of the German deep-sea cables by our Navy.

A new four-wire telegraph cable was laid between this country and Germany, early in the year, and a four-core loaded telephone cable between Wales and Ireland—the longest cable of its kind in the world. A still longer one, however, is to be laid this year, between England and Holland—if circumstances permit of it.

The Post Office has made good progress in improving its methods with regard to both telegraphs and telephones; the Postmaster-General appointed a Special Committee to report on systems of high-speed telegraphy, and the Baudot system, which is being widely adopted in this country, was developed experimentally to sextuple-duplex between London and Birmingham, *i.e.*, six separate channels in each direction on a single circuit. Quadruple-duplex Baudot is being installed between London, Liverpool and Glasgow, and the use of phantom telegraph circuits, superimposed upon the trunk telephone lines, has been greatly extended. The standard of maintenance of the overhead lines has also been raised, reducing the number of interruptions, and the underground telegraph system is approaching completion.

In July a Committee was appointed to inquire into the working of the telegraph service, with a view to improving its economy and efficiency.

The telephone service has also shown material improvement during the past year, largely due, no doubt, to the very elaborate system of recording, classifying and analysing the faults that occur in connection with the various exchanges which has been developed by the engineering staff. This system has the advantage that the condition and progress of each district can be continuously watched, and the staffs of the various exchanges are put in competition with one another to produce the most creditable showing. The outbreak of war imposed upon the London telephone department extraordinary demands for emergency connections to Government offices, hospitals, &c., which were handled with a celerity beyond all praise.

The direct connection between the Liverpool and Manchester exchanges by junction lines proved so satisfactory, that the Post Office has decided to apply the principle in other cases where important towns are at no great distance from one another. Three automatic telephone exchanges are being equipped, and eight others are in prospect. The telegraph and telephone services are working hand in hand; in many cases it has been possible to extend them jointly to places where either service alone would have proved too costly, and the transmission of telegrams by telephone is increasing.

As regards municipal telephony, the Portsmouth Corporation agreed to sell its undertaking to the Government, whilst, on the other hand, the latter sold the plant of the National Telephone Co. in Hull to the City Council, which is now the only municipality controlling its own telephone service within the United Kingdom.

The introduction of an entirely new system of automatic telephony, employing only relays, was a notable event, which will bear fruit at no distant date; and the successful experiments with wireless telegraphy and telephony to trains in motion in the United States may prove the key to the prevention of railway accidents in the future.

In October the opening of the American Marconi Co.'s wireless service between San Francisco and Honolulu was announced.

Revised tariffs for week-end letter telegrams to the Dominions were introduced during the year, with the co-operation of the cable companies.

The outbreak of war in August, of course, affected the telegraph and telephone services severely; all channels of communication with enemy countries were at once closed, and the telephone services between this country and the Continent were cut off. All telegrams became subject to censorship, and the prohibition of the use of codes for communication with the Dominions bore very heavily upon our industries. The restriction was eventually relaxed, but the limitations still imposed upon the use of codes greatly increase the cost of cable messages.

The Postmaster-General forbade not only the use of all private wireless stations in this country, but even the possession of wireless apparatus of any kind, and numerous prosecutions followed. It is a curious circumstance, however, that the only means of direct communication with Germany that we retain in full working order is the wireless telegraph, and the German Government uses the great station at Nauen for the distribution of more or less true news regarding the war and other matters broadcast over the surface of land and water. There can be little doubt that, in addition to the German wireless stations that were captured or destroyed by our forces, the enemy's cruisers were well served by secret stations, and possibly by others on neutral territory, so long as they were able to keep the sea. Of the immense value of wireless telegraphy to the British Navy during the war there can be no question; and it is interesting to note that this is the first great naval war in which it has been possible to put it to the test.

The wreck of the cable ship *Buccaneer* in the Indian Ocean was a regrettable incident of the year, fortunately of a kind that we rarely have to record.

The value of wireless telegraphy in saving life was once more exemplified, in connection with the loss of the *Empress of Ireland*. Progress towards the solution of the problem of wireless telephony on a commercial basis was reported, but was apparently interrupted by the war.

Electrical Progress at Manchester.

To anyone who has watched it year by year, the development of electricity supply in its various phases provides a fascinating study. Though the actual generation of electricity may be attractive only to the engineer, its successful production and distribution on the grand scale of the future will involve widespread interests, of which one is apt to lose sight in a casual survey of the situation.

To say that the supply of electricity is nowadays rapidly becoming a governing factor in social economics in certain —particularly industrial—areas, is not overstating the case, although it is not commonly realised how very closely interlinked the coal pile at the electricity works and the welfare and happiness of the surrounding population in such areas are becoming, nor how manfully the electrical engineer of the past and central station manager of the present have struggled to render this state of things possible. Cramped ideas of electricity supply, begotten of village pump traditions, are gradually fading away with the realisation of the greater things in store in the future, of which the various large schemes in hand at the present time in Europe, America, South Africa, and Australia afford some indication.

Of such projects, that of the Manchester Corporation to build a 160,000-kw. generating station at Barton, just outside the city boundary, is the most ambitious at the moment in this country, and is interesting because it indicates a degree of confidence in the big generating unit, of which our central station engineers have, to some extent, fought shy in the past.

Through the courtesy of Mr. S. L. Pearce, chief engineer of the Manchester electricity department, we are able to publish elsewhere in this issue some particulars and drawings of the proposed Barton station, the outstanding features of which will be the arrangements for receiving and storing fuel, the use of semi-purified sewage for condensing purposes and the adoption of the largest size of turbine-driven machinery, while the proposed 33,000-volt underground transmission between the Barton station and the centre of the city is also a distinctive feature of the complete scheme. To those who have studied the problem, it is evident that while successive advances in the design of turbo-electric plant have removed many of the practical difficulties in the way of concentrating large electrical powers, the boiler house and its attendant coal pile have shown no corresponding progress. Even in the favoured position of the Barton plant, only some four miles from a coalfield, with which it will be connected by both canal and railway, the delivery, reception, storage, and utilisation of, say, half a million tons of coal a year at one station, is an engineering problem in itself, involving greater difficulty than the adequate supply of condensing water, and suggestive of a probable limiting factor in future large generating plants.

It will be noted that at Barton the silo system of coal storage is to be adopted, this being an unusual feature in generating station design in this country, where fuel is generally stacked in the open for storage. Each of the boiler units will be equipped with the Prat induced draught system, and the array of 48 bell-mouthed chimneys will constitute something of a record, even in the Manchester district.

The first section of the plant will comprise two 15,000-kw. turbine sets, and the plans of the complete plant include four such sets, together with four 25,000-kw. sets. Manchester already uses one 15,000-kw. turbine unit, and when the new station reaches the stage where larger plant is required, even the 25,000-kw. turbine will have had sufficient time to demonstrate its usefulness.

Electricity supply is ever expanding, and all past experience has shown the futility of nibbling at the supply problems which will require to be faced in the near future, for which reason Mr. Pearce's scheme is a welcome departure, and it is fully justified by the wider American experience, which, after all, will be our own in a few years' time.

American central station authorities have a confident way of anticipating the future—and we are not aware that their unbounded enthusiasm in matters electrical has met with any disappointments—while by comparison we usually adopt hand-to-mouth methods, having no proper relation to prospective business, no *primâ facie* engineering basis, and which can only be explained by the timidity of those who control municipal exchequers and have not only to safeguard rates, but also to answer for their deeds to the guardian angels of the Local Government Board.

We believe that not only is this policy based on a mistaken conception of things, but that the Barton scheme will provide a much needed object lesson to those electricity authorities, municipal and private, in this country who have failed to appreciate the future of electricity supply at its true worth.

War Risk and Workmen's Compensation. The question whether a workman who is killed directly, or indirectly, through the action of an alien enemy is the victim of an accident arising out of, and in the course of, his employment, has already arisen. It is a question of some interest, and it is important to those concerned with the supply of electricity, inasmuch as, according to common belief, generating stations are to be objects of attack from the Germans within our gates as soon as the Germans outside have effected a landing. A bomb falling through the roof of a station might give the man at the switchboard what Mark Twain would have described as "a considerable of a jolt in the back!" The facts in the only case hitherto decided are somewhat far removed from these; but the decision is, nevertheless, interesting on general grounds. It appears that a Grimsby trawler, which had taken due note of an Admiralty warning about floating mines, discovered some of these dangerous objects in the North Sea. Having put down a buoy to mark them, the skipper was making off to warn a warship, when his vessel collided with another mine and was blown up. The engineer, having been seriously injured, prosecuted a claim for an injury alleged to have arisen by accident arising out of, and in the course of, his employment. It was contended on behalf of the respondents—the owners of the trawler—that inasmuch as the skipper had gone out of his way to warn the warship, the accident did not arise in the course of the employment. The employers had judgment, the learned County Court Judge saying: "My decision is based upon the broad principle that an injury caused by the act of an alien enemy is not an accident arising out of, and in the course of, the employment of a workman."

With all respect to the learned Judge, we think he stated the principle rather too broadly. Indeed, the fact that the County Court decision has been reversed on appeal fully justifies this view. Suppose the trawler had been on her "lawful occasions," and had then been blown up by a mine, so far as the engineer was concerned he would have been the victim of an accident just as much as if he had suffered from a peril of the deep. Applying this principle, the victim of a bomb thrown from a hostile airship on to a generating station would clearly have suffered an accident "in the course of his employment." The further question is: Did it arise "out of" the employment? This appears to depend on whether there was special exposure. We know of two cases in which special exposure has enabled a workman to recover. In one of these (Challis *v.* L. & S.W. Rly. Co.) an engine driver was injured by a stone thrown by a boy from a bridge under which his train ran. It was shown to be a common practice for boys so to throw stones. The accident was held to have arisen out of the employment. In another case (Nisbet *v.* Rayne & Burn) a cashier carrying money in a railway for the payment of colliery wages was murdered. It was held that there was special exposure to risk of attack, and that the accident arose out of the employment. As it is the duty of an engineer to be at a post of danger, it seems to us that the station engineer injured at his post by a bomb from an airship, or a shell from an anti-airship gun, might well be able to make a claim for compensation.

Rubber. The old year having come to an end one can take a dispassionate glance back over the twelvemonth, which has been a period of exceptional anxiety for all. Production has inevitably suffered from the world upheaval promoted by the Huns, and the result is that whereas it had been thought that 1914 might and probably would see a large increase in the rubber output of the world, so far as has been revealed at present, output was about stationary. It is calculated by Messrs. Gow, Wilson & Stanton that the production during 1914 totalled 107,000 tons, which is approximately the same amount as in the previous year, but there has been a distinct falling off in the yield of wild rubber areas, and a considerable gain therefore in the output from the plantations. It is estimated that last year's total of plantation rubber was 65,000 tons, compared with no more than 46,000 tons in 1913, and the growing importance in a relative and also in an actual degree of the plantation crops is thus unmistakeable. There do not appear to have been any great or appreciable strides made in the development of synthetic rubber, from which so much has been feared at one time and another, but there will be continual research work and more or less costly experiments no doubt. Price is, however, against synthetic rubber. It needs extravagant rates to justify and encourage experimental work on a large scale, and these prices are not now to be had for genuine rubber let alone for imitations.

There is no reliable information to be had in respect to the real statistical position, which is a good deal overclouded, partly in consequence of the embargo on exports. Considerable quantities of rubber are stored in public warehouses in both London and Liverpool, but a portion of this is merely held there awaiting export permits, so that it would be unwise to treat the warehouse returns as representing the real position of the commodity. There is very little to talk about in connection with the trade demand. Naturally things have been very quiet over the holidays, while prices are much about as they have been of late, and stand not far off the lowest points of last year. During 1913 standard crepe at one time touched 3s., but sold down to 1s. 11½d., which was also the lowest figure in 1913, while prices are close upon this now. The poorness of the market lately has been caused entirely by the financial and commercial difficulties brought about by the war.

The news from the United States is not very cheering. Nevertheless there has been an improvement during the last few weeks, and the most has been made of the resumption of operations at the Hartford Rubber Co.'s plants at Hartford and Providence. Both of these had been idle for several months, partly because there had been a number of scares threatening the supply of crude material. Under those circumstances the management decided to close down the works, and use up the reserves of tires and other finished goods. The stocks in this direction have now been greatly reduced, and the resumption of work is the natural result of the improved position in this respect. The American tire plants have booked a number of large orders for solid tires for the armies of the Allied nations in Europe, and the tire plants of the United States are now rapidly getting to work at full capacity.

The latest details to hand show that the exports of plantation rubber from the Straits Settlements (not including the Federated Malay States) for the 11 months—January to November—of last year totalled 17,393 tons, against 10,672 tons in 1913, and 5,242 tons in 1912.

HIGH-VOLTAGE DANGERS PRESENT IN STATIC TRANSFORMERS DUE TO ELECTROSTATIC CAPACITY OF THE WINDINGS.

By J. LINDLEY THOMPSON, M.Sc., A.M.I.E.E., and S. AUSTEN STIGANT.

(*Concluded from page 26.*)

Now take the case of a transformer earthed at any high-pressure phase point and with core and low-pressure neutral earthed as shown at fig. 6*a*. With simply the above conditions, but the high-pressure windings completely unearthed, the potential diagram would be as shown at fig. 5*b*, but immediately any point of the high-pressure winding becomes earthed, that point drops to zero potential and a corresponding rise of potential takes place at the other terminals, as shown at fig. 6*b*. As will be seen then in this case with earthed high-pressure winding at A, the terminals B and C are (at a certain definite instant) at a potential of 10,300, or full line volts below earth with the neutral point at 6,000 volts below earth, where previously (at the same instant) the high-pressure terminals B and C were only at 6,000 volts (10,300/$\sqrt{3}$) below earth and the neutral point was at zero potential. It should be particularly noted here that no rise of potential can possibly occur on the low-pressure winding due to electrostatic conditions *when the low-pressure neutral is earthed.*

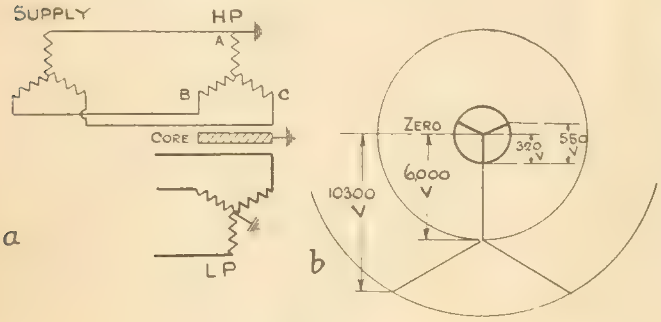


Fig. 6.

Taking now the cases before mentioned (*a*) and (*b*), fig. 7 shows diagrammatically a three-phase star/star transformer with earthed neutral supply and unearthed high and low-pressure transformer windings. The *average* potential of each high-pressure phase winding will equal line voltage ÷ 2 × $\sqrt{3}$, assuming even distribution of windings. Then since the capacities of high-pressure winding to low and low to core are equal, as the high-pressure supply neutral is earthed, the low-pressure winding being open-circuited will assume a static potential to earth equal to the high-pressure average phase voltage. This value, as with single-phase transformers, will be much in excess of its normal working pressure, and will present the same danger as in the cases previously cited, though, at the same time, probably being much lower than in the instance of uneven switching.

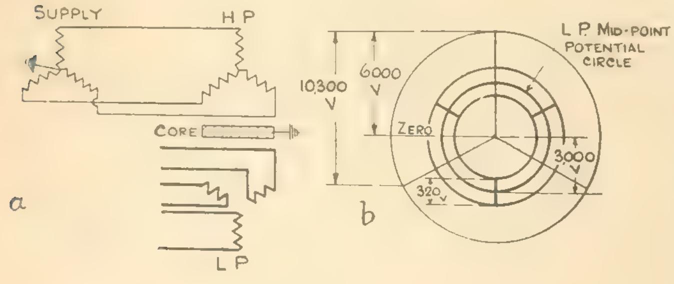


Fig. 7.

Turning now to the case of uneven switching, if one pole of the three-phase high-pressure supply be connected to the transformer winding, then the whole of the high-pressure winding assumes a potential above earth equal to the full line voltage. Supposing also, in this example, that the low-pressure windings are all disconnected from each other, as would be the case for instance in a transformer for supplying a six-phase rotary, then the low-pressure windings would assume a potential above earth equal to—

$$V = V_1 \times K_1/(K_1 + K_2),$$

where V_1 = full high-pressure line voltage. This potential would, in most cases, be of a very high value, and would most probably puncture the low-pressure insulation to core, assuming that the core is earthed. And as with single-phase transformers, although this puncture would not necessarily at the time produce disastrous results, the presence of this defect in the insulation would soon become apparent under normal working conditions, by presenting an earth at an unintended point, and thus bringing other parts of the low-pressure windings to definite voltages above earth, which voltages may be dangerous to human life. Fig. 8 *a* and *b* diagrammatically represent these conditions due to uneven switching.

Before passing on to other conditions of operation, it will be profitable to study a little further the danger to human life and apparatus, which will be present, due to a failure of insulation between high and low-pressure windings occasioned by electrostatic pressure as described in fig. 8. Suppose the high-pressure supply has its neutral earthed. Then upon completion of the switching operation, the fault above-mentioned having occurred, the low-pressure windings at this point of the breakdown, and therefore throughout, will assume a potential to earth equal to that existing between the high-pressure fault and earthed neutral. The value of this potential will depend on the exact position of the breakdown on the high-pressure windings, and this it will be readily seen will be excessive compared with the normal low-pressure voltage. Since the insulation of the low-pressure winding is generally very substantial for mechanical reasons, a breakdown of the low-pressure winding to earth will not necessarily occur. With these conditions existing and the low-pressure winding switched on to its load mains, all apparatus on these mains is subjected to this high-pressure voltage. Here lies the grave danger to human life and apparatus, which follows as a consequence from the original static breakdown as fully explained above. As an example of this danger, it will be worth while to quote a disastrous breakdown which occurred to a large electric rolling mill plant with which the authors were acquainted.

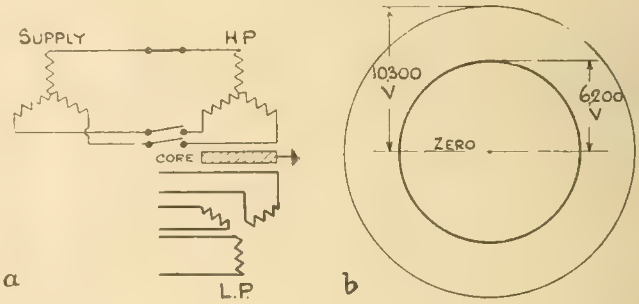


Fig. 8.

The plant consisted of a large 3/6-phase transformer supplying a rotary converter, which, in turn, supplied the large D.C. low-speed rolling mill motor. A fairly large induction motor for barring gear purposes was also supplied from the low-pressure side of the transformer. The transformer was supplied from a high-voltage three-phase main with an earthed neutral. The low-pressure windings of the transformer were unearthed. Due to some inexplicable cause, the high-pressure windings broke down to the low-pressure windings, and these for a time maintained their insulation to earth. The low-pressure windings of the transformer being connected in the usual way to the rotary, passed on the high pressure which they assumed from contact with the high-pressure windings, and so all the load circuit became subjected to this high pressure, with the result that breakdowns to earth occurred in the stator windings of the induction motor and at one point of the field windings of the large D.C. motor.

This breakdown to earth completed a circuit which was virtually a short-circuit across the breakdown point of the high-pressure windings and the earthed neutral, with the result that a heavy current flowed round this circuit, causing extensive damage.

The failure beyond that of the transformer, it will be seen, was due to the neglect of earthing the low-pressure side of the main transformer in an effective manner. Fortunately, no human element came into contact with live parts during the breakdown, but, nevertheless, danger existed and also expensive repairs were entailed.

In all the cases previously mentioned, the diagrams have been taken on the basis of the transformer core being earthed, which procedure should be followed in all cases as before mentioned. If for some reason or other the core is unearthed, a further electrostatic potential will exist between the core and earth, and since the core is usually connected to, and earthed from, the transformer tank, then the tank will also assume this same static potential. The danger due to this possibility will be readily appreciated. With regard to this point, it will be interesting to cite a case which came under the authors' notice, in which a 500-K.V.A. transformer having a voltage ratio of 6,500/440 volts and connected star/delta was supplied with high-pressure voltage in a non-symmetrical distribution. It was found on measuring with a static voltmeter that the core of the transformer had assumed a potential above earth of 3,500 volts. Commensurate then with this value we can take the core in our particular case to be at a potential of 3,200 volts above earth, for due to greatly varying external factors, it is practically impossible to calculate the capacity of core to earth. Fig. 9 *a* and *b* illustrates the condition of affairs, and, as will be seen, with the low-pressure neutral earthed that winding remains unaffected by electrostatic potentials. Similar static potentials would result with two-phase transformers with the mid-wire earthed and the secondary winding open-circuited, or, again, with one of the outer wires earthed and the secondary winding open-circuited or connected for three-wire operation.

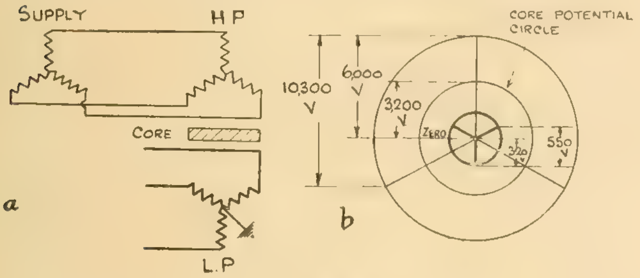


Fig. 9.

For a final example, let us take the case of an accidental breakdown to earth of one phase of an unearthed high-pressure three-phase system supplying a step-down transformer operating with unearthed high and low-pressure windings, as shown in fig. 10 *a*. Assuming that the earth fault occurs in one of the high-pressure supply cables, then that end of the transformer phase winding which is connected up to the supply system by the faulty cable in question immediately falls to zero potential, and the other two high-pressure terminals assume the full line potential of 10,300 volts, the neutral being at 6,000 volts below earth. Then, as the average potential of the high-pressure winding is that of the neutral, the low-pressure neutral will, due to the earth connection on the supply cable, assume this average potential of 6,000 volts, while the low-pressure terminals will be at a potential of the normal ratio volts above this value, viz., 6,320 volts, as shown in fig. 10 *b*.

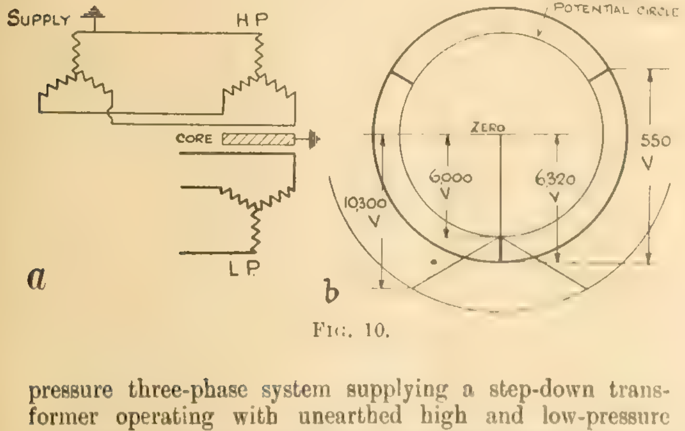


Fig. 10.

From the several foregoing examples it will be an easy matter to ascertain the precise electrostatic conditions engendered in any particular system, the same fundamentals applying for delta and other connections as above enumerated for star.

In conclusion, the authors would point out that to safeguard against this accumulation of excessively high electrostatic potentials on the low-pressure windings, and consequent danger to insulation, it is necessary either to (1) solidly earth the low-pressure mid-point or one of the low-pressure terminals, or (2) earth through a multiple spark-gap or static earthing device. The advantage, chiefly on account of human safety, apart from the reduction of stresses in the insulation, lies, in the authors' opinion, with the static earthing device, since this apparatus only causes an earth when the high static potentials exist and not during normal operations. The danger to the human element if it should accidentally come into contact with the low-pressure winding is much less than if a solid earth were existent, causing a definite voltage *always* to be maintained above earth, particularly if the earthed point was one terminal of the low-pressure winding.

Regarding the diagrams, it will be seen that the vectors and curves representing the low-pressure potentials are necessarily drawn to a larger scale than those representing the high pressure, as the ratios above taken are too small to conveniently allow of the use of the same volts per inch scale.

AUTOMATIC PROTECTIVE SWITCHGEAR FOR AUTOMATIC CURRENT SYSTEMS.

By E. B. WEDMORE, M.I.E.E.

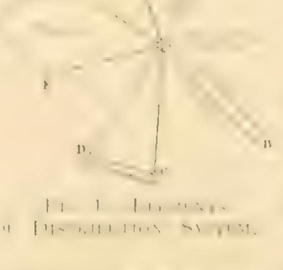
(*Abstract of paper read before* The Institution of Electrical Engineers, *Dec. 10th*, 1914).

The use of protective devices acting selectively to cut out faulty sections will not only ensure continuity of supply, but by enabling faults to be cleared quickly and whilst only a small current is flowing, will greatly reduce their destructive effects.

On plant rated at more than 20,000 kw. the systematic employment of selective devices throughout is commercially almost a necessity. On much smaller plants it is not sufficiently recognized that the use of selective protective devices often enables economies in the expenditure on cables to be effected, which alone will more than cover the expenditure on the apparatus.

If the selective apparatus employed is of a type independent of the arrangement of the cables the distribution network can be laid out on the most economical principles, unhampered by the limitations of reverse-current relays and similar apparatus.

Fig. 1 shows the elements of which distribution systems are constructed, and will serve to define the terms employed.



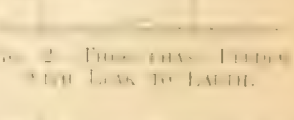


Fig. 1.—Elements of Distribution System. Fig. 2.—Three-phase Feeder with Leak to Earth.

The supply to the point A is through an independent feeder. The supply to B is duplicated by the use of parallel feeders, whilst that to C and D is duplicated by the use of an interconnector. The ring main, feeding points E, F, G, and H, [illegible] limited number of feeders and interconnectors. At each interconnecting point the circuits supplying individual motors, etc., are independent feeders.

All distribution systems are built up of combinations of the above. Independent feeders may be branched as at J and K.

Protection of Independent Feeders.

In the case of independent feeders it is impossible to remove the fault without causing a temporary loss of supply to that part fed by the faulty feeder; but trouble should be confined to the part in question. Fuses are satisfactory for small circuits, but are replaced by automatic circuit-breakers on large circuits. In order to prevent loss of supply it is necessary to adjust the overload devices to withstand perhaps several times normal load. Such an arrangement necessitates all faults being retained on the circuit until they become heavy faults, and it may allow of serious injury to the plant on a sustained overload. This difficulty is partly met by the use of time-limit overload devices.

A leak may occur between poles or to earth. A leak between poles generally develops into a short-circuit, and the case is met by the use of overload devices.

A leak to earth may not cause overloading, and thus may continue for a long time on a circuit protected only by overload devices. This introduces a risk of fire or shock, serious in mining work and undesirable in all cases. In case the the leak is through combustible insulating materials, as in machines or cables, it will probably develop into a short-circuit between phases. On large distributing systems it is becoming increasingly important to provide means for disconnecting, before the short-circuit stage is reached, sections on which there are leakages.

Fig. 2 represents an independent 3-phase feeder having a leak to earth at the point A. It will be observed that prior to the leak all current going out through one of the conductors must return through the others, and that the sum of these currents must be zero. When a leak occurs, however, some of the current returns through the earth and the balance of the currents in the three conductors is no longer zero. This principle has been known for many years, and it is remarkable that it has only recently been applied in the design of automatic switchgear.

The principle finds its embodiment in protective switchgear of the core-balancing type, so called because the currents in the several cores in one cable are balanced. In one form a current transformer is furnished with a core surrounding the feeder conductors as in fig. 3, which conductors form the primary winding. The secondary is connected directly through a relay to the circuit-breaker. Such devices are obtainable adjustable to operate on a leak of a few amperes.

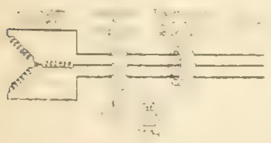


Fig. 3.—Feeder Protected by Core-balancing Transformer.

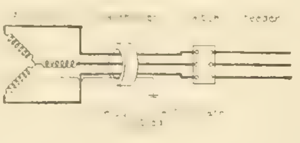


Fig. 4.—Source of Supply protected by Core-balancing.

In another form separate transformers are furnished, one in each conductor, and the tripping device is connected in a common return circuit. With this arrangement direct-acting trip coils can commonly be employed, operating at about one-third normal load, and the same transformers may be employed to excite instruments and to operate the usual time-limit overload devices which are still necessary to protect the system against faults between phases and heavy overloading.

A sensitive leakage device is of great value and should be used universally on independent e.h.t. feeders, and on high-tension service where current transformers are available. The arrangement not only ensures the early disconnection of faulty circuits, but enables the fault to be removed from the system with a minimum of disturbance.

On 3-phase systems having the mid-point earthed through a current-limiting resistance the core-balancing system allows the use of a resistance of high ohmic value, positively limiting the fault current to earth to a relatively small figure. Where core-balancing devices are not employed, the earthing resistance must allow a sufficiently large current to pass to operate the overload devices with the highest current settings which may be employed on the system.

[illegible] core-balancing apparatus enables selective action to be obtained to an extent quite impossible with overload devices.

[illegible] automatic devices in series between [illegible] supply circuits can be graded in [illegible] without sacrificing the requirements at either end.

[illegible] time setting between two consecutive switches must be sufficient to admit of one switch completely disconnecting the circuit before the other commences to operate. The total will generally lie between ¼ second and [illegible]. To this must be added a

All 3-phase systems have mid-point earthed through the star-connected condensers formed by the capacity of the cable, and on a fault to earth a corresponding capacity current will flow which may be quite sufficient to operate core-balancing apparatus.

If an earthing resistance is used, as is generally the case on e.h.t. systems, the resistance should not pass less than 50 amperes or 100 amperes on high-tension and medium-tension systems. In practice the current required is generally higher than this on account of the higher settings of the automatic releases in large generator switches.

It has been shown that the use of leakage devices on feeder circuits has many advantages, and it remains to say that when core-balancing apparatus is applicable it will always give better results than overload devices.

Leakage Protection for Sources of Supply.

The core-balancing principle has been applied recently to independent feeders conveying current from sources of supply. If the conductor from the generator's neutral point to earth is included in the core-balancing transformer as in fig. 4 it will be found that the transformer is now unaffected by a feeder fault, but is affected by a fault in the machine or on the machine side of the transformer. Thus core-balancing apparatus will cut out an individual faulty load circuit or source.

This arrangement can be applied to any source having one point earthed, for example a transformer, or a 3-phase machine with one pole earthed. It gives a very simple solution in the case of Scott-connected transformers feeding a 3-phase 4-wire system, but it is not a general solution of the problem of completely protecting sources of suply, as it is operative only on faults to earth. It gives complete protection only if the design of the apparatus protected is such that a breakdown must involve an earth fault and cannot occur simultaneously on all the phases.

Protection of Parallel Feeders.

The familiar and primitive solution of this problem lies in the use of time-limit overload devices at the end nearest the generating station, and reverse-current devices at the remote end of each feeder. When a fault occurs near the remote end of one feeder the current may be shared nearly equally between them. The current flowing back into the fault from the common point at the remote end will actuate the reverse relay on the faulty feeder and thus relieve the sound feeder. The time-limit overload devices prevent the disconnection of the feeders until the reverse-current device has separated them at the remote end, thus concentrating the fault on the faulty feeder.

In addition to the disadvantages attaches to the use of overload devices, this combination possesses several others inherent in the use of simple reverse-current relays that depend for their discriminating action on the use of potential windings.

Several attempts have been made to get over these difficulties, and although not one of them presents a general solution of the problem they are worthy of further consideration.

Perhaps the most-important device is that which has been described as interlocking and is based on the principle that parallel feeders of the same length, make, and cross-section will normally share the current equally.

The essential feature of the interlock is the establishment of a relationship between the apparatus and the circuits such that the apparatus cannot operate to cut out the circuits unless the balance of current between the circuits is destroyed.

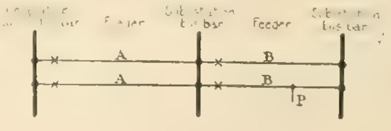


Fig. 5.—Sub-station Fed through Parallel Feeders.

Fig. 5 shows two sub-stations fed in series through pairs of parrallel feeders A, A, and B, B, from a generating station, the feeders being protected by overload devices at the points marked X.

If the overload devices in each phase are interlocked as described above, they will be unaffected by any fault on the system other than one in the individual pair of feeders. For example, a fault in either sub-station will be fed equally through the feeders in either pair whether from the source of supply or from running machinery returning current. If a fault occurs at P in feeders B, B, the feeders A, A, will still carry equal currents and only feeders B, B, will be affected.

A further device is required to discriminate between the two feeders B, B, and this may be obtained by arranging that the more heavily loaded feeder shall be cut out first. It will be seen in the example illustrated that the faulty feeder will carry most of the fault current.

Fig. 6 shows diagrammatically a relay having the required characteristics. The operating coils are excited respectively from the two feeders and the balance arm is biased to the middle position. So long as the currents are equal the balance arm will be unaffected, but with an increase of current on one side the arm will be drawn down on that side and will close the corresponding pair of contacts to trip the switch in the feeder on that side.

On the faulty feeder being disconnected, the other becomes the more heavily loaded and some device is required to prevent its being disconnected. The only sound method is to employ auxiliary switches on the oil-switch mechanism to bring the coils into action automatcally. Satisfactory service has been given by such a device which automatically converts the protection into time-limit protection on one feeder on the failure of, or the deliberate disconnection of, the other.

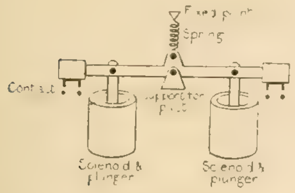


FIG. 6.
BALANCED OVERLOAD RELAY.

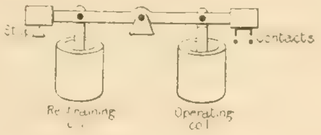


FIG. 7.
BIASED PROTECTIVE RELAY.

In practice a perfect balance of current between the feeders is not obtainable and there will be an appreciable excess current on one side or the other on a severe overload. The balancing difficulty can, however, be completely eliminated by a simple device which has been employed successfully on E.H.T. service. Each feeder is furnished with a relay having two elements, one an operating element and the other a restraining element, as for example in fig. 7.

The operating coil is excited from the feeder which is being protected, and the restraining coil by the feeder in parallel with it. The arrangement is biased in favour of the restraining coil to the extent of say 10 per cent., by placing extra turns on that coil so as to make it more powerful than the operating coil by 10 per cent. Now unless the balance is upset by more than 10 per cent. the device cannot operate, and yet at normal load the device tends to operate immediately the fault current exceeds 10 per cent. of the normal load current. This eliminates all errors in balancing, whether in the relays, current transformers, or feeders, and also the maintenance of balance.

As interlocked overload relays are proof against overloads or faults occurring outside the parallel feeders protected, it will be seen that they are particularly suitable for the protection of a number of stations in series. All the devices may be set to operate instantaneously and at less than the normal load current, and yet none of them will operate except in the faulty section.

Another method of eliminating the balancing problem is by the use of leakage relays interlocked in the same way as overload relays. These relays, as previously described, operate only on faults to earth, of which the extent can be limited by an earthing resistance. The relay settings will be in the neighbourhood of the maximum fault current, and thus even a 10 per cent. unbalancing is quite negligible. Seeing that most cable faults are faults to earth, and that of the faults between phases most develop first or simultaneously as faults to earth, this arrangement will successfuly remove the large majority of feeder faults and is proof against disturbances from other sources. Two feeders can be protected by one relay instead of requiring three or six.

It will be understood that as leakage relays are inoperative on faults between phases, their employment only reduces disturbances, and the most severe disturbances, namely, those due to faults between phases, are left to produce an extensive or complete shut-down. The addition of interlocked leakage relays to a system otherwise protected by overload relays will improve the conditions but cannot be considered a real solution of the problem of protection.

Reverse-current relays are now obtainable which will operate at about 3 per cent. of the normal working voltage and over a wide range of power factor, but below this voltage they are inoperative on currents of any magnitude. On a fault which develops practically instantaneously and reduces the voltage below this limit, the relays will be of no service.

The difficulty due to loss of voltage has been dealt with by making the moving parts unstable at low voltages so that any movement initiated is completed. At full voltage the moving parts must be stable so as to ensure restoration of the relay and freedom from trouble due to vibration and sudden changes of load. Such relays have given satisfactory operation for a number of years. These improvements render the reverse relay almost independent of voltage. The application of the interlocking idea renders them unaffected by current fed back from sub-station plant and of surges in either direction.

Whilst well-designed reverse-current relays with potential windings will deal successfully with the majority of faults, it is to be noted that the faults with which they cannot cope are just those likely to occur as the result of bad design, bad workmanship, defective material, and carelessenss, and are also those most disastrous in their result.

PROTECTION OF INTERCONNECTORS AND RING MAINS.

As the energy flow in a sound interconnector or ring main may be in either direction, varying with the distribution of load, reversal is no longer a sign of leakage. A leak of sufficient magnitude may so disturb the distribution that energy may flow into the faulty conductor from both ends. This condition is a sure criterion of a heavy fault. Attempts have been made to utilize this feature to obtain selective action.

A pilot wire may be employed to take a sample of current from one end of the feeder to the other for use as a standard. The current at the remote end may then be compared with the sample to determine whether the direction or magnitude of flow is the same. The latter is the better course as the magnitude changes with the smallest leakage, but the direction will only change with a relatively large leakage.

This is the basis of the well-known Merz-Price protective system.

Current transformers are inserted at the two ends of the conductor to be dealt with and are connected through the pilot wires. In the balanced-voltage system diagrammatically illustrated in fig. 8 the current transformers are connected in opposition and the relays in series with them. In the circulating-current system illustrated in fig. 9 the transformers are so connected as to circulate the current between themselves under normal conditions. The trip coils are connected in shunt between equipotential points and carry only the difference current corresponding to the leak. The balanced-voltage system is best adapted for feeder protection and the circulating-current system for the protection of transformer and generator windings, for all of which applications well proved designs are available. There is no better method of protecting existing feeders, and all generators and transformers.

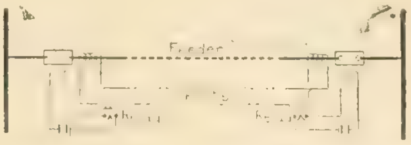


FIG. 8.—PROTECTION OF INTERCONNECTOR BY BALANCED VOLTAGE SYSTEM.

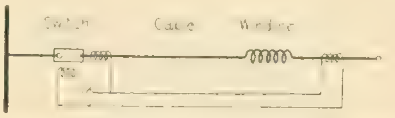


FIG 9.—MACHINE WINDING AND CABLE PROTECTED BY CIRCULATING-CURRENT SYSTEM.

GENERAL SOLUTION OF THE PROBLEM OF FEEDER PROTECTION.

Any arrangement capable of dealing with a single interconnector can be applied to any cable in the system. The Merz-Price system is applicable to interconnectors, and is therefore a general solution of the problem.

A general solution has the immense advantage that one can ignore the protective gear when laying out the cable system, and that each and every feeder can be protected in a similar manner and by a self-contained combination of similar apparatus independently of all other feeders.

The split-conductor protective system is, up to the present, the best solution of the problem. [illegible] tion give an arrangement applicable to ring mains, interconnectors, and duplicate feeders—in fact to all systems of distribution—but it gives an arrangement absolutely selective and so sensitive as to perform this function instantaneously at a fraction of the normal load current.

The system requires the employment of a cable of special construction, or in the case of overhead lines a special arrangement of conductors. The construction involves but a slight departure from that [illegible] the splitting or separating of each conductor into two parallel portions [illegible]

[illegible] fig. 11 illustrates a [illegible]

[illegible] The current

transformer core has two primary windings, to which the two halves of the split conductor are connected, and the core carries also a secondary winding connected to a relay controlling the oil-switch trip coil.

Under normal conditions, as in fig. 12, current entering the feeder at one end divides equally between the two parallel paths, being united again on the remote side of the second current transformer. In each transformer the magnetizing effects of the two primary coils are equal and opposite, thus the transformer offers no impedance to the current flow, and the secondary windings and relays are unaffected.

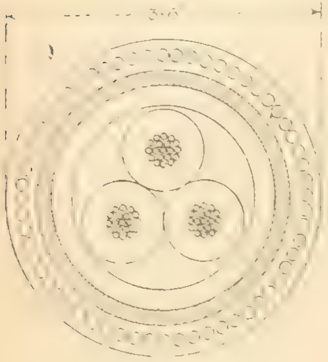


Fig. 10.—Standard 20,000-volt. 0.1 sq. in. Cable.

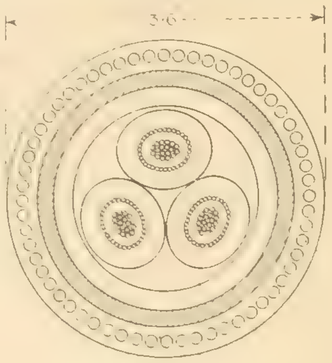


Fig. 11.—Standard 20,000-volt 0.1 sq. in. Split Conductor.

In case, however, a fault develops, for example at the point A in fig. 13, the fault current flowing towards A will upset the balance of current between the two primary windings in each transformer, thus producing a magnetizing effect on the secondary windings and exciting the relays.

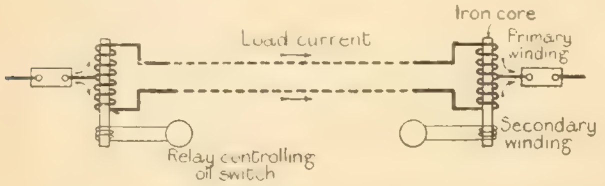


Fig. 12.—Split-conductor System—Sound Feeder.

The transformers also serve a second function in case the fault occurs near one end of the split conductor, as at B in fig. 14. In this case the fault current flowing from the left-hand end would divide equally between the two halves of the cable, were it not for the impedance of the transformer near B. The fault current flowing to B through the sound conductor traverses the two primary windings at B in the same direction, thus highly magnetising the core. The impedance so offered hinders the flow of current through the sound conductor and thus upsets the balance at the remote end, causing the simultaneous operation of both relays.

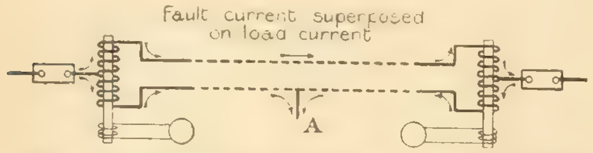


Fig. 13.—Split-conductor System—Faulty Feeder.

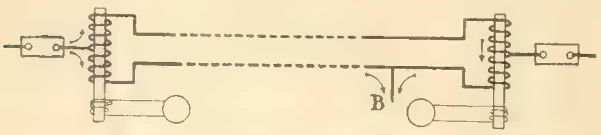


Fig. 14.—Split-conductor System—Fault at One End.

As the cores are not magnetized under normal running conditions, there is no core loss. In practice the core is of circular form, and the primary and secondary windings are superposed.

On reference to fig. 14 it will be seen that the arrangement is more sensitive at the end nearest the fault, as the whole fault current passes through the adjacent transformer winding in one direction. Advantage is taken of this to make the whole arrangement more sensitive by employing an oil switch with split contacts which separate the two halves of the conductor on breaking circuit. The switch nearest the fault will operate first, and on separating the conductors the whole fault current is then concentrated on one conductor at the other end [illegible]

This system is readily applied to overhead lines. In this case the half conductors may be run as separate overhead lines on the same posts.

As a general solution, however, the twin conductors are carried on common insulators and but lightly insulated one from the other. Spacers of insulating material are inserted at intervals between supports to keep the wires apart. Fig. 15 is an enlarged detail of the insulators. If a wire is broken and falls to the ground the line will be cut out even though the fallen line fails to make a good earth. This adds materially to the protection of the public.

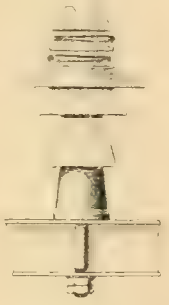


Fig. 15.—Details of Insulator.

The simplicity of this arrangement should be noted. There are no pilot wires and no potential transformers. The relays are plain overload devices requiring no special adjustment. The transformers can generally be built with bar primary windings, a construction which gives the maximum of simplicity and safety. The secondary windings are subjected to no forces except on the occurrence of a fault in the individual feeder which has to be protected, however severely the system may be disturbed.

It is difficult to connect up the apparatus incorrectly, but should the connections be crossed by mistake the switch will open immediately any attempt is made to put the feeder into service, and thus the mistake will be discovered.

It is not essential that the conductor should be divided into equal sections. If one section be made smaller than the other, say reduced to a single wire, this wire may be carried always within the other portion which will surround it. Any fault to earth or between phases must occur on the outer portion; thus it is unnecessary to provide for excess current in the inner portion.

We may now substitute a relay of the balanced type shown in fig. 7. We connect the restraining coil to the inner wire and the operating coil to the outer conductor. The relay may be biased to an extent which fully covers all possible unbalancing, thus removing all occasion for balancing tests.

This arrangement is not quite so good as that above described, as the transformers cannot be constructed with bar primary windings, that for the fine wire requiring a multiple-turn primary. On small installations such as colliery and industrial plants where the conditions accompanying short-circuits are not so severe as they are on the large power supply schemes, this objection disappears, and advantage may be taken of the cheapening of the cable and the elimination of balancing. This applies equally where such plants receive supply from the power companies, as the severest short-circuit conditions are only met with near the generating stations.

The balancing problem now presents no difficulties, although in the experimental stage some were experienced. It is necessary to balance both the reactance and the resistance of the twin conductors as it is the vector difference which is operative. This requires no attention in overhead lines, and is successfully accomplished by the adoption of simple precautions in the manufacture of the cables.

To meet all the requirements of electric supply there are now available a series of devices simple in character, well proven in service, and giving a degree of protection hitherto quite unattainable. The series is as follows:—

(a) For the protection of all closed feeder circuits—the split-conductor system.
(b) For the protection of all open-ended feeder circuits, core-balancing system.
(c) For the protection of generators and banks of transformers—the circulating-current system.

The advantages of the above combination may be summarized as follows:—

1. All the apparatus is simple in character.
2. All the apparatus is self-contained and completely independent of that on other circuits.
3. All the apparatus may be adjusted before installation.
4. No feeder pilot wires are required.
5. The relays are all simple contact-making devices operating on excess current and are of the same character throughout. In many cases direct-acting trip coils can be substituted.
6. The relays are not subjected to any forces until they are called upon to operate.
7. None of the devices are affected by surges.
8. None of the devices are affected by variations of voltage or of power factor.

9. None of the devices is affected by faults occurring outside the sections controlled.
10. All the devices will deal with faults between phases or to earth on systems with any number of phases.
11. All the devices are instantaneous in operation.
12. All the devices will operate at currents comparable with and generally materially less than the normal load current.
13. If incorrect connections are made this will be discovered on the first trial run.

TRADE STATISTICS OF NEW ZEALAND.

THE following figures, showing the imports of electrical and allied goods into New Zealand in 1913, are taken from the official statistics which have just reached this country. The comparative figures for the previous year are added and increases or decreases noted. Reference to these returns also appears on page 57 of this issue. It should be understood that the countries to which the goods are credited are not in every case the countries of manufacture, but merely those from which the goods are invoiced.

	1912. £	1913. £	Inc. or dec. £
Leather belting.—			
From United Kingdom ...	4,000	3,000	— 1,000
,, Other countries ...	1,000	2,000	+ 1,000
Total	5,000	5,000	—
Belting other than leather.—			
From United Kingdom ...	26,000	35,000	+ 9,000
,, Australia	1,000	2,000	+ 1,000
,, United States ...	2,000	3,000	+ 1,000
,, Other countries ...	2,000	—	— 2,000
Total	31,000	40,000	+ 9,000
Engine packing.—			
From United Kingdom ...	13,000	13,000	—
,, Australia	2,000	2,000	—
,, Other countries ...	5,000	5,000	—
Total ...	20,000	20,000	
Rubber goods.—			
From United Kingdom ...	4,000	3,000	— 1,000
,, Australia	10,000	8,000	2,000
,, Other countries ...	2,000	2,000	—
Total	16,000	13,000	— 3,000
Scientific instruments.—			
From United Kingdom ...	8,000	7,000	— 1,000
,, Other countries ...	5,000	4,000*	— 1,000
Total	13,000	11,000	2,000

* Includes Germany £1,600.

	1912. £	1913. £	Inc. or dec. £
Rails.—			
From United Kingdom ...	153,000	191,000	+ 38,000
,, Belgium	5,000	—	— 5,000
,, Other countries ...	3,000	7,000*	+ 4,000
Total	161,000	198,000	+ 37,000

* Includes Australia £3,000.

	1912. £	1913. £	Inc. or dec. £
Telegraph and telephone wire, iron.—			
From United Kingdom ...	7,000	11,000	+ 4,000
Electrical machinery.—			
From United Kingdom ...	274,000	307,000	+ 33,000
,, Australia	33,000	29,000	— 4,000
,, Germany	27,000	24,000	— 3,000
,, United States ...	39,000	71,000	+ 32,000
,, Belgium	7,000	5,000	— 2,000
,, Other countries ...	17,000	39,000	+ 22,000
Total	397,000	475,000	+ 78,000
Steam engines.—			
From United Kingdom ...	29,000	8,000	— 21,000
Gas and oil engines (except for motor-cars).—			
From United Kingdom ...	149,000	160,000	+ 11,000
,, Australia	6,000	4,000	— 2,000
,, United States ...	22,000	24,000	+ 2,000
,, Other countries ...	3,000	2,000	— 1,000
Total	180,000	190,000	+ 10,000
Boilers.—			
From United Kingdom ...	6,000	10,000	+ 4,000
Other machinery (except agricultural, printing, sewing, textile, etc.).—			
From United Kingdom ...	76,000	77,000	+ 1,000
,, Australia	9,000	8,000	— 1,000
,, Germany	3,000	6,000	+ 3,000
,, United States ...	20,000	22,000	+ 2,000
,, Other countries ...	6,000	5,000	— 1,000
Total	114,000	118,000	+ 4,000
Mining machinery.—			
From United Kingdom ...	13,000	15,000	+ 2,000
,, Australia	5,000	7,000	+ 2,000
,, Germany	1,000	—	— 1,000
,, United States ...	7,000	4,000	— 3,000
Total	26,000	26,000	— —
Meters: Water, gas and electricity.—			
From United Kingdom ...	27,000	33,000	+ 6,000
,, Australia ..	1,000	2,000	+ 1,000
,, United States ..	2,000	2,000	- -
Total	30,000	37,000	+ 7,000
Railway and tramway plant.—			
From United Kingdom ...	38,000	67,000	+ 29,000
,, Australia	2,000	2,000	—
,, Other countries ...	5,000	2,000	3,000
Total	45,000	71,000	+ 26,000
Lamps and lanterns.—			
From United Kingdom ...	35,000	36,000	+ 1,000
,, Germany	15,000	12,000	— 3,000
,, United States ...	15,000	14,000	— 1,000
,, Other countries ...	7,000	2,000	— 5,000
Total	72,000	64,000	— 8,000

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Garage Heating.

As the problem of garage heating should surely be served by electricity, it would be very interesting to hear the views of other readers of the ELECTRICAL REVIEW.

As a contractor, I have been asked from time to time by many customers to make suggestions for heating their private garages, in some cases not only with a view to keeping the circulating water of the motor-car from freezing during the frosty periods of the year, but to prevent damage to upholstery, &c., from dampness, and I have had considerable difficulty in supplying their wants.

Manufacturers' knowledge on the matter seems to be very limited. Some have suggested luminous and radiant heating; others have even sent us on approval convectors running at red heat, wired with ordinary flexible wire, and without provision for earthing, ignoring our carefully-worded inquiries calling for suitable apparatus that would be safe to use where petrol vapour might be present and the danger from shock.

I find it impossible to get any data on the subject, although I found one firm who illustrated a "Garage Heater," which I was assured "would be quite satisfactory," but upon receipt found the elements glowed when in use. When complaining, I was told that I viewed the matter too seriously, suggesting that almost any electric stove would be quite safe to use.

Now, if the latter is the case, I should be only too pleased to stand corrected, but as I am confident that there is a demand for an inexpensive, economical and *safe* electric heater, if only to protect the cylinders of cars when garaged against damage from frost, I think that some account of others' experiences would be interesting to manufacturers, contractors and supply engineers, as also to car-owners themselves. Perhaps some of your readers would oblige by replying.

Interested Inquirer.

[We believe there is no danger in using glowers at a dull red heat (1,300° F.); the ignition temperature of petrol vapour in air is about 2,200° F., or bright orange. Certain slow-combustion stoves are commonly used in garages, so low-temperature electric radiators should be quite satisfactory.—EDS. ELEC. REV.]

From the Fleet.

On behalf of the electrical staff, I wish you and yours a Happy and Prosperous New Year.

I shall look forward with much appreciation to the ELECTRICAL REVIEW, which, thanks to your kindness, I now receive regularly each Saturday.

H. Christie, *Electrician.*

H.M.S. *Bonaventure*, c/o G.P.O.,
December 29th, 1914.

German Agencies.

It seems hopeless to induce the Electrical Co., Ltd., to reply to any attacks that may be made upon them, and this more than ever convinces me that they have received their orders from Berlin in the first place as to what to do, and it is perfectly plain that they have been told to lie low and say nothing, and consider themselves an English firm until such time when they can blossom out again. In the meantime, the "foolish" Englishman will keep on supporting them and provide profits to be sent to Berlin later on.

It would be interesting to know how many British contractors are foolish enough to purchase from firms like these, the head of which, as has already been stated, being one of the Kaiser's right-hand men in all his scheme of devilry. I should be glad if someone would consider the question of forming a league to advertise all firms like this throughout the whole of the British Empire, there being in addition to the Electrical Co. a large number of others posing as British which are absolutely German from beginning to end. It would certainly be worth while to take good care that the general public know about it.

I heard lately that the Electrical Co. still have the audacity to call upon people and pose as a British firm offering to sell British-made goods, but it is apparent, I again repeat, that they have had their orders what to do.

One particular firm, the proprietor of which has an intense hatred for everything German, absolutely declined to believe me, until I showed him the list of the shareholders of this company, and he based his opinion on the fact that they were offering to sell him nothing but British-made goods—and for a very good reason, I should imagine, as, seeing our Navy has tightened things up so much, it would be hopeless for the Germans to attempt to get anything out of their country, as it takes them all their time, with all their trickery and dodges, to get anything into it.

I should be obliged if someone in the different towns where this firm has branches would take this matter up to the point of directly insulting them to a certain extent, which might bring the matter to a head, as, so far as I can gather, in all the towns where their branches are situated they are still carrying on business as if nothing had happened, and just as if we were carrying on war with properly civilised people, whereas, from the records of the war so far, we are carrying on war with the foulest savages.

Contractor.

Advertising and Character.

As one whose business is concerned with engineers' advertising, I can concur wholeheartedly with the views expressed by you in your present issue, and with those of "Consultant."

An advertisement does, or should, reflect the character of the firm issuing the announcement. Humour has a place in advertising, though not in technical advertising. A funny cartoon may attract attention, but the chances are that it will not influence business. An advertisement of this nature may interest and amuse the reader, but the point is, will it impress him with the quality of the goods advertised; will it create a bias in favour of the specialities put forth? After all, readers of technical journals are engaged in serious work, during business hours; it is when the work is over for the day that they seek mental relaxation. Humour only appeals to a man when he is in the mood for it, and most of us are not in the right frame of mind to be amused when business calls for our whole attention.

A reader of a technical publication picks up his journal for information on his particular branch of trade. Well, if you are an advertiser, give him what he wants—data about your goods—and present this information as attractively as you can. Your object is to make your advertisement stand out from the pages of the paper in which it appears; stand out distinctively so that it will attract, and create a favourable impression. Now an ugly advertisement may secure attention, but it will never cause a feeling of pleasure to arise in the mind of the reader. The four functions of any advertising announcement are: To attract attention; to create interest sufficiently strong to induce the reader to read the message put before him; to give a bias in favour of the advertised article: to get him to act, either by calling on the advertiser, by writing for a booklet or for information, or to purchase outright. The latter depends on conditions, necessarily.

Many advertisers do not realise the value of plenty of white space. Wide margins will give an advertisement dignity and prominence, and do away with any impression of overcrowding. A comparison of the advertising pages will prove this. Let the reader try this in one of his own advertisements and he will appreciate the improvement.

Another failing with some firms is to use blocks of their machines which are too large for the space they occupy. This makes the announcement look overcrowded and heavy, and furthermore, leaves very little room for the message.

In many instances it is a good plan to show the application of the goods offered. The value of pictorial representation cannot be over-estimated. A picture tells the story at a glance; but it must be appropriate. For instance, it is better to show an electric fan at work in a smoke-room, dispelling tobacco fumes, than to use just a plain cut of a fan standing idle. The first has life—"imagination"; the second is dull, uninspiring. But as I have said earlier, illustrations must be used with care and judgment.

And the same degree of care should be exercised in writing the "copy," that is, the text. Information should be tendered pleasingly but forcibly; just enough data to interest the reader but not enough to satisfy him. The appetite wants to be whetted. You want him to write for more. Once he is in touch with you, the advertisement has done its work.

One final word. Let the advertiser select his list of papers with the same care which he uses in choosing his travellers. Having decided on his media let him stick to them, and not change from one to another every few months. The most successful advertisers are consistent advertisers. To keep changing from paper to paper means losing the cumulative effect. Very few salesmen call on a firm and get an order at the first visit; they keep calling on the best firms, in many cases for months and months before they open the account. In the same way your "silent salesmen," your advertisements, must convey their message at regular intervals.

If any reader who is not satisfied with the results from his expenditure will only apply the suggestions I have made to his own case, I am sure he will experience greater success than he has obtained in the past, as these remarks are engendered by a close acquaintance with the subject under discussion.

Ernest Ingram Hill.

Wimbledon, S.W., *January 1st*, 1915.

The letter from "Consultant," and your editorial thereon, remind me of a conversation which I had with a man in the petrol-motor trade about reorganising several departments, and who, when it came to publicity expenses, emphasised a statement to the effect that his firm spent a lot on advertisement. "Pardon me," I said. "Your firm buy a good deal of space, but they never advertise." He was astonished, and could not grasp the difference for several minutes.

The above is the case with some 95 per cent. of the advertisers in this country in all trades. A very high percentage of the space taken is taken simply because it is usual to "advertise," and almost everyone else does it. Further, whoever is responsible for engaging an advertising manager or his staff, seldom has any knowledge of publicity work, and simply resorts to catch-phrases, such as "pulling copy," and the like, while the very meaning of "pulling copy" is unknown to the interrogator. Again, directors and managing directors seldom actually know what an advertisement is, and mistaking somewhat fluent space-filling for the genuine accomplishment, a highly efficient advertising man is not always engaged, as a man who can talk intelligently about his subject cannot make any more impression on another who does not understand it, so that the writer of hackneyed common-places stands as much chance of being engaged—perhaps more, because he will be cheap. One of the results is that we get space very often filled with "dead" and very usual matter, while blocks suggest a trial set suspended in space or a vehicle stranded outside the works without a sign of "life" in sight. One could, of course, write at great length in dealing fully with all the advertising ramifications of any special trade, but, speaking generally, matter in periodical advertisements should emphasise a leading line each week, or as often as the publication appears, with all the remaining or principal lines in rather smaller type, conveniently placed for reference. Illustrations should preferably show installations, and blocks should not be so highly finished or photographs so re-drawn as to produce a terribly wooden effect, which often has a particularly unfavourable result on overseas business. There is a whole budget of other practical advertising suggestions going for any firm who will begin to realise that mere space-filling is one of the most unproductive of expenses.

If any firm could see their way to standardise and advertise prices for different-sized D.C. and A.C motors they would touch a remunerative line. I believe, however, that as the prices of these machines vary so much with the circumstances, competition, &c., under which they are sold, it would be difficult to give publicity to figures. Such prices, however, would have to be from 12 to 15 per cent. below the official figures, which were thought to be high at one time.

Arthur Mallord Turner.

London, S.W., *January 4th*, 1915.

Alluding to your "critique" entitled "Advertisement and Character," one has but to move down a main street, to turn the leaves of a periodical, or to watch the speeding countryside from a flying track, to behold "Advertisement" tragic in its endeavour to appeal—humorous, in its analogy to the burdened washing line of Poverty's back yard.

The line is a necessity, so also is advertisement, but whereas we shun gazing at the one, alas for natural instinct, we are the puppets of a moving show on the other.

If only advertisers would realise that their productive effort is for the *uninitiated*, and that the sure way to appeal to ignorance is by suggestion—knowledge gilded with subtle flattery—colour yells would cease to deafen, and the public, treated more as a sane community than a kindergarten, would be less liable to seek the haven offered by "the rainy day" theory.

A few well chosen lines leading up to the main scheme instead of an opaque mass of monochrome or futurist nightmare of colour, and, again, a gradatory form of lighting advertisement for night work, would go far to procuring business and helping the trade. The elusive advertisement of a necessity lives longer than the one that strikes a solitary note and then is silent.

Trusting that the raising of the question will bring the matter the notice it deserves.

Rex. C. Andersen.

London, W., *January 4th*, 1915.

A.C. v. D.C. for Lighting.

I am planning the illumination of a number of machine shops at present lighted by gas, by means of several thousand drawn-wire and half-watt lamps.

Two electric supplies are available—D.C. at 240 volts, and A.C. 110 volts 40 cycles.

As the class of work done in these shops is of very close nature and demands much local lighting, the low-voltage A.C. would be most suitable, but it has been suggested that A.C. lighting is more trying to the eyes, and that trouble may be experienced by the lights getting into synchronism with the moving machinery.

Personally, I should think the heat capacity of the filaments would prevent this, but perhaps some of my fellow-readers of the ELECTRICAL REVIEW who have had experience with A.C. lighting under similar circumstances will be kind enough to give their views upon the matter.

Ex-Gas.

January 2nd, 1915.

WAR ITEMS.

Divisional Engineers—Royal Naval Division.—The Institution of Electrical Engineers is informed that it has been decided to form another Field Company of Engineers for the Royal Naval Division. It is desired that at least two sections of the new company should consist of highly-trained men, and applications are accordingly invited from members of the Institution between the ages of 19 and 35. It is understood that the rates of pay and the duties are the same as those of the Royal Engineers. Applications should be addressed to Captain Harrison, Adjutant, Divisional Engineers, R.N.D., 2, The Downs, Dover Road, Walmer. It will be remembered that the Engineer units of the Division consist largely of members of the Institutions of Civil, Electrical and Mechanical Engineers. Nearly 100 of those who joined these units since they were formed last September have received commissions in the Army.

Post Office Engineering Volunteer Training Corps.—Although some 20,000 postal employés have joined the Colours, this number falls far short of the total number that would gladly enlist; but the necessity of maintaining the efficiency of the service, especially in the telegraph and telephone departments, compelled the authorities to retain the men in their customary occupations. There are in all nearly 50,000 men in the service of the Post Office in London, of whom over 7,000 belong to the Engineering and Stores Departments, and when it was proposed to form an Engineering Corps, to train the men who were not allowed to enlist, the response was enthusiastic. A commencement was made with 600 men, though fully double this number applied for enrolment, and the corps was duly formed three weeks ago. The Commandant is Mr. H. C. Gunton, principal power engineer to the Post Office and engineering adviser to the Central Association of Volunteer Training Corps; the Acting Adjutant is Mr. G. F. Preston, Controller, London Telephone Service, and the Second Commandants are Messrs. A. J. Stubbs and W. Noble, Assistant Engineers-in-Chief, and A. Moir and J. M. G. Trezise, Superintending Engineers, London District. The Quartermaster is Mr. A. Parsons, Controller of the Stores Department, and the Company Commanders are Messrs. D. H. Kennedy, Assistant Superintending Engineer, London; A. Watts, Staff Engineer, Engineer-in-Chief's Office; G. F. Greenham, Assistant Superintending Engineer, London; and L. B. Turner, Assistant Staff Engineer, Engineer-in-Chief's Office. Drills take place in the evenings at the Inns of Court Hotel, which has been acquired by the Post Office for a future telephone exchange, and a programme of field work for Saturdays and Sundays has been arranged. The A, B, and C companies are designated as air-line companies, and will erect temporary telegraph and telephone lines and stations in the field; D company is known as a field company, and will deal with permanent line construction and the heavier branches of engineering field work generally. The first Corps parade took place on Saturday last in the yard of the King Edward VII Building, and was followed by a route march of 5½ miles.

The Volunteer Training movement has quickly overspread the whole country, and at least a million men are said to be training diligently in their spare time; but few corps are likely to make a better showing than the new P.O. Engineering Corps, which is recruited from an exceptionally fine body of men, very many of whom have been through the mill already.

Board of Trade Electrical Exhibition: Open To-day.—The Board of Trade Commercial Intelligence Department invites British electrical manufacturers and representatives of wholesale houses who have previously imported electrical accessories from Germany and Austria-Hungary to attend the exhibition of such goods that they have organised. The exhibition was opened yesterday at 32, Cheapside, E.C., and it continues open to-day, and various samples of German and Austro-Hungarian goods are on view. Many of these, no doubt, our firms have already come up against in the ordinary course of business, but the collection, as a whole, if anything like representative or complete, should be instructive.

German Methods in Australia.—A short time ago, in commenting upon methods of German electrical firms, Mr. Harper, city electrical engineer, Melbourne, stated (says the *Melbourne Age*) that it was often very difficult to perceive the German connections of many firms. Many German firms, like the Allgemeine Electricitäts Gesellschaft, had their headquarters in Melbourne, and traded under all sorts of local names. The practice of removing name plates and manufacturers' marks was, he believed, a common one, and was being indulged in pretty freely at the present time. He was quite certain that England could supply the Colonies with every type and quality of electrical appliance required, and believed that Australia was, in fact, one of England's best customers in electrical goods.

In the course of an article on the "Duty of Australians," published in October, the *Australian Mining Standard*, which has ever since the outbreak of war made a weekly feature of a forceful anti-German campaign, made the following observations on the methods of German traders:—

"How thoroughly the Germans prepared for this war has been shown in many ways, and it is also becoming increasingly clear to what an extent their business men trading or having agencies in Australia were aware that this war was coming. . . . It is significant as showing how thoroughly ostensibly peaceable firms knew what was coming, that many German accounts with Australia were, *for the first time*, allowed to fall into arrears towards the close of the first half of this year. Can we then trust a people such as this? Indeed, do we not know them to be a contract-breaking people, whose signature to 'a scrap of paper' is of no sanctity whatever? If we cannot trust them, have we any justification for continuing to deal with them? No, it is our duty, both on moral grounds and on grounds of policy, to have nothing whatever to do with a race so treacherous. Let it be added further, that, now we are thoroughly acquainted—but no, that is too much to say: let it be altered to 'now we are to some slight extent acquainted'—with the dubious and underhand methods employed by German firms for the furtherance of business in Australia and elsewhere, we will say deliberately and unhesitatingly that any municipality, any Government, any public concern whatever, accepting a contract from any firm representing German interests, will lay itself open to a very grave suspicion of having had its honour tampered with. It is notorious that some of the German firms trading in Australia set aside sums of money for use by their agents for purposes of bribery. Let it be made quite clear then that anybody, when this war is over, accepting the contracts of such firms, will be open to the suspicion of having been induced in this way to consent to the placing of a contract with a nation which has shown itself to be the deadly enemy of the Empire to which we belong."

Haslingden Corporation Contracts.—A long discussion took place at a recent meeting of the Haslingden Corporation Electricity Committee upon the question of trading with Messrs. Siemens Bros. & Co., Ltd., and Mr. Snow-Huddleston and Mr. Hill, representatives of the firm mentioned, appeared before the Committee and explained the position and composition of the company. Eventually a resolution was moved to the effect that when tenders are required in future for electrical cables and goods, Messrs. Siemens Bros. & Co., Ltd., should be allowed to compete as heretofore. An amendment was brought forward that when existing contracts with the firm were completed the Corporation should cease trading with the firm, and 10 voted for the amendment and 13 against. The amendment, therefore, was lost, and the original resolution was subsequently adopted.

A Copper Famine.—According to a report from Switzerland, Germany is so sorely in need of copper that telegraph and telephone wires are being pulled down, at first in the less populous districts, and electric light cables will also be utilised to supply the need. The great gates of Antwerp Railway Station have been commandeered. According to the *Times* Brussels correspondent, the German authorities are requisitioning copper articles in all parts of Belgium. Copper saucepans, crucifixes, and holy water basins are being taken, and from a Brussels factory copper to the value of £12,000 has been requisitioned.

Sydney Council Contracts.—When the Sydney City Council had before it toward the end of October a recommendation of Mr. Forbes Mackay, the city electrical engineer, that three transformers be obtained from the U.S.A., at a cost of £5,097 (an English firm had tendered £1,000 less), it was explained that the American firm had guaranteed delivery within 13 weeks, and that the type offered by the British firm was not what the engineer wanted. As a result of the discussion in the Council (according to a report in the *Sydney Morning Herald*) it was decided that fresh tenders be called, confined to articles of English manufacture. The principal speaker in the discussion said that he believed in distributing a wage fund within the Empire in this supreme crisis, and not in sending their money to foreigners.

"One Clear Call."—This is the title of a pamphlet by Mr. A. H. Ashton, founder of the Voluntary Recruiting League, of which the latter has printed 100,000 copies for general distribution, with the object of stimulating the enlistment of recruits throughout the British Isles. The published price is 1d., and copies can be obtained from the League at Empire House, Piccadilly, W. A selection of the opinions of eminent readers shows that the pamphlet has made an excellent impression on them, and is regarded as a valuable aid to recruiting. The author recapitulates the events which led to the outbreak of the war, and makes an effective appeal to the reader to enlist in the new Army, if he is eligible. All profits made from the sale of the pamphlet will be devoted to the furtherance of recruiting.

Burnley Tramwaymen.—The War Office has expressed a desire that ex-non-commissioned officers on the staff of Burnley electrical tramways department should join the Army as instructors. Up to the present, 118 men have joined the ranks from the tramway staff.

Royal Flying Corps.—According to the *Manchester Courier*, the Royal Flying Corps military wing are calling for the following and other tradesmen:—Acetylene welder, aeroplane mechanic, cable jointer, coppersmith, draughtsman (mechanical), electrician, fitter, instrument repairer, metal turner, pattern maker, wireless operator, driller, dynamo attendant, electric-bell fitter, machinist, motor fitter, switchboard attendant, tool grinder, wireman.

E.T.U. Men with the Forces.—In an article in the *Herald* on the policy of the Electrical Trade Union, the author, J. Kinniburgh, says that the membership is 8,000, of whom 10 per cent. are "fighting for *our* king and *their* country"; another large number are building warships, leaving "about 2 per cent., if that, out of employment."

Personal.—Mr. E. B. C. Preston, manager of Messrs. Siemens Bros. Dynamo Works, Ltd., Rangoon, has been appointed a 2nd Lieut. in the Indian Army Reserve of Officers. He has been attached to the 32nd Sikh Pioneers at Sialkot, Punjab, and left Rangoon on December 13th for that place.

Owing to their not being allowed to enlist in the Forces for active service on account of the exigencies of the work of the department, the names of the following members of the electricity staff at Woolwich have been recorded in the minutes by the T.C.:—Mr. W. B Wadie, assistant engineer; Mr. Walter Scott, acting charge engineer; Mr. J. Rhodes, stoker; and Mr. G. R Smith, clerk.

Mr. Leonard J. Aron is in France serving as Corporal in the Army Service Corps, "Mechanical Transport," British Expeditionary Force.

Private Wm. Lonsdale, who was condemned to death for an assault at the Doberitz Concentration Camp, Berlin, but whose sentence is said to have now been commuted to one of ten years' penal servitude, is a Leeds man, who was a reservist in the 2nd Battalion West Riding Regiment. He was called up from his employment as a tram conductor in Leeds at the outbreak of the war, and took part in the battle of Mons, where he was wounded and taken prisoner on August 24th.

Mr. Francis B. Shaw, A.M.Inst.C.E., A.M.I.E.E., electrical engineer to the Government of Siam, who recently contributed to our pages an interesting account of the Siam Electricity Works, has joined the R.N.V.R. armoured car division as Lieutenant, and hopes soon to be on active service.

The Manchester Tramways Committee has passed a resolution expressing appreciation of the excellent work done by Mr. J. M. McElroy (general manager) and the whole of his staff in connection with the war crisis.

In the list of certificates of naturalisation appearing in the *London Gazette* on January 5th, the following entry appears:—Gerald Henry John Hooghwinkel (Netherlands), consulting engineer, 95, Linden Gardens, Bayswater, London. Date of oath of allegiance, December 10th, 1914.

Roll of Honour.—Private Matthew Partington, of the 3rd Loyal North Lancashire Regiment, an employé at the Preston electricity works, has been killed by a bomb dropped from a German aeroplane.

Private Thomas Turner, of Dukinfield, who was employed as a driller at the generating station on Tame Valley, has been wounded whilst serving with the 1st Shropshire Light Infantry.

Lance-Corporal Ernest Mann, a motorman on the Manchester tramways, has received an official intimation that he is to be recommended for distinction for conspicuous bravery in the field.

Sergt. William E. Sayle, of Bispham, a driver on the Blackpool and Fleetwood tramcars, has been killed in action whilst serving in the Scots Guards.

REVIEWS.

Test Questions in Wireless Telegraphy. Series 1 and 2.—The Students' Library. London: The Wireless Press. Price 1/- each set.

These test questions are published in the form of a series of cards, 38 in Series 1 and 48 in Series 2. They are intended for students who are beginning to take up "wireless" as a profession, as well as for amateur wireless experimenters, and they provide a convenient means of testing knowledge.

Series 1.—This series of 38 cards comprises 228 questions, roughly graduated from the very elementary principles of magnetism, electrostatics and current electricity up to questions involving considerable technical knowledge of wireless operations. In places the graduation is very rough, and in the cards numbered 1 to 10 there is needless repetition and very little method in the choice of questions; card 11 on the induction coil and the series of cards on waves show a much less random selection. The questions on the technical part of the work are certainly calculated to search out the weak points of the student who sets himself to work conscientiously through them, but even here a certain reckless mixing of easy and difficult questions is to be regretted.

The cause of the trouble is probably to be found in the suggestion that the student "can either choose a card at random, taking a new card each day, or he can work steadily through the set in numerical order." It is fairly obvious that one set of cards can scarcely hope to serve both purposes—the "random selection" method demands quite a different arrangement of questions from the "work through in order" method, and where the cards fail is in the attempt to fulfil these two conditions simultaneously.

Series 2.—This series of 48 cards comprises 288 questions, covering the whole of the ground in the theoretical section of the P.M.G.'s examination. The questions dealing with electricity and magnetism are based on the ordinary text-books, those which deal with wireless telegraphy on Hawkhead's Handbook of Technical Instruction for Wireless Students and those concerned with regulations on the P.M.G.'s Handbook.

The failing noticed in Series 1 is conspicuous by its absence in Series 2, the questions being graduated with obvious care. This series is, indeed, admirable in every way, and the first 20 cards could be worked through with advantage by any student of applied electricity, while to the students of wireless the whole set should prove an invaluable aid to a mastery of both the theoretical and practical sides of his subject.—P.H.S.K.

Anleitung zum Bau Elektrischer Haustelegraphen Telephon Kontrol und Blitzableiter Anlagen. Berlin: Aktiengesellschaft Mix and Genest. 7th Edition.

This book, which was first published in 1890 and has now reached its seventh edition, occupies a position in the literature of weak-current installations somewhere between the ordinary maker's catalogue and the scientific text-book, though much nearer the latter than the former. Although it is published under the auspices of one of the large makers in this branch of the industry, and is illustrated by means of their own particular make of apparatus, the method of treatment distinguishes it entirely from the mere trade catalogue. It contains a clear and orderly account not only of the apparatus itself but of the principles underlying its construction and of the applications for which it is suitable.

It is, in fact, just the kind of book that the user, or intending user, with little technical knowledge would wish to have at hand as a guide to what can and cannot be accomplished by electricity in the house, office or works, in certain directions.

The contents deal with domestic bells and telephones, telephone exchanges, special types of telephone, mine signalling, sources of energy, line erection, and lightning conductors.

Electric Wiremen's Work. By J. H. Havelock. 1914. London: Crosby, Lockwood & Son. Price 5/- net.

It is to be feared that Mr. Havelock lacks a due sense of proportion—at any rate as regards the relative importance of different sections of a wireman's work. For example, he devotes a large proportion of the first section of the book to the working out in every detail of a series of simple calculations, many of them by logarithms to 4 decimals, when a brief statement of the equation and the answer (which most people would work out on a slide rule) would have sufficed. Again, he wastes some 40 pages in reprinting I.E.E. rules and similar matter which one can obtain free from any insurance company.

The result of this is to fill up the book with a large amount of comparatively valueless material, whilst many important subjects are scarcely treated at all. The whole subject of wiring in every kind of building, for example, (except mills and factories, which get an extra page), is dismissed in one-and-a-half pages, with another three pages of diagrams of but little real value. Again, there are nearly twenty pages of "problems" reprinted from old examination papers, but no diagram of any inter-communication system of telephones—one of the commonest requirements of the wireman.

. Such a subject as the best method of wiring to suit various conditions is ignored entirely, as is also that problem, the answering of which is so important to the contractor, viz., which is the cheapest way to run wires between various lights, switches, etc., with due regard to economy of material and labour?

Whilst these defects are very apparent, there is much in the book which is of value. The chapters on practical work are the most useful, and the suggestion that every wireman should be able to diagram out a wiring problem and make sketches of his work is excellent. The statement that "all sketches should be neatly dimensioned" would have been more pointed if it were not for the fact that out of the seven sketches that are reproduced as illustrations four are without dimensions!

Mr. Havelock has made a framework on which a useful book could be built, but there must be a good many omissions and additions and a number of corrections to the present matter before the book attains to its best value.

Light, Radiation, and Illumination. By Paul Högner; translated by Justus Eck. London: *Electrician* Printing and Publishing Co. Price 6/- net.

It would have been better, we think, if this book had been published primarily as a mathematical treatise, for looking at it from a practical point of view we have to confess ourselves very disappointed. The preface announces that it is "intended to assist electrical engineers, architects, and others in planning lighting installations, with special reference to arc lighting." The last paragraph, however, points out that "an exact mathematical solution is not always possible . . . as so many causes influence the result in uncertain ways," etc., etc. Although this may be read in the preface we find in the text abstruse calculations which are carried to a very fine point. It should be a comparatively easy matter to amend the formulæ given so that they could quickly be applied and understood by those whose mathematical knowledge is only elementary, and yet be sufficiently correct for all practical purposes.

The first chapter deals with light emission from surfaces, and the formulæ are given in such a manner that many prospective readers would put the book down at once; in fact, it is assumed that one is thoroughly acquainted with the rules and laws relating to the subject. Light emission from bodies is next dealt with, and generally speaking all the steps in the calculations are clearly shown, but unfortunately we begin to stumble over some of the many mistakes which the volume contains. Too much is taken for granted, as for example on page 9, $I = \frac{1}{8} d^2 \times \pi \times h\,(1 + \cos \alpha)$ is said to be "easily seen"; similar "obvious" statements occur throughout the book, and are not conducive to its being well understood.

Having considered matter relating to the above headings we arrive at the real object of the work and learn of the light emission from arc lamps. This subject is well treated from all points of view, and the author is very frank regarding the lack of reliability of that type of unit. Many interesting and useful facts regarding illumination are closely dealt with.

Again somewhat cryptic references are made, and it is unfortunate that nearly all the elaborate tables given contain a multitude of figures which compare a 10-ampere old type of arc lamp with a modern 12-ampere proprietary flame arc, so that they can be of but little service. The pages following may possibly be useful to some engineers, but we very much doubt whether the matter put forward will appeal to any but those who have a large amount of time on their hands. We have very carefully studied the formulæ and tables, and as yet fail to realise their practical importance save for those particular lamps for which they are worked out; conclusions may be drawn which are entirely erroneous, especially since full details of conditions are not given. This is particularly the case with table XXV, and we think that the author could be, with advantage, more explicit; also many illuminating engineers will disagree with the statements put forward, for the arguments savour of considerable bias. The figures in table XXVI, which state the minimum requisite illumination, are in many cases very similar to American figures, and are abnormally high when compared with English practice. The writer fails to point out that the sizes of the units with which he deals are somewhat prescribed. In example 2, on page 48, there is apparently one of the frequent omissions which the book contains.

Unidirectional illumination is next considered, and again one finds remarks which are seemingly contradictory; careful study will, however, disclose the fact that the punctuation of the fourth paragraph of section 35 is incorrect; nevertheless the matter itself is of exceptional interest.

The book concludes with a section entirely devoted to calculation methods; these are full of novel features but of doubtful service, for although curves and tables are worked out in a most elaborate manner, the context itself leaves much to be desired in the way of explanation, and we are of the opinion that in the stress of modern business it is almost impossible for the engineer to prepare the necessary data for every type of unit which might be used; the methods given are ingenious but laborious.

As previously stated, this work contains much for those wishing to study the subject treated from an academic point of view. It is to be regretted that the author has confined his attention to certain units; had he generalised his examples and tables the book would have been of greater service. We would also suggest that more care might have been taken in the proof-reading, since errors and seeming contradictions abound, so that the book is scarcely of the standard usually attained in the admirable series published by our contemporary.

BUSINESS NOTES.

Consular Notes.—SPAIN.—The United States Consul at Seville says:—There is a special call at this time for electrical machinery. The Consulate already has received inquiries from firms desirous of importing electrical motors, &c., but the smaller lines of supplies, fixtures, &c., will probably be furnished, as heretofore, by a German firm that has a factory for this class of goods in Barcelona. There are several well-equipped electrical goods stores in Seville, and people of the better class are taking to the use of fans, irons, water-heaters, foot-warmers, and kindred articles, all of which are shown here. The import duty, however, has been an obstacle to the development of the trade. Electricity is supplied at low rates for industrial purposes, and there is a growing tendency towards a larger use of electrical equipment. Most of the smaller towns and villages are, or are being, equipped with electric light. Catalogues, if they are to be of any use at all must be in the Spanish language and include the quotation of net prices, weights per unit and in quantities, numbers packed in the case, quotations on complete machines, including all accessories, measurements set up and knocked down, and probable cost of packing and shipping. It is scarcely necessary to say that a salesman with the actual goods to show can do more business in an hour than catalogues in a year.

Trade During 1914.—The Mirrlees Watson Co., Ltd., report that their brisk business of the last few years slackened off materially during the first half of 1914, mainly because sugar planters with phenomenally good cane crops had to be content with phenomenally low prices for their products. Foreign financial dislocation, through the war, has further depressed matters, preventing some promising schemes from maturing, and hindering the placing of much customary business of a less degree of importance. Shipping difficulties, increase in cost of material, and shortage of labour, have accentuated that trouble, particularly as regards the latter, no fewer than 77 men from the offices and workshops having left to join the Territorials and Regulars. Notwithstanding all this, a fair amount of work has been undertaken, and prospects for the coming year seem good. Apart from the sugar-making and general machinery departments of the business, it may be mentioned that the condensing department has been kept employed throughout. Amongst the larger sizes of installations is one for the Leeds Corporation electricity works, the surface condenser in this case having 46,000 sq. ft. cooling surface—probably the largest surface condenser in existence. A very large number of rotary air pumps of "Mirrlees-Leblanc" type have been supplied, including several for the Maritime Service, and we understand that the working results have been very satisfactory. A steam "Multijector" air pump on a new principle is now being made for marine purposes.

The *Chamber of Commerce Journal* for January contains that journal's usual annual trade review—if anything can be called usual relating to last year. It comprises 60 pages of matter written by experts in leading trades and industries, and reports from special correspondents in all Home, commercial and industrial centres. In the editorial, of which an advance proof has been sent to us, the writer takes a very hopeful view of the outlook, confirming the opinion of the Chancellor of the Exchequer that after the war there will be some four or five years of prosperity for British industries. On the question of the capture of German trade, the writer expresses the opinion already voiced in our own pages, that it is for the Government and commercial men alike to carefully study the possibilities of Germany unloading stocks of goods here at below cost price after the war, and to devise means for dealing with this problem, which will be so urgent and difficult in the near future.

Calendars and Diaries.—MESSRS. NALDER BROS. AND THOMPSON, LTD., of 97A, Dalston Lane, London, N.E., have sent us one of their wall calendars with monthly sheets for 1915; it is of the usual size and in the familiar style.

From MESSRS. THERMIT, LTD., of 27, Martin's Lane, London, E.C., we have received, as in previous years, a pocket note-book, with calendars for 1915 and 1916. The opening 36 pages contain illustrated material concerning the Thermit process and some general information.

MESSRS. STEWART & LLOYDS, LTD., of Winchester House, E.C., adhere to the same form and appearance as in previous years for their wall or desk calendar for 1915; monthly cards are fitted in a white frame bearing a gilt monogram, the whole forming one of the neatest of the New Year souvenirs that reach us.

THE VICTA ELECTRICAL CO., of 60, Queen's Road, Battersea, S.W., have issued a wall calendar for 1915, with monthly slips.

From MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C., we have received a wall calendar with weekly slips. The words 1837 and 1915, placed on either side of a view of the Tower of London, remind us that the business is one of the oldest established in the industry, while the excellence of the calendar shows that the firm knows how to do a thing well in 1915.

A calendar with monthly sheets has been received from the NAVY EMPLOYMENT AGENCY, of 25, Victoria Street, S.W., where from among men who have served in the Royal Navy or Royal Marines, engineers, artificers, electricians, mechanics and other workmen, can be engaged.

MESSRS. BRECKNELL, MUNRO & ROGERS, LTD., of Thrissell Street, Bristol, have prepared a wall calendar with neat and small monthly date slips below a view of London. An impressive panoramic view executed in effective colouring embraces both sides of the Thames, as seen looking up the river from the Tower Bridge, bringing within its compass the many buildings and other features typical of metropolitan and national greatness coming between the Tower of London on the one hand, and the Houses of Parliament on the other. With feelings of pride, one is reminded of Blucher's celebrated remark, "What a city to sack!"

THE WESTINGHOUSE BRAKE CO., LTD., of 82, York Road, King's Cross, N., have issued a calendar for 1915. Monthly tear-off sheets each bear a half-tone illustration of an application of the Westinghouse-Morse silent rocker-joint chain drive.

DAVENPORT ENGINEERING CO., Bradford.—A calendar for 1915 has been issued by the firm. The card depicts some of the firm's cooling towers and a block of daily date slips with clear figuring is attached.

MR. CHARLES H. BLUME, of Fitzalan Square, Sheffield, is sending out two good rules to his friends, one is of 5 in. in length and can be used as a letter opener; the other is, of course, to use "Megomac" and "Insulac" varnishes.

MESSRS. GILLESPIE & BEALES, of Amberley House, Norfolk Street, Strand, W.C., have issued a war calendar which is bound to be a favourite. Its strongly patriotic note and the unobtrusive manner of printing of the firm's name will ensure for it a place on our own walls, and we can give no better testimony. The design includes the flags of the Allies, the heads of their respective nations, and our military and naval leaders in the struggle. The importance of our naval and aerial fleets is fully taken into account pictorially.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, has prepared a large hanging calendar, with a sheet for every month of 1915. The calendar differs as usual from all others received at this office, by reason of the fact that each sheet includes the preceding and following month in addition to the current one. Each sheet contains a bird's-eye view of the Rugby Works and an illustration of one or other of the firm's manufactures.

THE VARLEY MAGNET CO., LTD., of Woolwich, have issued a serviceable wall calendar for 1915, with monthly tear-off sheets.

From MESSRS. MAWDSLEYS, LTD., of Zone Works, Dursley, we have received a wall calendar, with neat little monthly date slips for 1915. In the selection of a subject for the pictorial feature, "Her Favourite Flower," which is executed in colour, the firm have shown the excellent taste that has always marked their choice in such matters.

Bankruptcy Proceedings.—WILLIAM HENRY WOOD, electrical engineer, Lorna Doone, School Lane, Hall Green, Birmingham, Warwick.—The adjourned public examination of this debtor was held at the Court House, Corporation Street, Birmingham, last week, before Mr. Registrar Lowe, when debtor returned his liabilities at £470, and his assets at £1,228, the estate disclosing an apparent surplus of £759. He stated that he did not consider himself to be insolvent, but that owing to the action of a limited company, of which he was managing director, in refusing to pay his salary, and in making an illegal call on shares, he had been forced into such a position that he could not immediately meet his liabilities, but his assets more than covered them. Questioned by the Official Receiver with regard to the assets, debtor said that the book debts were due from the company of whose action he complained, and they were the subject of an action now pending, the company disputing their liability to pay him. Nevertheless he regarded the debts as good, and he should say that if the company had got any money they ought to pay the debts. He admitted that the only tangible asset was a small balance from the furniture. In October, 1912, he acquired the lease of half an acre of land at King's Road, Tyseley, upon which a factory was built, and a limited company was promoted for the purpose of carrying on the business of electrical engineers, and especially for manufacturing machine-made brass work for most trades. He borrowed money to equip the factory. In April, 1913, the company was registered with a nominal capital of £8,000, and altogether about 6,000 shares were subscribed for. He agreed that the concern had a fair amount of working capital, and that there was no reason why it should not have been successful. Friction arose between the directors and debtor, and he was requested to keep away from the works, at any rate for a time. This he protested against through his solicitor. From that time his salary ceased. The complaint against him was that the work was not turned out as it might be, but he pointed out that the offence, whatever it was, was condoned by a subsequent agreement he had with the company on terms which, if the concern had been successful, would have paid him better. This was dated January 9th last, and no further complaints were made. He had received no notice to terminate his services. The examination was closed.

For Sale.—Coventry Electricity Department have for disposal by tender one 600-KW. McLaren-Siemens generating set, particulars of which are given in our advertisement pages.

Electrical Industry in Scotland.—A correspondent writes:—"Electrical firms in Glasgow and the West of Scotland are pressed with orders. The Electric Control, Ltd., have supplied several very large controllers, including four 600-H.P. three-phase controllers for high-pressure hydraulic pumps, each taking 900 amperes to start, and many automatic sets for air compressors in shipyards, of 200 to 350 H.P. The firm are now fulfilling the order for the automatic controllers for what will be the largest electric lifts in the United Kingdom, each lift being operated by 250-H.P. three-phase motors. Messrs. Drysdale & Co., Ltd., Yoker, Glasgow, have provided a large installation of electrically-driven pumping plant for the Port of London Authority for use as impounding pumps. A feature in shipbuilding work is the growing popularity of the 'Hele-Shaw Martineau' electric hydraulic steering gear. At present Messrs. John Hastie & Co., Ltd., are completing four sets for new battleships, and two sets for torpedo-boat destroyers, and also a large number of sets for Diesel motor vessels. A Glasgow firm has orders in hand for plant for Japan, Sumatra, South America and Australia, in addition to all descriptions of electric plant for ordnance and ammunition workshops. The 'Quartowatt' electric heaters have been placed on board many new ships, including various new British India liners, to take the place of steam heating. The West of Scotland firms have a good share of urgent War Office and Admiralty work. An East of Scotland firm, Messrs. Hawthorn & Co., Leith, specialise in electric slipway haulage machinery, and are shipping out a set of 600 tons to Auckland Harbour, also a set of 800 tons capacity for Peru."

Spagnoletti Developments.—In regard to the recent enlargement in the business of Spagnoletti, Ltd. (established 1851), and the change in its title, we learn from the directors that a factory has been erected on an extensive site at Park Royal, London, N.W., and further, that the company will in future by known as the PARK ROYAL ENGINEERING WORKS, LTD. Except for additions, the directors and staff remain unchanged. The factories have been specially designed on up-to-date lines with a view to handling the large switchgear and instrument output manufactured for the Admiralty, War Office, and many Corporations to whom the company are contractors. A history extending over 63 years is a long one in the electrical trade, and so lengthy an experience, combined with well-equipped factories, should go far to ensure a successful career for the new company.

Catalogues and Lists.—BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price list No. 2,510 describes and gives dimensions of B.T.H. shaft couplings.

MESSRS. SIEMENS BROS. DYNAMO WORKS CO, LTD, Caxton House, Westminster, London, S.W.—The firm have issued a new eight-page printed list of lantern slides that are held in stock at Caxton House for lending free of charge to lecturers, schools, &c. The list has been revised and enlarged, and now consists of 208 different views, covering all classes of electrical machinery and apparatus manufactured by the firm at Stafford and Dalston.

EDISWAN & SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponder's End.—Four picture postcards have been issued, showing the application of Royal Ediswan drawn-wire lamps in different departments of the household. Quantities bearing customers' names, &c., will be supplied on application. The company have also issued correspondence poster stamps as a "Symbol of Electric Service."

GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—New illustrated and priced leaflet (O.S. 1.878) of Osram half-watt drawn-wire lamps, 1,000 and 2,000 C.P. Also No. O.S. 1,852, a new four-page list, the front page of which bears the "leading light" coloured poster design (reduced, of course !), the contents being illustrated particulars and prices of various types of Osram lamps with bayonet caps.

MESSRS. J. H. TUCKER & CO., King's Road, Hay Mills, Birmingham.—New folder (No. 1) describing their latest ironclad switch.

DAVENPORT ENGINEERING CO., Bradford.—This publication consists almost entirely of half-tone photographic views of Holehouse's patent natural draught chimney cooling towers as supplied by the company to various electric light and power authorities, collieries, and woollen mills, also line drawings of interiors of the towers.

MESSRS. SIMPLEX CONDUITS, LTD., 116, Charing Cross Road, London, W.C.—Thirty-six page list, giving descriptive information regarding their Plexsim system of electric heating and cooking, and illustrations and prices of a complete range of appliances, including many designs of kettles, irons, hot-plates, &c. Four distinct types of electric ovens are illustrated, and electric urns, large and small water-heaters, hot cupboards, and larger electrically-heated appliances are also shown.

Dissolutions and Liquidations.—SCHLEYDER'S ECONOMIC STEAM FURNACE (CONTINENTAL), LTD.—This company is winding up voluntarily, with Mr. R. W. Ednie, of Craven House, Kingsway, WC., as liquidator. A meeting of creditors was held on January 4th.

FELGATE INSTALLATION CO., LTD.—A meeting of creditors is called for January 11th, at the Reading Gas Co.'s Lecture Hall, by the liquidator, Mr. A. G. West.

ARGENTINE ELECTROLYTIC SYNDICATE, LTD.—A meeting will be held at 17, Albion Street, Hanley, on February 8th, to hear an account of the winding up from the liquidator, Mr. R. E. Clark.

ABBOTT, POPE & CO., builders and electrical engineers, 248, Belsize Road, Kilburn, N.W.—Messrs. J. Abbott and A. Pope have dissolved partnership. Debts will be attended to by Messrs. Abbott & Pope, at 42, Bolton Road, St. John's Wood, N.W.

SPAGNOLETTI, LTD.—In pursuance of Sec. 188 of the Companies' (Consolidation) Act. 1908, a meeting of the creditors will be held at 34 and 36, Gresham Street, London, E.C., on January 19th. The Park Royal Engineering Works, Ltd., purchased the entire issue of debentures in Spagnoletti, Ltd., and the new factory now being completed, the liquidation of Spagnoletti, Ltd., has become necessary. Certain of the assets, in which are included the stock and book debts and work in progress, have been transferred to the Park Royal Co. in full satisfaction of the debentures, the new company at the same time having undertaken to discharge all the existing trade liabilities of Spagnoletti, Ltd. The meeting is a formal one.

Machine-Stoking at Blackpool.—MESSRS. EDWARD BENNIS & CO., LTD., of Little Hulton, Bolton, have installed four of their chain-grate stokers at the Blackpool Corporation electricity works, fitted with the Bennis-Miller-Bennett patent links, the distinctive feature of which is the device of halving the link at the point of junction with the next link in the series, making an uninterrupted sequence which, it is claimed, prevents the admission of excess air. The grates are fitted to water-tube boilers of the B. & W. type. An 8-hour test made with new slack, having a calorific value of 12,012 B.TH.U., gave an evaporative duty, as from and at 212° F. per lb. of coal, of 9·7 lb., and a total thermal efficiency of 78 per cent. Two chain-grates were at first supplied to the order of the Corporation, and the results being in every way satisfactory, the order was given for two additional grates. The grates are working with natural draught. This and other successful installations are mentioned in a pamphlet on "Chain-Grate Stoking," recently issued by Messrs. Bennis, copies of which may be had on application.

Italy.—H.M. Consul at Rome (Mr. C. C. Morgan) reports that an agent in that city wishes to secure the representation of United Kingdom manufacturers of electrical goods. The name can be ascertained at the Board of Trade Commercial Intelligence Branch, London. Other inquiries should be addressed to the British Consulate, Rome.

Book Notices.—The *Practical Electrician's Pocket-Book and Diary.* Edited by H. T. Crewe. London S. Rentell and Co. Price 1s. net.—The sixteenth edition of this popular pocket-book has been issued, having undergone an exceptional rearrangement and condensation ; new chapters have been added, on electric clocks, electricity in coal mines, and distributing systems, and new sections deal with half-watt lamps, C.T.S. wiring, Zed fuses, &c. Not the least of the attractions of this little companion is the neat format and excellent printing by which it is distinguished ; the illustrations are particularly good, and so long as the present high standard of production and composition is maintained, the book need fear no competitor.

"Samuel F. B. Morse : His Letters and Journals." Edited by E. F. Morse. London : Constable & Co. Price 31s. 6d. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LIII, No. 239. January, 1915. London : E. & F. N. Spon, Ltd. Price 3s. 6d.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXX, Part 6. December, 1914. Newcastle-upon-Tyne : The Institution. Price 5s.

"*Bulletin* de la Société Internationale des Electriciens." Vol. IV (3 series), No. 37. July to December, 1914. Paris : Gauthier-Villars et Cie. Price 2 fr. 50.

"Automatic Telephony." By A. B. Smith and W. L. Campbell. London : Hill Publishing Co., Ltd. Price 17s. net.

Deed of Assignment.—GEO. BRAULIK, 8, Lambeth Hill, E.C., &c., electrical engineer.—Mr. G. E. Corfield, the trustee in this matter, in giving a statement of his receipts and payments, says that the terms contained in the deed of composition and assignment between the debtor and his creditors, has so far been carried out. The trading operations of the debtor, under his supervision, are being well maintained, and he expects to be able to fully carry out the conditions of the deed and eventually discharge the whole of the said composition of 10s. in the £.

Trade Announcements.—The business of Alderman R. H. Mason, electrical and general engineer, of Lorne Street, Oswestry (Salop), has been taken over by MESSRS. DARLING AND LLOYD.

THE MIDLAND ELECTRIC WIRE CO., LTD., or Leicester, have removed to Lutterworth, and all communications should be addressed there in future.

The address of the firm mentioned in the first of our trade announcements last week, is 32, County Buildings, Corporation Street, Birmingham, not 32, Corporation Street.

LIGHTING and POWER NOTES.

Accrington.—NEW GAS PLANT.—The electrical engineer reports that the new No. 3 gas producer plant is now in operation, and the gas cleaning and sulphate plant has had trial runs. The gas-engine plant arrangements are progressing, but only one new engine is at present in use. The total fuel cost per unit generated by the steam plant was ·379d., and for gas plant ·273d.

Argentina.—Residents in the city of Santiago del Estero being dissatisfied with the charges made by the Compania Eléctrica del Norte, appointed a Special Committee to study the contract made between the Government and that company. As the municipal authorities will do nothing, the public have decided to defend themselves. The Committee thinks that the reason of this municipal indifference is that they owe the company more than $20,000, and do not, therefore, dare intervene.—*Review of the River Plate.*

Ascot.—SEWAGE PUMPING.—The Windsor R.D.C. has decided to consider electricity for sewage pumping as an alternative to the Diesel plant originally proposed. The estimated capital cost of the installation—current being taken from the local works—is £4,775, made up of the following items :—Mains in duplicate, booster, &c., £2,750 ; two 100-H.P. motors and pumps, one 80-H.P. motor and pump, £1,200 ; building, £500 ; foundations £100 ; contingencies, £225. The estimated annual cost is £720.

Australia.—The Melbourne City Council is proposing to substitute metal filament for carbon lamps for renewals of not less than 40 watts and to charge an extra ½d. per unit when such renewals are carried out by the Council.

It is proposed to invite tenders for 62,500 assorted metal lamps, at an estimated cost of £3,906. The city electrical engineer estimates a reduced revenue of £6,000 per annum owing to the change.

The Coonamble (N.S.W.) Municipal Council has entered into an agreement with the Australian Electric Supply Co. for electric lighting in the town.

The Toowong (Q.) Council has decided to establish an electric lighting scheme for the town and to apply for an Order in Council.

The Dalby (Q.) Council has prepared plans and specifications for an electric lighting scheme.

The Brunswick (Vic.) Council has accepted the offer of the Commonwealth Bank of a loan of £10,000, for extending the electric light and power system in the city. It is proposed to introduce electricity into every street in the municipality.—*Tenders.*

Barrow.—The electrical engineer reported that it would be necessary, at an early date, to consider some further extension, with a view to maintaining the pressure at Walney. A 150-kw. rotary converter has now been installed at the Furness Railway Works, and a balancer and switchgear has been fitted in the Furness Abbey sub-station.

Beaconsfield.—In order to safeguard the Council's interests, the U.D.C. has decided to formally oppose the London Electric Supply (No. 2) Bill.

Belfast.—Extension Scheme.—The Corporation has approved, subject to certain conditions, of the extension scheme submitted by the Tramways and Electricity Committee on the report of the city electrical engineer; the cost is estimated at £28,301.

Birmingham.—Temporary Supply Station.—At a recent meeting of the City Council, the Electric Supply Committee were to ask permission to erect and equip a temporary supply station at Nechells, at an estimated cost of £97,000, to meet the urgent demands of local manufacturers engaged on Government work. In view of the urgency of the work it is proposed to proceed with it in anticipation of L.G.B. sanction. To meet normal demands it was intended to install 5,000 kw. of temporary plant at the Aston Manor station, but since the end of September applications for the supply of 11,000 kw. for power purposes have been received, and a still greater demand is anticipated. Of the estimated £97,000 to be spent on the temporary plant, some £10,000 for buildings, foundations, &c., will cease to be remunerative when the plant is dismantled. The permanent Nechells power station will not be available for supply purposes until the winter of 1916-17.

Bradford-on-Avon.—Prov. Order.—The U.D.C. has sent a letter to Mr. J. H. Edwards, of Bristol, asking when he intends exercising the powers granted him by the prov. order for E.L.

Bradford.—It is stated that despite the war, the number of units turned out at the electricity works is constantly increasing. Slight extensions of plant are being made when new textile buildings are erected, but, says our correspondent, it appears to be a somewhat difficult task to persuade owners of old mills to install electricity.

Brighouse.—The Electric Power Sub-Committee has recommended the Electricity Committee to make a further reduction of 1d. per unit for the supply of energy through a generator for cinematograph purposes, subject to a minimum consumption of 3,000 units per annum.

Chile.—A decree has been published approving the scheme presented by Don Herman Bernales for the installation of an electric lighting and power system for the town of Casablanca. —*Board of Trade Journal.*

Continental Notes.—Belgium.—The Belgian town of Zeebrugge, which has become prominent during the war, is at the mouth of the Bruges Ship Canal. Its entrance lock is equipped with 80-ft. wide rolling gates operated by electric motors. An adjacent power station, which contains two 200-h.p. Willans steam dynamos supplying d.c. at 440 volts, is reported to have been destroyed by British warships, together with the lock gates.

Spain.—A concession has been granted to the Sociedad Anonima Hidro-electrica Ibérica, to utilise the waters of the Rio Mijares, in the district of Fanzara, for the production of electric power.—*Board of Trade Journal.*

Coventry.—New Sub-Stations.—The City Council has decided to purchase land in Walsgrave and Foleshill Roads, for the erection of electricity sub-stations.

Cuckfield (Sussex).—Prov. Order.—The B. of T. has called the attention of the R.D.C. to the stipulations of the prov. order granted to the Mid-Sussex E.L. and P. Co. which had not been carried out, and asking for the Council's observations as to the order being revoked. The Council has decided to make no observations on the subject.

Darlington.—Extension Scheme.—The Electricity Committee has prepared a scheme for the extension of the works, comprising new generating plant and the erection of larger buildings, the cost being estimated at £20,000.

Dover.—New Plant.—A Sub-Committee of the Electricity Committee has been formed for the purpose of considering the steps to be taken to provide for additional alternating current plant, to ensure completion of the work by next autumn.

Edinburgh.—Electrical Trades Protest.—The local electrical traders have petitioned the T.C. against the clauses in the proposed prov. order, giving the T.C. power to supply and hire electrical apparatus (except for lighting), and to open showrooms in the city, &c. The protest has been signed by a 100 firms in the trade as well as by 35 firms on behalf of the local Ironmongers' Association. Amongst other things, it is stated that the Corporation has not accepted the offer of co-operation by the traders made as a result of previous proposals of the same kind. There are also numerous private electrical showrooms in the city. The terms of the prov. order will be considered by the T.C. on January 12th.

Esher.—Thames Flood.—Owing to the flooding of the river at Molesey, water entered the low-lying pipes of the Twickenham and Teddington Electric Supply Co., and the Esher supply was cut off.

Finchley.—Year's Working.—With reference to the note which appeared in our last issue under this head, we are informed that there was a credit balance shown in last year's accounts of £2,278, not a debit balance of £2,116, as mentioned by our correspondent.

Frinton.—The Frinton and District E.L. and P. Co., Ltd., has decided to appeal against the assessment of its undertaking. The appeal will be defended by the Assessment Committee of the Tendring Union.

Glasgow.—For about 15 minutes, on Saturday evening, the centre of the city was deprived of its electric light, and much inconvenience was caused among the shopping crowds and the spectators at picture houses. The cause was a short circuit on two of the mains leading from Port Dundas power station, with the consequent overloading of the machinery running at the time. As the tramways department supplies its own power, the cars were not interfered with.

Greetland.—The Electrical Distribution of Yorkshire, Ltd., has informed the U.D.C. that it had not been able to proceed with the erection of the sub-station at Greetland on account of the war, but the estimates for the station would be considered early in the new year, and it was hoped that the building would soon be in course of erection.

Halifax.—The Electricity Committee has refused an application made by the War Refugees' Committee for the free use of electricity in the houses occupied by Belgian refugees.

India.—According to the *Indiaman* the Madras Government has had before it during several years a scheme for generating electric power from the Pijkara Fall for the purpose of lighting the principal stations on the Nilgiris. As it is more than probable that this enterprise will not soon emerge from its present form, the Municipal Council of Ootacamund has passed a resolution, subject to the approval of Government, sanctioning the employment of Mr. Fulton, representing a Ceylon firm of electricians, to prepare plans and estimates for a proposed scheme to light the station and supply power to private and business houses. The idea is to derive the power from the St. Lawrence Lake. The estimated cost of the enterprise is Rs. 50,000.

Llandudno.—Proposed Loan, &c.—The Urban Council has decided to make application to the L.G.B. for sanction to borrow £926 for supplying and laying a new feeder cable from the works to a feeder pillar to be erected in Mostyn Street. The Council refused the application for a free supply of electricity for the headquarters of the local Battalions of the Welsh Army Corps, and ordinary rates are to be charged.

London.—Greater London Scheme.—The Standing Conference of Metropolitan Municipal Electricity Undertakings has passed a resolution to the effect that the L.C.C. electricity scheme is prejudicial to the development of electricity supply in London, and to the interests of the Borough Councils owning electricity undertakings, and contrary to the interests of the ratepayers.

Bethnal Green.—The Electricity Committee is to submit to the B.C. an estimate of £15,914 for the supply and laying of cables, &c., in connection with the new electricity undertaking. The Committee proposes to stipulate in the contract for cables and accessories that they shall be of British manufacture.

Woolwich.—Bulk Supply, Loans, &c.—The B. of T. has sanctioned the arrangement for bulk supply of electricity between the Woolwich B.C., the South Metropolitan Electric Light Co. and the West Kent Electric Co.

The Electricity Committee has consulted Sir John Snell with a view to his report, submitted to the Council in 1912, being brought up to date. This report has been considered by the Committee, and an estimate has been forwarded to the Finance Committee of the further expenditure, amounting to £32,935, necessary to complete the works recommended. In addition to the 3,000 kw. turbo-alternator now on order, further boilers, and another 1,000-kw. motor-converter are necessary. The Council has authorised the Committee to obtain tenders for the necessary plant, and, if necessary, the services of Sir John Snell will be obtained to interview the L.C.C. with a view to obtaining the longest periods for the repayment of the proposed loan.

Marylebone.—The returns of the Electricity Department, for the September quarter of 1914, show that 2,811,607 units were sold, a decrease of 972 units as compared with the previous year. The revenue was £30,203, an increase of £43, and the generation and distribution expenditure £15,152. Due to more economical plant the generating costs were ·573d. per unit as against ·644d. in the 1913 September quarter. For the half-year to September 30th, the amount available for capital charges was £31,597 as against £29,992, and the increase in the available balance amounts to £1,605.

The B.C. has decided to petition against the L.C.C. Greater London Supply Bill and the London Electric Supply (No. 2) Bill.

Maidenhead.—The T.C. has decided to appoint a station superintendent at the electricity works, in order to free the electrical engineer for other necessary duties.

Manchester.—Owing to the darkness of the Christmas holidays, the consumption of electricity for the three days showed a considerable increase, the figures being, for 1914, 594,400 units, and, for 1913, 583,820 units, an increase of 10,580 units.

A representative of the Withington Committee of the Corporation has been deputed to interview the chairman of the Electricity Committee as to lighting main roads at Withington by electricity.

New Zealand.—Lake Coleridge Scheme.—The inauguration of the hydro-electric power scheme took place on November 25th, the Premier, the Hon. W. F. Massey, switching on the current.—*New Zealand Shipping and Commerce.*

Nottingham.—Proposed Loan.—The Electricity Committee is recommending the City Council to apply for sanction to borrow £20,000 for underground mains and services.

Oldham.—Supply of Motors.—With reference to complaints which have been made by the Chamber of Trade that the electricity department of the Corporation is competing with the local electrical traders in the supply of motors, a deputation of the E.L. Committee is to meet the Chamber to make a statement on the matter. At a meeting of the Electricity Committee last week it was stated that the complaints of the Chamber were very unfair. The Committee tried to work with the traders, but if a man came to the electricity station and would not go to a private trader for a motor, it was only natural that the Corporation should supply him, rather than lose a customer for energy.

Loan Sanction.—The T.C. has received the sanction of the L.G.B. to a loan of £40,000 for additions to the plant at Greenhill Works, and for the provision of cooling towers.

Runcorn.—Prov. Order.—Subject to the work being carried out within a given period, the R.D.C. has decided to consent to the application of the Warrington T.C. for a prov. order in the parishes of Stockton Heath, Latchford Without, Thelwall, Grappenhall, Lower and Higher Walton, and Appleton.

Salford.—Proposed Loans, &c.—The Electricity Committee has decided that in all cases where separate premises in the occupation of one consumer are supplied with energy at the sliding scale of charges, such premises be regarded as separate premises, and charged accordingly, except in the case of a consumer under contract where the conditions of supply are specifically agreed upon. Application is to be made to the L.G.B. for sanction to borrow £18,252 for the provision and equipment of a transformer station in the Greengate District, and £25,000 for the extension of H.T. mains and provision of L.T. mains.

Walsall.—The R.D.C. has concluded an agreement with the Walsall Corporation for a supply of energy to the new pumping station at Rushall. A new showroom was opened on Tuesday, in connection with the Sales Department.

West Bromwich.—Proposed Loan.—The T.C. has been recommended to apply for sanction to borrow £2,450, required to cover the cost of future extensions of mains.

Wimbledon.—The B.C. has decided to supply electrical energy to houses occupied by Belgian refugees and their helpers, also to the Wimbledon Recruiting Committee for lighting purposes at 1½d. per unit.

The borough electrical engineer, as the result of a canvass in Worcester Park, is to include applications signed by 17 residents in the application to be made for permission to supply electricity in certain roads in Worcester Park.

Wrexham.—The T.C. has arranged to supply current to the military huts being erected at 3d. per unit, and to extend the mains along King's Mills Road, to supply new property, and to provide five public electric lamps in place of gas.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Tramway Purchase.—The Corporation Tramways Committee has received a letter from the Suburban Tramways Co. regarding the proposed purchase of the undertaking by the T.C., stating certain terms and conditions upon which a basis of purchase might be arranged. It is understood that the terms mentioned would be about equal to a payment of 30s. per share to the shareholders of the company.

A petition against P.A.Y.E. cars from users of the tramways in Great Western Road and adjoining streets has been sent to the T.C. The petitioners state that these cars are disliked by both drivers and conductors; that risk of accidents is incurred by drivers having to operate the barrier regulating the exit, thereby diverting their attention from the front; and that the conductors have to stand on the platform of the car practically motionless, having no opportunity of exercise, and consequently during the winter season the cold will be most trying. The petition concludes by asking that these cars be at once discontinued, and the former system reverted to.

Brighouse.—The General Purposes Committee has decided not to consent to the Halifax Corporation's tramway proposals in Brighouse.

Belfast.—The Corporation tramways are not giving the results anticipated, the reason given being the number of extensions recently made, which have not proved remunerative enough to defray the expenses incurred. The war, too, has seriously affected the traffic, no fewer than 16,000 Belfast men, exclusive of reservists and special reserve men and yeomen, having left to join the new armies since the war opened.

Chile.—The anti-German riots in Valparaiso, originating in the doubling of the tramway fares, were repeated for several days and necessitated cavalry charges, in which several persons were injured, to disperse them. In the meantime the tramway cars have been boycotted.—*Review of River Plate.*

Continental.—Italy.—Electric traction has just been introduced on the Turin and Savona Railway, for passenger traffic only, on the section of the line across the Apennines, between the latter town and Coval, a distance of 29 miles. This section, which is the heaviest part of the line, includes the Belbo tunnel, about 3 miles in length, with maximum gradients of 1 in 40. The maximum speed is 31 miles per hour. Savona, after Genoa and Venice, is the principal coal port in Italy; it is also an important manufacturing town, with large steel works.—*Railway Gazette.*

Derby.—Electric Tower Wagon.—The Corporation has purchased an Edison electric tower wagon for use in connection with the electric tramways. The vehicle, the chassis of which is designed for a load of 20 cwt., is equipped with a battery of 60 Edison cells having a capacity of 190 ampere-hours, or sufficient to enable a distance of 42 miles to be covered, at an average speed of 12 miles per hour.

Doncaster.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £8,550, £5,500 of this being for the purchase of six new tramcars.

Halifax.—Proposed Tramway Extension.—The Tramways Committee has decided to extend the tramway track to Southowram, on condition that the Southowram U.D.C. guarantees to pay £200 per annum for the first five years, £150 per annum for the second five years, and £100 per annum thereafter, such payments to terminate when the undertaking to Southowram is financially successful.

Huddersfield.—Arrangements for the extension of the tramways *via* Bradford Road to Brighouse have now been completed by the two Corporations.

London.—Stepney.—With reference to the opposition of the B.C. to the electrification of the L.C.C. tramways in Grove Road and Bordett Road, except on the conduit system, the B. of T. has intimated to the Council that it would not be prepared to withhold consent from the proposals of the County Council on the ground that that authority do not propose to equip the line on the conduit system, or on the ground that the lines are to be renewed in such a way as to facilitate their equipment for electric traction on the overhead trolley system. The Board submitted a copy of a communication from the Poplar B.C. showing that the boroughs of Poplar, Hackney and Bethnal Green have agreed to the overhead system, &c.

Northampton.—Owing to the war, the new tramway to Far Cotton has not yet been fully brought into use, due to the delay in completing a railway crossing near the terminus. It is hoped that as a result of negotiations with the railway company the full service will shortly be inaugurated.

Rhondda.—Proposed Tramway Extensions.—The U.D.C. is applying for powers to construct additional lines of electric tramways in the district.

Salford.—Car-Shed Extension.—The T.C. is to be recommended to apply for permission to borrow £6,553 to cover expenditure connected with the erection and completion of a proposed extension to the central car depôt at Pendleton.

Stainland.—The U.D.C. has decided to support the Halifax Corporation Bill, which provides for extensions to the tramway system.

Stoke-on-Trent.—Tramway Accident Inquiry.—As a result of the Coroner's inquest into the death of the driver—who was found dead on the platform of his car after it had run away on December 14th—evidence was given showing that the car was equipped with the air-brake, but that only the driver could control it; also that the conductor did not apply the hand-brake on account of the greasy nature of the rails. Medical evidence showed that the driver died through rupture of an aneurism of the heart, which might result from a sudden strain, and that this would not have been detected from examination. On behalf of the company it was stated that some of the cars were so equipped that the conductor could control the air-brake, but people might tamper with the apparatus. Mr. Dickinson, Birmingham Corporation tramways, who examined the car and found it in good order, said that his Corporation had 300 cars fitted with a controlling device at the rear, and more were on order. The verdict was in accord with medical evidence, with a rider respecting the provision of rear control of the brakes.

U.S.A.—Tube Railway Fire.—On Wednesday morning an outbreak of fire occurred on the New York Subway at a time when it was crowded with traffic. We gather that some cable insulation became ignited at a time when, according to the *Times*, some 500 trains, containing 300,000 people, were at a standstill. Several hundred passengers were rendered unconscious by the smoke, and were rescued by through gratings at street-level by the fire brigade, one person being killed and at least 200 injured, The subway service will be suspended for some days.

TELEGRAPH and TELEPHONE NOTES.

A Telephonic Probe.—In the *British Medical Journal* Sir J. Mackenzie Davidson points out the difficulty of accurately localising a bullet or other foreign body with the X-rays, unless stereoscopic X-ray photography is employed. On the other hand, he states that the telephone can be advantageously used for this purpose by connecting one terminal to a moistened electrode which is applied to the patient's skin, and the other terminal firmly to a metallic instrument such as a probe or forceps. Directly the probe touches metal embedded in the tissues, a grating sound is heard in the telephone, due to the voltaic cell thus formed. This method, especially when employed in conjunction with stereoscopic photography, greatly reduces the time occupied in the search and the disturbance to the patient's tissues. On the other hand, it is stated that in modern warfare the removal of bullets from the body is not very necessary, as their presence is usually without harmful effects.

Argentina.—The Government having proved that two steamers belonging to the Hamburg South American Co. which fly the Argentine flag had misused their wireless installations, thereby infringing Argentine neutrality, has issued a decree on the question. By this all coasting vessels are to have their apparatus sealed by the port authorities, and some are only to be used in case of danger. Wireless operators are to be Argentine citizens and will be considered as agents of the maritime authorities.—*Review of River Plate.*

Bolivia.—Owing to difficulties which have arisen in connection with the carrying out of the contract entered into some months ago by the Government of Bolivia and the Marconi Co., for the erection of a number of wireless stations, Congress has now authorised the Executive Power to rescind the contract.—*Review of River Plate.*

Cheap Telegrams for the Forces.—Special arrangements have been made for the transmission of week-end letter telegrams at about one-fourth the rate of ordinary telegrams between British sailors, soldiers and nurses in Europe and the extra-European British possessions. Inquiries concerning casualties will be transmitted free of charge. These arrangements do not apply between this country and the Continent.

Illicit Wireless Apparatus.—Amateurs who have not surrendered or otherwise got rid of their wireless apparatus of all kinds should take warning from the case of R. Softley, of Ramsgate, who was fined £15, with the alternative of six weeks' imprisonment, for being in possession of apparatus in sections without the written permission of the Postmaster-General. Evidence was given that the parts could have been assembled in four hours, and would then have been capable of receiving wireless messages from Germany.

Romford.—The master of the Romford Workhouse is to draw up plans and estimates for reorganising the whole of the intercommunicating telephone system, the service having been disorganised owing to the recent rough weather. It is proposed to connect up five more buildings in the institution.

Storm Interruptions.—The effects of the storm on December 28th were even more serious than was at first supposed, especially in respect of telephonic communication; up to Friday last London was cut off from the north beyond Birmingham, from the West of England and from Ireland. The telegraphs were much less affected. The trouble was much reduced by the effective cooperation of the telegraphs and telephones. The interruptions were due to the force of the wind, and not, as usual, to soft snow clinging to the wires.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY.—March 15th. Municipal Council. Transformer testing apparatus. Specification from City Electrical Engineer. A copy can be seen at the Board of Trade C.I. Branch in London.

ADELAIDE.—January 27th. Accumulators, and power board, for Postmaster-General. See "Official Notices" December 18th.

February 10th. Testing instruments, for Postmaster-General. See "Official Notices" January 1st.

February 17th. Victorian Railway Commissioners (Spencer Street, Melbourne). 3,300 tons of steel rails, 232 tons of steel fishplates, 5,000 flame arc carbons for arc lamps. Specification, &c., may be seen at the Board of Trade Commercial Intelligence Department in London.

BRISBANE.—January 13th. Switchboard cable, for Postmaster-General. See "Official Notices" to-day.

March 10th. Motor-generator, power board, &c., for Postmaster-General. See "Official Notices" to-day.

PERTH.—February 10th. Telephone switchboards and parts, for Postmaster-General. See "Official Notices" to-day.

Beckenham.—January 25th. U.D.C. One 120-KW. D.C. generator and switchgear to couple to 120-KW. steam alternator. See "Official Notices" to-day.

Birkenhead.—January 12th. Twelve months' supply of electric motors and motor-starters, from ½ to 15 H.P., for the Corporation electricity supply. See "Official Notices" Dec. 18th.

Bolton.—February 11th. Corporation. Low-tension sub-station switchgear, for the Electricity Department. See "Official Notices" to-day.

Croydon.—January 25th. General stores, for the Corporation Tramways Department, for a year. The Manager, Thornton Heath.

Dublin.—January 13th. Twelve months' supply of electrical fittings, for the Dublin Port and Docks Board. Forms of tender from the Secretary, Port and Docks Office, Westmoreland Street.

Hong Kong.—January 15th. Two 1,500-KW. (2,000 K.V.A.) turbo-alternators with condensing plant and switchboards, E.H.T. cable, sub-station switchboards and transformers, for the North Point generating station. See "Official Notices" Dec. 18th.

Leeds.—January 22nd. Overhead electrically-driven travelling crane, coal and ash-conveying plant, for Electric Lighting Department. See "Official Notices" December 11th.

January 16th. Steam coal (small slack, smudge, or similar material), for the Electric Lighting Department, during the year ending March 31st, 1916. Mr. C. N. Hefford, Manager, 1, Whitehall Road.

Leyton.—U.D.C. Repairs, &c., to cooling tower, for Lighting Committee. See "Official Notices" December 18th.

Liverpool.—January 14th. Electrical generators and switchboard at Mill Road Infirmary, Everton, for West Derby Union. Mr. H. P. Cleaver, Union Offices, Brougham Terrace, Liverpool.

London.—L.C.C.—January 26th. Platelaying, &c., for electric tramway, Grove Road and Burdett Road, &c. Specifications, &c., from Mr. G. W. Humphreys, County Hall, Spring Gardens, S.W.

January 12th. Two steam turbo-generators of 8,000 KW., with auto-transformers, &c., for Greenwich generating station. See "Official Notices" January 1st.

Manchester.—January 19th. Tramways Committee. (*a*) Permanent way special track work, and (*b*) permanent way points, tongues, and hardened steel centres. Specifications, &c. (£1 1s. returnable), from Mr. J. M. McElroy, general manager.

New Zealand.—WELLINGTON.—February 28th. Public Works Department. 18 step-down transformers, for the Lake Coleridge power scheme. Specification at the Public Offices, Wellington.

Plymouth.—January 21st. Corporation. Twelve months' supply of carbons, A.C. meters, transformers, cables, oils, waste, &c. See "Official Notices" to-day.

Redditch.—U.D.C. Two turbo-alternators, each 1,000 KW., with condensers, cooling tower, &c.; two synchronous motor-alternators of 300 KW. and 150 KW. respectively. See "Official Notices" to-day.

Shanghai.—January 12th. 68 three-phase induction motors, various sizes between 5 and 60 B.H.P., with slide rails and liquid starters, for Municipal Council. See "Official Notices" December 25th.

Spain.—CANARY ISLANDS.—February 25th. Direccion General de Obras Publicas, Madrid. Construction and working, for a period of 60 years, of an electric tramway in San Cristobal de la Laguna, in the Canary Islands. An option on the concession is held by the "Sociedad Tranvias Eléctricos de Tenerife."—*Board of Trade Journal.*

February 10th. Four electric cranes, for the Junta de Obras del Puerto de Valencia, Valencia. Particulars may be seen at the Board of Trade Commercial Intelligence Department, London.

February 10th. Electric lighting installation at Teruel. Municipal Authority.

Tunbridge Wells.—January 26th. Cooling tower and pipework, two water-tube boilers, economisers, mechanical stokers, pipework, and feed heater, for Borough Electricity Works. See "Official Notices" January 1st.

CLOSED.

New Zealand.—The Auckland City Council has accepted the tender of Messrs. Richardson, M'Cabe & Co. for overhead cables, £943; lead-sheathed, £4,210 8s.; V.B. cables, £1,516.

Bradwell.—The Joint Isolation Hospital Committee has accepted the tender of Mr. John Richards, of Leek, for the installation of the electric light at the new hospital buildings, at £415. Three tenders were received, the highest being £494.

Derby.—The T.C. has accepted the tender of Messrs. Newton Bros. for an electric hoist, with motor, at £52 1s.

Dundalk.—The U.D.C. has received the following tenders for electric light wiring for artisans' houses :—Mr. T. P. Curran, Broughton Street, £73 19s. 8d. ; Messrs. Gaskin Bros., £66 ; and Mr. P. J. Watters, £79 13s. It was decided to accept the lowest tender, and to have all the houses wired, the engineer to submit a scheme which would enable electricity to be supplied for cooking purposes.—*Irish Builder*.

Eccles.—The Electricity Committee has accepted the tender of the British Westinghouse Co. to supply consumers' meters for a period of 12 months.

Glasgow.—The T.C.'s Committee on Health recommends acceptance of the offer (£3,976) by Messrs. Johnston, Park & Co., Glasgow, for the electrical installation at the new hospital at Robroyston. The Clyde Navigation Trustees have accepted an offer by Mr. Lackie, on behalf of the Glasgow Corporation, to make, for £105, the extension of the switchboard panels for the main cable connections in the electric sub-station at Yorkhill.

Grimsby.—The Public Lighting Committee recommends the acceptance of the tender of Messrs. Ed. Bannister & Co., Ltd., for an annual supply of Sherwood fine slack to the electricity works, at 6s. 4½d. per ton.

Liverpool.—The City Council has been recommended to accept the tender of the Edison Accumulators, Ltd., for the supply of a 2-ton battery electric motor vehicle for the Tramways Committee.

London.—STEPNEY.—The Electricity Committee reports having purchased 5,320 tons of coals for the Electricity Department at prices varying from 11s. to 16s. per ton.

The following quotations have been received by the Electricity Committee for a supply of carbons :—

	Per 1,000 pairs.
British Central Electrical Co., Ltd., France (accepted)	£13 3 0
National Carbon Co., U.S.A.	(F.A.S. New York) 10 16 6
Heap & Johnson, U.S.A.	15 12 6
The Electrical Engineering and Equipment Co., Ltd., Switzerland	16 0 0

The Committee states that it understands that there is only one firm at present manufacturing carbons in this country, and that this particular firm are not at the present time manufacturing carbons of the type required.

BETHNAL GREEN.—The B.C. Electricity Committee has received the following tenders for the supply of high and low-tension cables and for the execution of roadwork in connection with the scheme for the supply of current in the borough :—

Brit. Insulated & Helsby Cables, Ltd. .. (recommended)	£12,499
W. T. Henley's Telegraph Works Co.	12,586
Johnson & Phillips, Ltd.	12,618
Siemens Bros. & Co.	12,661
Western Electric Co.	12,734
Callender's Cable and Construction Co.	12,887
W. T. Glover & Co.	12,943
Union Cable Co.	12,949

Mr. H. W. Couzens says that the tender recommended is the lowest in point of view of the lump sum and also the schedules for the various classes of work required. The price quoted shows a saving roughly of £2,000 on Sir John Snell's estimate for the work contemplated, which, the Committee states, is largely due to the decrease in the price of copper. In view of the fact, however, that the price of copper is rapidly advancing upon the market price which obtained at the date of the tender, the Committee states that it is desirable that the contract should be proceeded with as early as possible, and it has, therefore, decided in accordance with Mr. Couzens's recommendation. The following tenders have been received for the supply of transformers and high and low-tension switchgear :—

	Two 500-K.V.A. and two 250 K.V.A. 3-phase transformers.	H.T. and L.T. switchgear for two sub-stations.	Total.
Johnson & Phillips, Ltd.	£924	£2,132	£3,056
Brit. Westinghouse Co. (recommended)	1,086	2 362	3,446
Electric Construction Co.	940	2,587	3,527
British Thomson-Houston Co.	1,122	2,705	3,827
Siemens Bros. Dynamo Works, Ltd. ..	1,100	3,050	4,150
Ferranti, Ltd.	996	Incomplete.	
Alternative	932		
Brush Electrical Engineering Co. .	900	—	—
Alternative	950	—	—
British Electric Transformer Co. ..	995 10s.	—	—
Alternative	1,004	—	—
Ferguson, Pailin & Co.	—	2,126	—
General Electric Co...	—	2,500	—
Switchgear & Cowans	—	2,856	
Reyrolle & Co...	—	3,271	—
Electrical Apparatus Co.	—	5,960	—

Reporting upon these tenders, the Committee states that in each section the lowest tender is based upon the assumption that the contractors will supply materials differing in some respects from those included in the specification. Mr. Couzens recommends the acceptance of the tenders of the British Westinghouse Co., which are practically identical with the specification. In this instance also the amount of the tender shows a substantial saving as compared with Sir John Snell's estimate.

Messrs. Napier-Kimber, Ltd., have received the contract for wiring for electric light at the National Health Insurance Commission, Leonard Street, E.C., for H.M. Office of Works.

Manchester.—The Educational Committee has accepted the tenders of Messrs. R. O'Brien & Co. and Messrs. R. Seddon and Sons for electrical work in various schools.

The Tramways Committee has accepted the tender of the J. G. Brill Co. for tramway trucks.

West Bromwich.—The tender of the British Westinghouse Co. is recommended to the T.C. for acceptance for a supply of E.H.T. and L.T. switchgear, and rheostats ; as is also that of the New Conveyor Co. for extending the coal bunkers at the works.

Woolwich.—The following tenders have been accepted by the Electricity Committee :—

John Spencer & Co.—Steam pipes, £91.
Mechan & Sons.—Water and exhaust pipes, £169.
Herbert Morris, Ltd.—Travelling crane, £355.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Saturday, January 9th. At 3 p.m. At Albemarle Street, W. Juvenile lecture on "Light in the Home," by Prof. C. V. Boys, F.R.S.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, January 9th. At 6 p.m. At Carlton Café, Queen Street, Cardiff. Paper on "The Prevention of Electrical Accidents in Mines," by Mr. T. J. Nelson.

Institution of Mechanical Engineers (Graduates' Association).—Monday, January 11th. At 8 p.m. At Storey's Gate, S.W. Paper on "Semi-Diesel Engines," by Mr. R. A. Pfleiderer.

Junior Institution of Engineers (Midland Section).—Tuesday, January 12th. At 8 p.m. At Imperial Hotel, Temple Street, Birmingham. Ordinary Meeting.

Association of Engineers-in-Charge.—Wednesday, January 13th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Electric Accumulators," by Mr. R. T. Mitchell.

Greenock Electrical Society.—Thursday, January 14th. Visit to Babcock and Wilcox's Works, Renfrew.

Institution of Electrical Engineers.—Thursday, January 14th. At 8 p.m. At Victoria Embankment, W.C. Paper on "The Shape of the Pressure Wave in Electrical Machinery," by Dr. S. P. Smith and Mr. R. S. H. Boulding.

Manchester Local Section.—Tuesday, January 12th. At 7.30 p.m At the Engineers' Club, 17, Albert Square. Paper on "The Shape of the Pressure Wave in Electrical Machinery," by Dr. S. P. Smith and Mr R. S. H. Boulding.

(Scottish Local Section).—Tuesday, January 12th. At 8 p.m. At Princes Street Station Hotel, Edinburgh. Paper on "Cables," by Mr. C. J. Beaver.

(Yorkshire Local Section).—Wednesday, January 13th. At 7 p.m. At Philosophical Hall, Leeds. Paper on "Automatic Protective Switchgear for Alternating-Current Systems," by Mr. E. B. Wedmore.

NOTES.

Copper.—The quantity of copper in stock and generally available for European consumption, known as European supplies, is, at the present time, of only relative value in estimating the copper position, as no returns of French or German stocks have been issued since July 31st, 1914. Messrs. Merton's statistical tables for December 31st, 1914, give this quantity as 35.432 tons. Deducting French and German stocks, the figure is 25 923, compared with 26,240 tons at the end of November, and 21,558 tons (with the same omissions) for the end of December, 1913. The figure for English stocks is 21,098. The quantity under the same head at the end of 1913 was only 15,258 tons.

Compared with the average for the 12 months ending July 31st, 1914, American supplies are still low, and Spain and Portugal to England and France, very low. From the not specifically detailed source "other countries," however, 8,521 tons have been received during the month, nearly double the average quantity received before the war. Chile shipments for December, 1914, were well above the pre-war average, Australian shipments being still rather below. Total deliveries, at 31,708 tons, are 9,167 tons higher than the preceding month.

Institution and Lecture Notes.—Birmingham and District Electric Club.—The tenth annual report of this club shows steady progress. The membership stands at 80 as compared with 72 on the corresponding date in the previous year. Mr. A. E. Morgan, who had been hon. treasurer since the formation of the club, resigned, and, as a mark of appreciation of his services, he was unanimously elected as hon. life vice-president. The report ended with a reference to the temporary loss of the valuable services of the popular hon. sec., Mr. W. G. L. Riddle, business calling him to the Far East. It was decided that the ordinary member's subscription should be reduced from 6s. to 5s. per annum. The balance in hand was £22 10s. 8½d.

Electrical Association of Australia. — The first annual general meeting of the Victorian Section of the Association took place on Monday, November 30th, when the formation of the new Society was celebrated by means of a "Smoke Social Evening." The Victorian Institute of Electrical Engineers has joined with the N.S.W. Electrical Association under the above new title; the the V.I.E.E. forms the Victorian Section.

What did the Glass Contain?—"Now we see only in a glass darkly, but when on the conclusion of peace we see things clearly we shall realise the degree of stability and stamina which has sustained the body commercial during the period of the war. It may be that *even our ancestors* will marvel that the strain, the wearing, nervous strain of the war, could have been borne with such fortitude, equanimity and resource, and with so little effect upon the everyday routine of the industry." That round table has much to answer for!

Portable Chemical Fire Extinguishers. — The British Fire Prevention Committee, after an extensive series of investigations, to meet the danger of badly made liquid chemical fire extinguishers, the defects in which had resulted in fatalities, has issued a complete specification, which covers all points as to size, strength, precautions against bursting, directions for use, facilities for testing, &c., of importance in such appliances. The public are reminded that ordinary buckets of water (together with hand pumps) are equally, if not more, effective in the majority of cases, and further, have considerable economic advantages for ordinary purposes.

American Electrical Exports for October.—The following data regarding the electrical exports from the United States for the month of October are published by the American *Electrical Review and Western Electrician.* The total value of electrical shipments in October was less than 60 per cent. of that for the corresponding month of 1913; it also was slightly lower than the total for September, but considerably higher than the figure for August, the first war month. In the four classes for which numbers of articles shipped are reported, there were exported in October the following:—electric fans, 428; arc lamps, 359; carbon-filament lamps, 38,293; metal-filament lamps, 229,168. In the following table are given the detailed figures for the different classes for October of last year and of 1913:—

	Oct., 1914.	Oct., 1913.
Batteries	$69,061	$73,078
Dynamos or generators	131,286	245,569
Fans	6,684	20,582
Insulated wire and cables	144,906	304,561
Interior wiring supplies, &c. (including fixtures)	47,551	86,039
Lamps—		
Arc	9,846	2,820
Carbon-filament	4,625	23,745
Metal-filament	42,007	16,918
Meters and other measuring instruments ..	34,418	—
Motors	229,605	411,784
Static transformers	40,655	150,838
Telegraph instruments (including wireless apparatus)	9,454	3,910
Telephones	64,544	190,875
All other	660,150	999,726
Total	$1,494,792	$2,516,415

Educational Notes. — NORTHAMPTON POLYTECHNIC INSTITUTE.—At the annual presentation of prizes and certificates by Lord Moulton last month, in his report on the session's work, Dr. R. M. Walmsley said that the reorganised system of evening education by the L.C.C. had deprived the Polytechnic of many junior students, but, on the other hand, the Post Office policy of improved staff education had added between 200 and 300 students to the classes in Technical Telegraphy and Telephony, theory and practice. The dearth of optical instrument makers was particularly serious at present, and made the completion of the new annexe specially desirable. All the engineering students had been placed in workshops during the summer vacation, or, in the case of certificated fourth-year students, had found favourable employment. About 250 students and members of the staff had joined the Colours, and the war had naturally reduced enrolments this session by several hundreds.

Lord Moulton said that his work as chairman of a special Board of Trade and Government Committee had shown him to what an extraordinary extent England had become industrially dependent on Germany. The time had gone by when industrial success depended on making the best of limited available scientific knowledge. There were now available stores of information on which it was possible to base definite policies with the certainty of success, and the country which best took advantage of such information would lead all others in industrial competition. To some extent England had undoubtedly fallen behind other countries, among them Germany, in securing and applying technical education, but given the realisation of the extreme importance of basing our own work on what was already known—and hence of voluntary devotion to preliminary study and labour—England could and must show that she was no more intellectually and industrially decadent than she was decadent in military prowess.

KING'S COLLEGE.—FACULTY OF ENGINEERING.—Next term begins on Wednesday, January 13th. Particulars are given in our advertisement pages to-day.

Legal.—CLAIM FOR ELECTRICAL GOODS.—In the City of London Court, on Tuesday, before Mr. Assistant Registrar Tattershall, a claim was made by Otto Bohndel, proprietor of Schoen Bros., electrical accessories manufacturers, 29, Cock Lane, against Messrs. S. H. Lewin & Co., electrical engineers, 29, Walton Street, Chelsea, for the sum of £1 10s. 2d. for electrical switch-blocks supplied. The defendant, Mr. Lewin, was said to have given the order for the goods to the plaintiff personally. The defendant, who was requested to cross-examine the plaintiff, said:—"We are perfectly well aware we owe the money, but these goods are made in Germany. We have had the pleasure of doing business with Schoen Bros. for 10 or 12 years, and I have paid their accounts." When the war started they received a demand for payment of the account, but to that he took exception, and as a patriotic Englishman, confided it to the waste-paper basket. They then had a letter from a debt collecting agency, but he gave instructions to his clerk to write across it "We object to pay, because we are patriotic. The goods were made in Germany, and I do not intend to pay unless the Registrar says we shall." They had been in business for 14 years, and they were one of the best firms, he supposed, in London. That was the first summons they had been served with. He had had the honour of sending seven men to Kitchener's Army. The Assistant Registrar: Life is short. We do not want a long address upon patriotism. You admit you have had these goods. The defendant: I do. The Assistant Registrar: Pay in 14 days. The Defendant: German made, Sir.

The Trade War.—The campaign which is being carried on in the *Evening News* against Germany's trade, on Monday dealt with "British Enterprise in Electrical Trades." The article contains a proportion of truth, but is, in the main, so ill-informed and inaccurate, that it is liable to produce very erroneous impressions on the mind of a layman. In particular, the statements which it makes regarding the private telephone manufacturing business are utterly nonsensical. The public are informed that before the war all the British private telephone companies bought their telephones from the Germans, but that two months after the war broke out a British engineer established "a factory where all the instruments required for the private telephone companies in this country could be manufactured." This piece of British enterprise is described as "distinctly encouraging." The author of these wild statements appears to be unaware of the fact that there are at least eight large telephone factories in this country, most of which have been established for many years, and that these are capable of producing all the private telephones required for our needs. He goes on to say that the same thing may be said in regard to metallic-filament lamps, which can be obtained of British make, "at prices which compare most favourably with those formerly made in Germany." The prices are exactly the same as before the war, and the lamps have been manufactured in this country on a very large scale almost from the commencement. In justice we must commend the last three paragraphs of the article, in which the writer points out that an enormous amount of the ratepayers' money has been paid for German electrical goods, which ought to have gone into the pockets of British workmen.

Of course, our readers know all about these facts, but it is a pity that the general public should be misled by the daily Press.

Blackpool Traders' Exhibition.—The electricity and tramways department took a very prominent position at the Exhibition which was held last month, and erected a very fine stand for the display of electric heating and cooking apparatus; the exhibit of electric light fittings was left to the electrical contractors, and five of the principal contractors in the town had stands close to what was known as the Corporation Electricity Bureau. The display of up-to-date electric cookers and fires was a very large one, most of the principal electrical manufacturers' products being shown.

The Corporation also conducted demonstrations and lectures twice daily, and the skilled operations of Mrs. Mole, M.C.A. (Gold Medallist) Principal, Eustace Miles School of Cookery, London, attracted large crowds; it is hoped that the result will be that many of the existing consumers will adopt the Corporation's new rateable value tariff of ½d. per unit. The total number of electric cookers and ovens on exhibition was 18, and there were no fewer than 108 electric fires. A considerable amount of literature was distributed, and the electricity department soon felt the benefit from the Exhibition, as the contractors installed during the past month something like 100 electric fires in the residences of consumers.

It is a settled policy on the part of the British Commercial Gas Association to introduce, on every occasion where possible, a counter-attraction to that of the electricity undertaking. This was obvious from the display which the gas department and the ironmongers in the town made at the Blackpool Exhibition, for some 56 gas ovens and 68 gas fires were exhibited. Steps were also taken to counteract the publicity campaign of the electricity department in the local Press; the latter department has for some time adopted a policy of this character, with the result that the revenue has gone up at the rate of £1,000 per quarter. The importance of carrying on an effective propaganda of this kind can hardly be over-estimated; the British Gas Association has set an admirable example, and it is most desirable that the electricity supply industry should co-operate on similar lines, and carry the war into the enemy's camp.

The activity of the gas department in challenging on every possible occasion the propaganda of the electricity supply is shown by the following incident:—Some months ago, Mr. Charles Furness, the borough electrical engineer, advocated in Committee the desirability of opening a showroom in a central part of the town for the display of electric heating and cooking apparatus, but without any intention whatever of selling direct to the consumer. His reason for this recommendation was that whereas every ironmonger in the town was an indirect agent for the gas department and displayed gas cooking apparatus for the information of the consumer, the electrical contractor in Blackpool was generally content with an office and had no facilities for the display of electric heating and cooking apparatus. The recommendation was adopted by the Committee, but immediately it was known that this department had taken a shop for the purpose of a showroom, the gas department came along with a similar resolution for premises adjacent to the electricity showroom.

To this Mr. Furness had no objection whatever, but when the matter came before the Council, both the resolutions were rescinded. There is no proof that the rescission was engineered by the local gas interests, but upon the face of things it looks suspicious.

The showroom scheme having been defeated, the only alternative for the electricity department is to be represented on every occasion in the local exhibitions, and to distribute in literature and publicity matter, at least what would have been spent in rent for the showroom.

Appointments Vacant.—Wireless telegraph operator (£250), for Government of St. Lucia; junior engineer-in-charge (£91); switchboard attendant (30s.), temporary, for Newport electricity department; switchboard attendant (30s.), for Plymouth electricity works; power station superintendent, over 25, for Maidenhead electricity works; shift engineer (£104) for Birmingham electric supply department; traffic superintendent (£150) for Darlington Corporation; mains assistant and shift engineer (35s.) for Radcliffe U.D.C.; chief assistant (£117), also shift engineer, for King's Lynn electricity works; junior shift engineer (30s.), for Luton electricity works. Particulars are given in our advertisement pages to-day.

Radium Hospital.—The new radium laboratories of Manchester Infirmary, which contain radium of the value of £20,000, were formally opened last week by the Lord Mayor.

Inquiry.—A correspondent wishes to meet with a firm selling high-class second-hand electric light fittings.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Dublin Corporation, on Monday, appointed MR. EUGENE ALLAN, son of Mr. Fred. Allan, secretary of the Council's Electricity Committee, to the position of superintendent of public lighting, city gas examiner and official meter tester, at a salary of £200 per annum, rising by annual increments of £20 to £300. Mr. Mark Ruddle, city electrical engineer, had reported that Mr. Allan's testimonials showed him to be well qualified for both gas and electrical sections. Mr. Allan secured 43 votes against 19 given for the next candidate. A motion to have the position re-advertised on the ground that the letter describing the qualifications of the 10 candidates assured the Council that nine were not qualified, was rejected by 54 votes to 13, and a further motion for the rejection of Mr. Ruddle's report was defeated by 41 votes to 17.

MR. A. J. BECKETT, borough electrical engineer at Bridlington, has received a commission in the engineering branch of H.M. service. The T.C. has granted him leave of absence, and appointed MR. F. FFRENCH as deputy electrical engineer.

MR. H. G. WRIGHT has been appointed temporary assistant mains engineer at the Dover electricity works

MR. J. COLLINGE has been appointed to the position of station superintendent at the Salford electricity works at his present salary.

Will MR. WILLIAM ROZE, recently junior engineer-in-charge in the Belfast Corporation electricity department, communicate with Mr. A. Nichols Moore, borough electrical engineer, Town Hall, Newport, Mon. ?

MR. A. HELLEWELL, of Govan, has been appointed shift engineer at the Eccles electricity works. MR KING, of Newcastle-on-Tyne, has been appointed temporary shift engineer.

General.—The marriage took place at the Parish Church, Knaresborough (Yorks.), on December 29th, of MR. ARTHUR R. FARRAR, of the firm of Farrar & Co., electrical engineers, of Bradford, and Miss Fearnside, elder daughter of Mr. Fearnside, of Yorke House, Knaresborough.

MR. OSBORNE, assistant telegraph superintendent for the Tonbridge Postal District, who has retired after 50 years' service, has been presented by the staff with a gold watch.

MR. H. FOUNTAIN, C.M.G., has been appointed Assistant Secretary to the Commercial Department of the Board of Trade, in the place of Mr. G. J. Stanley, C.B., C.M.G., retired. Mr. Stanley continues to assist the Board in an advisory capacity.

The *Times* states that the marriage of MR. O. W. F. LODGE, eldest son of Sir Oliver Lodge, to Winifred, only daughter of Dr. W. N. Atkinson, H.M. Inspector of Mines, took place on December 31st at St. John's, Cardiff.

MR. C. F. MACKNESS has resigned the appointment which he has held for the last 11 years as manager of the London office of the A.E.G. Electrical Co. of South Africa, Ltd. (late agents for the A.E.G. of Berlin, Foreign Department), and has joined the staff of Messrs. Vickers, Ltd., London, as assistant manager of the electrical department, as from the 1st inst.

We tender our congratulations to MR JOHN COWAN, the founder of the Stirling Boiler Co. in this country, and who has been its chairman since its inception, upon the honour of Knighthood, conferred upon him in the New Year's List. MR. E. G. CONSTANTINE, who has been associated with the company for many years, has retired from active business and resigned his position as managing director, remaining, however, a director of the company. He is succeeded in the management by MR H. J. S. MACKAY.

MR. H. L. AINSWORTH has resigned his position as head representative to Messrs. J. & H. Grevener, of London, and has joined the British Thomson-Houston Co., Ltd., as representative for London to their wiring supplies department.

Obituary.—We regret to learn that MR. GEORGE STEGMAN, principal in the firm of Stegman & Co., Clapham Junction, passed away on Tuesday, December 22nd, after a long and severe illness. The business will be carried on as usual.

The sudden death of MR. JOHN HOUISON, engineer, Methil, who had been in charge since the opening of Methil Dock, of the power department, is reported.

NEW COMPANIES REGISTERED.

Pullan Engineering Co., Ltd. (138,851).—This company was registered on January 1st, with a capital of £3,000 in £1 shares, to take over the business of an electrical engineer and merchant carried on by C. Pullan at 80, King's Arcade, Bradford. The subscribers (with one share each) are: G. Pullan, 80, King's Arcade, Bradford, electrical engineer; C. H. Best, 72, Market Street, Bradford, incorporated accountant. Private company. The number of directors is not to be more than five; the first are C. Pullan, H Best, V. Learoyd, and W. Myers. Qualification, 25 ordinary shares. Remuneration as fixed by the company. Registered office: 80, King's Arcade, Bradford.

B. T. Gardner and Co., Ltd. (138,839).—This company was registered on January 1st, with a capital of £1,000 in £1 shares, to take over the business of electrical engineers and contractors carried on by B. T. Gardner & Co. at 6, Fox Court, Holborn, W.C., and to adopt an agreement with B. T. Gardner. The subscribers are: B. T. Gardner, 44, Royston Avenue, South Chingford, electrical engineer, 5 shares; H. Boocock, 23, Bryanstone Road, Crouch End, N., shopfitter, 10 shares; D. J. Gaillard, 50, Crookham Road, Parsons Green, S.W., electrical engineer, 5 shares. Private company. The number of directors is not to be less than two or more than five; the first are B. T. Gardner, H. Boocock and D. J. Gaillard. Solicitors, Needham & Barrow, 34, Essex Street, Strand, W.C. Registered office: 6, Fox Court, Gray's Inn Road, W.C.

Devon and Cornwall Acetylene Co., Ltd. (138,842).—This company was registered on January 1st, with a capital of £500 in £1 shares, to experiment with and exploit any chemical and electro-chemical processes, to manufacture and deal in carbide of calcium, ferro-alloys, oxygen and similar products, to carry on business as electricians, manufacturers of electrical and mechanical plant, etc. The subscribers (with one share each) are: C. Bingham, 11, Queen Victoria Street, E.C., merchant; A. S. Young, 11, Queen Victoria Street, E.C., merchant. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. No qualification necessary. Remuneration as fixed by the company. Registered office: 223, Mansion House Chambers, 11, Queen Victoria Street, E.C.

Strand Electric Supply Co., Ltd. (138,813).—This company was registered on December 30th, with a capital of £6,000 in 400 cumulative preference shares of £5 each, 1,500 preferred ordinary and 2,500 ordinary shares of £1 each, to carry on the business of an electric lighting and power company in all its branches. The subscribers (with 50 shares each) are: A. A. Douglas, Brandon, Colwyn Bay, manufacturer; J. Herbert Edwards, Haresfield, Stonehouse, Glos., engineer. Private company. J. Herbert Edwards is the first managing director. Qualification, 50 shares. Solicitors, Seymour Williams & Co., 38, Parliament Street, Westminster.

Electro Galvanizers, Ltd. (138,767).—This company was registered on December 24th, with a capital of £20,000 in £1 shares (12,000 first pref., 5,000 second pref., and 3,000 ord.), to carry on the business of engineers and contractors, galvanisers, inlayers of metals, electro-platers of metals and other substances, metallurgists, metal workers, electro chemists, etc., and to adopt an agreement with W. G. Elliott. The subscribers (with one share each) are: H. E. G. Jarvis, 25, Ely Place, Holborn Circus, E.C., articled clerk; H. Handley, 4, Cromwell Road, Walthamstow, clerk. Private company. The number of directors is not to be less than two nor more than five; the first are D. Livingston and W. G. Elliott (both permanent). Qualification, 100 shares. Remuneration (except managing director), £100 each per annum and a percentage of the profits. Registered office: 18, St. Swithin's Lane, E.C.

Wadebridge and District Electric Supply Co., Ltd. (138,776).—This company was registered on December 24th, with a capital of £3,450 in £1 shares (1,250 six per cent. pref.), to carry on the business of electric light and power producers and suppliers, gas works owners, electrical engineers, supply agents for electric [illegible], etc., and to enter into an agreement with C. D. Minns, of Obnassi, Gold Coast Colony, West Africa. The subscribers (with one share each) are: C. E. Hannoford, The Cottage, Felbridge, East Grinstead, artist; A. Wright, Station Road, Sidcup, Kent, electrical engineer; W. Phillips, Court Place, Wadebridge, Cornwall, land owner. Private company. The number of directors is not to be less than two or more than five; the first are C. E. Hannaford, A. Wright, and W. Phillips. Qualification, 50 shares. Registered office: 1, [illegible], Wadebridge, Cornwall.

Bedale and District Electric Supply Co., Ltd. (138,794).—This company was registered on December [illegible], with a capital of £3,000 in £1 shares (2,000 pref.), to carry on at Bedale, Yorks, or elsewhere in the United Kingdom, the business of proprietors of an electric light undertaking. The subscribers (with one share each) are: C. H. Best, 72, Market Sereet, Bradford, incorporated accountant; R. W. Smith, 4, The Villas, Bedale, electrical engineer; W. Metcalfe, Elmwood House, Leeming Bridge, Bedale. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. The holders of the pref. shares have the right to appoint two directors, except when the total number in office does not exceed three, when one shall suffice to represent such shareholders. Qualification, £25. Remuneration as fixed by the company. Registered office: 72, Market Street, Bradford.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Telephone Development Co. (1912), Ltd. (121,272).—[illegible]

Universal Electric Contracts, Ltd.—Mortgage debenture, [illegible] taking and property, present and future, including uncalled capital. Holder: [illegible]

Rhondda Tramways Co., Ltd.—A memorandum of satis- [illegible]

North-Eastern Electric Smelting Co., Ltd.—A memor- [illegible]

Julius Sax and Co., Ltd.—Capital £18,000 in £1 shares. [illegible] 1914 [illegible] £5,995 [illegible]

Stearn Electric Lamp Co., Ltd.—Capital £4,070 in £10 [illegible] 1914 [illegible] shares taken up, £70 paid, £4,000 [illegible] mortgages and charges [illegible]

CITY NOTES.

The Siemens-Schuckert Group of Companies.

The Rhenish-Schuckert Co.

The directors of the Rhein Schuckert Gesellschaft fur Elektrische Industrie of Mannheim, as in the case of certain other companies, report that the balance-sheet for 1913-14 has been carefully prepared, having regard to the present state of affairs. After setting aside £25,000, as in 1912-13, as reserve fund for investments, and making other appropriations, the accounts show net profits of £56,000, as compared with the same amount in the preceding year. The dividend proposed is at the rate of 5 per cent. on share capital of £400,000 and at 2½ per cent. on new capital of £1,500,000; the sum of £10,000 has been placed to the extraordinary reserve fund, as in 1912-13, and £5,000 to the pension fund, leaving £18,000 to be carried forward, as against £17,000 in the previous year. Besides being interested in a number of undertakings, the company carries out constructional work, and the directors state that they hope to be able to continue this work with the diminished staff now available.

The Schuckert Electricity Co.

The report of the Elektrizitats A.G. vorm. Schuckert Co., which has been merely an investment company for some years past, and which is joint proprietor with the Siemens and Halske Co. in the Siemens-Schuckert Works, states that the company's own undertakings and those in which it is also financially interested experienced satisfactory results in the year ended with July 31st, 1914. The general backward movement in trade which had been occasioned by the warlike complications in the Balkans had reached a standstill, and the directors therefore would have proposed a dividend of at least the same amount as in 1912-13 if a new situation had not been created by the outbreak of the world-war at the beginning of the new financial year. Having regard, however, to the state of war, they had estimated the assets in a particularly careful manner and recommended a dividend of 6½ per cent. as compared with 8 per cent. in the previous year. The report proceeds to state that the influence of the war would naturally also be felt in connection with the company's undertakings in the present financial year. It had been possible everywhere to maintain the working and to continue the execution of extensions of supply stations, especially as a greater demand for electrical energy was being manifested in order to economise the stocks of petroleum. The company had participated in the formation of the Nuremberg War Credit Bank, in the subscription to the National War Loan, and in various benevolent funds in connection with the war, and had made provision for the families of employés who had been called to the colours. After giving details of the manufacturing and other investments in different countries, the report sets forth the following figures:—

	1913-14.	1912-13.
Share capital	£3,500,000	£3,500,000
Loan capital	2,365,000	2,215,000
Gross profits	412,000	484,000
General expenses	25,000	22,000
Interest on loans	103,000	84,000
Depreciation	700	700
Net profits and balance forward ...	304,000	364,000
Allocation to special reserve fund ...	—	5,000
Dividend	227,000	280,000
Dividend, per cent.	6½	8
Carried forward	66,000	63,000

The reserve fund is returned at £485,000 and the special reserve fund at £50,000. The holding in the Siemens-Schuckert Works remains at £2,247,500 for the ordinary capital and at £1,250,000 for the perpetual 6½ per cent. loan advanced by the two proprietary companies.

The Siemens & Halske Co.

The report of Siemens und Halske A.G. for the year ended on July 31st, 1914, states that the year terminated on the eve of mobilisation, and the working results, therefore, were not directly affected by the influence of the war. In general, the year had the character of increasing improvement. But, on the other hand, the accompanying phenomena of the war which had arisen in the meantime and the unknown developments of the future rendered necessary a specially careful examination of the list of assets in the balance-sheet. It had been emphasised for years past that particular care had been taken in this direction, but for the past year the company went beyond the usual measure, and also proposed to reduce the dividend from 12 to 10 per cent. In this way it was believed that the company would appropriately meet the various points of view which concerned the question of the computation of the dividend. The permanent investments in foreign companies, partly situated in hostile countries, stood in the books at amounts which also took into account the risks existing in time of war. It was obvious in a period of serious economic convulsion like that caused by the war that the electrical industry was considerably involved, because its manufacturers were to a large extent of the kind through the employment of which greater perfection in economy was obtained, but in war time requirements of that nature were only on hand to a smaller degree. As a consequence, the orders received by the works for articles of peace in the new financial year were considerably below the average of the corresponding period in previous years. As, however, the company from the beginning had occupied itself very fully with the requirements of the Army and the Navy in the matter of electrical equipment, and had participated in the development of new branches, an assured compensation was offered in the new spheres of work for the slacker activity in peace manufactures. In addition, the plant had been accommodated as much as possible to further military needs and had been placed at disposal. At the time of the report being printed the staff of the firm and of the Siemens-Schuckert Works had contributed to the colours 3,588 officials and 9,938 workmen, or a total of 13,526 men. The directors expressed the belief that they might abstain on the present occasion from reporting on the technical development which had taken place, except to mention that it had proceeded systematically in the usual manner and been successful. The accounts are given below:—

	1913-14.	1912-13.
Ordinary share capital	£3,150,000	£3,150,000
Loans	2,216,000	2,242,000
Gross profits	661,000	733,000
General expenses	49,000	54,000
Interest on loans	94,000	95,000
Depreciation	20,000	21,000
Net profits and balance forward	557,000	625,000
Special reserve fund	100,000	100,000
Disposition fund	25,000	25,000
Bonuses	45,000	45,000
Dividend	315,000	378,000
Dividend, per cent.	10	12
Carried forward	60,000	60,000

Siemens-Schuckert Works.

The directors report that the year 1913-14 developed better than might have been expected from the indications of a general decline in trade prosperity, and consequently the orders received were not inferior to those of the preceding year. During the twelve months the German works delivered 128,267 machines, motors and transformers of a total of 2,849,582 kw., as compared with 132,800 and 2,990,000 kw. in the previous year respectively. The time following the day of mobilisation on August 1st at first brought about stagnation in the course of economic activity, and in the early days of that month 1,602 officials and 6,081 workmen were called up, the number rising to 2,327 and 7,102 respectively by the middle of November. At present the staff corresponded with the extent of the orders received in consequence of the increased employment for the requirements of the Army and Navy. The company, in conjunction with the Siemens & Halske Co., participated with corresponding amounts in the War Credit Bank of Greater Berlin as well as in the Nuremberg War Credit Bank in association with the Electricity Co. (late Schuckert) of Nuremberg, and also in the War Metal Co. and other undertakings of public utility in accordance with the circumstances of the times. The active trade with the company's friendly houses in England, France and Russia had naturally been tied up through the war. Oversea trade, which had been of considerable extent, was also very difficult, but the directors ventured to have confidence that the victorious termination of the war would lead to increased prosperity in this branch of business activity. It was obvious that prudence rendered necessary a specially cautious calculation of the balance-sheet, which was possible thanks to the favourable results for the year. The accounts exhibit the following figures:—

	1913-14.	1912-13.
Ordinary capital	£4,500,000	£4,500,000
Loans (obligations)	3,877,000	3,905,000
Perpetual 6½ per cent. Loan	2,500,000	2,500,000
Gross profits	1,063,000	1,167,000
General expenses	94,000	94,000
Interest on loans	337,000	333,000
Depreciation	74,000	62,000
Net profits and balance forward	574,000	692,000
Allocation to reserve fund	125,000	125,000
Bonuses to staff and workmen	75,000	75,000
Provident fund	25,000	25,000
Profit share of the two proprietary firms	337,000	450,000
Percentage of profit distribution ...	7½	10
Carried forward	12,000	17,000

During the year the company's technical work showed quiet but constant development. In particular, attention was paid to the improvement of the methods of working, to reconstructions which were shown to be requisite in consequence of the new regulations of the Union of Electrical Engineers, and to the standardising and development of the branches which aim at the protection of electrical installations in connection with the increasing employment of high-tension currents. The company's activity for the mining industry, which was in a difficult situation, especially in regard to the potash industry, experienced an increase through the large advance in orders for winding engines for abroad, and the foreign orders for the iron industry also provided as great employment as in the previous year. No material change occurred in all other industries as contrasted with 1912-13. The extension of existing overland stations and the establishment of new works continued to follow an active course. As a matter of technical interest, the report mentions the central station at Zug, Saxony, which utilises water power and is situated at a depth of 1,000 ft. in a disused mine, the output being 2,400 kw. The experimental installations in progress for various administrations in regard to main line, city and suburban railways, were approaching completion. The trial runs on the main electric line between Kiruna and Riksgränsen in Sweden had begun, the railway being intended for the working for the first time in Europe of goods trains of over 2,000 tons, for the transport of iron ore. Owing to the war it was impossible to bring into operation by the pre-arranged time the almost completed sections between Halle, Leipsic and Bitterfeld and the Silesian mountain section between Laubau and Konigszelt, together with the auxiliary sections. In the case of South German lines, sections had been brought into operation with direct current at 1,200 volts with good success. The transmarine business was in a state of depression during the year in consequence of a reduced influx of European capital, disturbed political conditions, economic failures in regard to finance, unfavourable harvests, and the course of prices for important export commodities. As further technical progress are cited the facts that the large three-phase transformers, each of 23,000 kw., ordered in 1912-13, for 25,000 volts had well stood the test in working, and a similar remark was applicable to the Lauchhammer station, which was working at 110,000 volts. Other installations for the same high pressure were either carried out or placed on order, as, for instance, the Neuss station, the Palatinate station, as well as essential instalments for the Murg power station of the Bavarian Government, whilst 31 miles of cable for 50,000 volts were supplied to Spain. Direct-current turbo-generators were constructed at 3,000 revolutions to 1,000 kw.; three-phase turbos at 1,500 revolutions to 15,000 kw., and at 1,000 revolutions to 30,000 kw.; water-power generators at 214 revolutions to 12,000 kw.; converters and three-phase motors at 375 revolutions to 5,000 kw., and potential regulators to 20,000 kw., which is probably the largest so far employed.

Tata Hydro-Electric Supply Co., Ltd.—It appears from the recently issued fifth report that the whole of the company's available supply of power has been already disposed of, and that 35 cotton and three flour mills have contracted for such supply for a period of 10 years. The report gives a very satisfactory account of the progress of the work. The dam and other works of the Lonavla Lake are sufficiently forward for practically full storage and use, and the same, to all intents and purposes, may be said of the Walwhan Lake dam. The duct from Lonavla Junction to the forebay is sufficiently advanced to carry 3 ft. of water for beneficial use, and this water can be delivered as soon as the pressure pipe-line is completed. The Walwhan duct is not so far advanced, but the forebay dam and bed of the basin are sufficiently completed to enable the forebay to be filled to 10 ft. above the outlet level. The work on the pipe-line still appears to be the most backward, and in this respect very different to that in connection with the power house, where, it seems, power could be generated any time if water were available at the turbines. All the transformers required for the original installation are reported on the site. Complete motor equipments have been delivered for 19 mills, and partial deliveries have been made for several others. Work on cables, switchgear, meters, &c., is also well in hand. Thus it appears that there will be no difficulty in utilising current when once the supply begins.—*Indiaman.*

Nairobi Electric Power and Lighting Co., Ltd.—It is reported that the war has not yet affected adversely the company's working at Nairobi, and that there is no reason for uneasiness. The directors have, therefore, decided to make an immediate further distribution of profits by declaring a second interim dividend for the year 1914, making 6 per cent. now paid on both the preference and ordinary shares, and they hope that when the year's accounts are completed and audited, there may be sufficient profit shown to warrant a final substantial dividend in respect of the year's working.

Delabole Electric Lighting and Supply Co., Ltd.—The first annual meeting was held on December 31st, but no statement of accounts could be presented. Mr. M. J. Wills, the chairman, said that the secretary had been away serving his country, and the assistant secretary had been unwell. The meeting was adjourned to January 18th.

Mexican Electric Light and Tramway Companies.—Owing to the continued unsatisfactory condition of affairs in Mexico, payment of the half-yearly coupon now due on the 6 per cent. 50-year mortgage bonds of the Mexican Tramways Co. is deferred, as is also payment of the half-yearly coupon of the 5 per cent. first mortgage gold bonds.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended October 30th, 1914, were 1,464,381 compared with 1,426,639 in the corresponding five weeks of 1913. For the four weeks ended November 27th the units delivered amounted to 988,840, compared with 965,848 in 1913.

City of London Electric Lighting Co., Ltd.—Warrants in payment of the half-year's interest to December 31st less income-tax at 1s. 10d. in the £ on the first and second debenture stocks, have been duly posted.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange re-opened its doors last Monday, January 4th, for the first time since they were closed on Friday morning, July 31st, 1914. Notwithstanding the serious nature of the restrictions imposed by the Treasury as the price which the House has to pay for being allowed to conduct business within its own doors, members were unfeignedly glad to get back to their accustomed positions. Veterans who had not been seen in Throgmorton Street for many a year put in an appearance on this historic occasion. For the first time since Maurice Gifford and a party of Rhodesian Horse crossed the Kaffir Circus after the Boer War, men in khaki mingled with groups of their fellow-members who appeared in every-day clothes. The occasion tingled with keen excitement, suppressed nominally, but very apparent actually—to those who know the markets—in the high boisterousness of spirits which prevailed.

It might have been thought that members were returning to the pleasantest of business prospects, instead of coming back to chains and fetters provided by the Treasury for every bargain done. The fear is that alien enemies may take advantage of the Stock Exchange being officially open, and realise money which might be transmuted into guns and ammunition whereby the war might be lengthened and more lives sacrificed. The Treasury, moreover, views with lively apprehension the possibility of outside raids being organised against British credit, through the medium of bear operations in the Stock Exchange markets. These are the principal reasons why they have shackled Stock Exchange business with such impediments as to make House men despair of paying expenses for a long time to come, unless the conditions are modified.

The Stock Exchange sang the National Anthem with profound feeling and fervour; at the line "And make them fall," the domes reverberated with the force sung into the words. And when three rousing cheers were given for the King at the end of the brief ceremony, many members found themselves obliged to retire abruptly behind convenient pillars and telephone rooms, in order to swallow quite unusual sensations which persisted in arising in their throats.

Business is now on a purely investment basis. During those five months that lay between August and December, a certain amount of speculative buying and selling went on which now is no longer possible. The man who sells shares must, in giving the order, provide the name of the transferor and the distinctive numbers. The certificate must have been in physical possession within the United Kingdom for at least three months. The client, be he buyer or seller, has to sign a declaration to the effect that the transaction is not on behalf of an alien enemy, directly or indirectly. In exceptional cases, transactions may be carried through for clients outside the United Kingdom; but everything of this sort is subject to the keenest scrutiny, and must be submitted to the Stock Exchange Committee before it is allowed.

There should be now no difficulty experienced by the buyer in obtaining delivery of stock or shares, for the jobbers are precluded from selling short, even where they have the reasonable certainty of replacing stock at a profit. Every bargain has to be officially recorded, whether it be in quoted or unquoted securities. The Stock Exchange Official List has made its re-appearance in guise most unfamiliar. Not all markets, it should be added, are hampered by the imposition of a scale of minimun prices below which members are not allowed to deal. So far as the electrical issues are concerned, this restriction applies only to certain securities in the Home Railway lists. The Treasury, however, retains the right to extend the principle of medium prices as and when it considers such conditions needful.

Those clients who find such bars to business to be irksome and cumbrous will be the more ready to sympathise with the Stock Exchange broker who is obliged to deal only in this way, because of the Treasury requirements. The prophetic optimist foresees early modification of the restrictions, though the paternity of the wish renders it suspect.

The Metropolitan Railway issue of 5 per cent. Preference stock failed to achieve the same measure of success as attended those previously made by the London and South-Western and the South-Eastern Companies. The security was regarded as somewhat less attractive than that offered by the other two railways; whereas premiums are established in the case of the latter stocks, the new Metropolitan Preference stands at a discount of about 1½ per cent.

Home Railway stocks, as a whole, are not at all bad, expectation looking for maintenance of much the same dividends as those which were paid a year ago. The Underground group, however, is exceptional, and prices are heavy. It will be observed from the following list that small falls have taken place this week in three or four cases. We have added to our usual prices another column showing the levels at the end of July, when the Stock Exchange closed :—

HOME ELECTRICITY COMPANIES

	Mean price. July 27.	Jan. 5, 1915. Now.	Rise or fall this week.
Brompton Ordinary	9⅛	8¼	—
Do. 7 per cent. Pref.	8½	8¾	—
Charing Cross Ordinary	5¼	4¾	—
Do. do. do. 4½ Pref.	4¾	4¼	—
Do. do. City Pref.	4½	4	—
Do. 4 Deb.	91½	88	+ 1
Chelsea	4½	4¾	—
Do. 4½ Deb.	96½	91½	—
City of London	16	14¾	—
Do. do. 6 per cent. Pref.	13¼	13	—
Do. do. 5 Deb.	116½	114	—
Do. do. 4½ Deb.	100¼	98	—
County of London	12	11½	—
Do. do. 6 per cent. Pref.	12	11¾	
Do. do. 1st Deb.	102½	99	—
Do. do. 2nd Deb.	100½	97	—
Kensington Ordinary	7⅛	7½	—
London Electric	1⅜	1¼	—
Do. do. 6 per cent. Pref.	5 1/16	5	—
Do. do. 4 Deb.	92½	88¼	—
Metropolitan	3½	3⅛	—
Do. 4½ per cent. Pref.	4 1/16	4¼	—
Do. 4½ Deb.	97½	9[illegible]	—
Do. 3½ Deb.	83	81½	—
St. James' and Pall Mall	9½	9	—
Do. do. do. 7 per cent. Pref.	7	6¾	—
Do. do. do. 3½ Deb.	81½	83	—
South London	3 1/8	3	—
South Metropolitan Pref.	1½	1⅜	—
Westminster Ordinary	8½	8¾	—
Do. 4½ Pref.	6⅛	4⅛	—

TELEGRAPHS AND TELEPHONES.

	Mean price. July 27.	Jan. 5, 1915. Now.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108¼	102¾	— 1½
do. Def.	23	21¾	— ¼
Chile Telephone	7⅝	7	—
Constantinople Tel.	4¼	4	—
Cuba Sub. Ord.	8½	8½	—
do. Pf.	16⅜	15½	—
Eastern Extension	12¾	12	—
do. 4 Deb.	97½	94	—
Eastern Tel. Ord.	130½	121	+ 1
do. 3½ Pf.	77½	71½	— 4½
do. 4 Deb.	96½	95	—
Globe Tel. and T. Ord.	11¼	10	— ⅞
do. Pf.	12½	12¼	¼
Gt. Northern Tel.	32½	28	— 8½
Indo-European	59	57	— 1
Marconi	1⅛	1½	+ 1/16
New York Tel. 4½	101	96	—
Oriental Telephone Ord.	2⅛	2	—
do. Pf.	1 1/32	1 1/16	—
Tel. Egypt Deb.	98	97	—
United R. Plate Tel.	6⅝	6	
do. Pf.	5¼	5	—
West India and Pan.	1¼	1⅛	—
Western Telegraph	13⅝	12¾	—
do. 4 Deb.	96½	95½	—

FOREIGN TRAMS, &c.

	Mean price. July 27.	Jan. 5, 1915. Now.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅞	4⅛	—
do. 2nd Pf.	4½	4⅛	—
do. 4 Deb	91	86½	
do. 4½ Deb.	98½	96	—
do. 5 Deb.	96	89	—
Brazil Tractions	66	67½	— ⅛
Bombay Electric Pf	11⅛	10½	— ½
do. 4½ Deb.	96	95	— 2
Mexico Trams	70	45	—
do. 5 per cent. Bonds	84	70	—
do. 6 per cent. Bonds	76	65	—
Adelaide Sup. 6 per cent. Pf.	5½	5 1/16	—
do. 5 Deb.	101	100½xd.	—

HOME RAILS.

	Mean price. July 27.	Jan. 5, 1915. Now.	Rise or fall this week.
Central London, Ord. Assented	83	79	+ 1
Metropolitan	37½	31	⅛
do. District	21¼	18	— ¼
Underground Electric Ordinary	2¼	1⅝	— ⅛
do. "A"	7/6	6/-	— 3d.
do. Income	88	79	— 1

MANUFACTURING COMPANIES.

	Mean price. July 27.	Jan. 5, 1915. Now.	Rise or fall this week.
British Westinghouse Pref.	1¾	1⅝	— ⅛
do. 4 Deb.	74½	72	—
do. 6 p lien	102½	98	—
Callenders	11½	11½	
do. 5 Pref.	5⅛	[illegible]	—
do. 4½ Deb.	98½	97½	—
Castner Kellner	2½	[illegible]	— ⅛
Edison & Swan, £3 pd.	[illegible]	13/-	+ 1/-
do. do. fully paid	1¼	2½	—
do. do. 4 Deb.	59	60	—
do. do. 2 Deb.	61½	60	—
Electric Construction	[illegible]	10/-	—
do do Pf.	1 1/16	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	13	—
do. 4½ Pref.	5	4¾	—
do. 4½ Deb.	100½	97	
India-Rubber	9	8½	—
Telegraph Con.	38½	36	— 1

The Calcutta Electric Supply Corporation is offering its shareholders new Ordinary shares at 5½ and new Preference at 5. Application must be made for an equal number of both classes of shares. At the end of last July the offer would have been a very tempting one, because Calcutta Ordinary were standing at 7½ and the Preference at 5⅛. The war has brought prices down, and at the present time the nominal quotations are about 6 and 4¾ respectively, or £10 15s. together, so there is not much plunder to be made by subscribing at £10 10s. for the two. Moreover, no Stock Exchange dealings are allowed in any new issue made after January 4th, 1915, unless specially allowed by the Committee and approved by the Treasury. The company, however, has a fine record from 1900 onwards, so proprietors will probably take up their new shares as good investments

Manufacturing issues are fairly steady, though Westinghouse Preference and Telegraph Constructions show falls on the week. Edison & Swan partly-paid shares are 1s. higher at 13s, and have been up to 14s. That the Company is doing extremely well with its lamp business has been common knowledge for some time past, and rumour now has it that substantial contracts for work in connection with submarines have been secured.

The Bill has been deposited for introduction into Parliament next session for constituting a company with powers to supply electrical energy in the County of London and adjacent areas. It is proposed to incorporate a company, with a share capital of six million pounds sterling, with borrowing powers of another two million pounds, and some see in this the possible advent of that Electric Supply Board—on the lines of the Metropolitan Water Board—which has been the dream of many people for years. The electric lighting market exhibits no important changes on the week, but there may be significance in the renewed eagerness of the demand that is noticeable for all the best Debenture stocks in this group.

MARKET QUOTATIONS.

OWING to the war, the prices given below are, of course, more or less nominal.

Wednesday, January 6th.

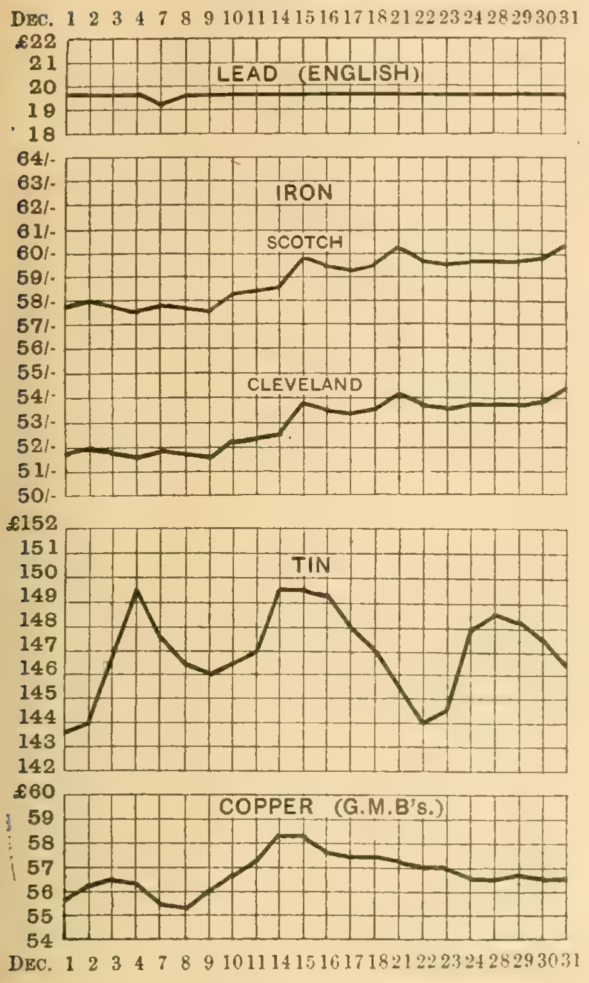
CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a „ Nitric	„	19/-	..
a „ Oxalic	per lb.	8d.	..
a „ Sulphuric	per cwt.	5/-	..
a Ammoniac Sal	„	£49	..
a Ammonia, Muriate (large crystal)	per ton	£49	..
a Bleaching powder	„	£8 10	..
a Bisulphide of Carbon	„	..	..
a Borax	„	£18 10	..
a Copper Sulphate	„	£20	..
a Lead, Nitrate	„	£30	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	7d.	..
a Potash, Caustic (88/90 %)	per ton	.	..
a „ Chlorate	per lb.	1/2	6d. inc.
a „ Perchlorate	„	8d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	55/-	..
a Sulphate of Magnesia	per ton	£8	£4 dec.
a Sulphur, Sublimed Flowers	„	£11 10	..
a „ Recovered	„	£8	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %)	„	£10 2 6	..
a „ Chlorate	per lb.	8d.	1d. inc.
a „ Crystals	per ton	45/-	..
e Sodium Bichromate, casks	per lb.	8d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£85	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£112	..
b „ Sheet, in ton lots	„	£112	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	..
c „ Tube (brazed)	„	9¾d.	..
c „ „ (solid drawn)	„	8¾d.	..
c „ Wire, basis	„	8¾d.	..
c Copper Tubes (brazed)	„	10¼d.	..
c „ „ (solid drawn)	„	10½d.	.
g „ Bars (best selected)	per ton	£78	
g „ Sheet	„	£78	..
g „ Rod	„	£78	.
d „ (Electrolytic) Bars	„	£61 10	..
d „ „ Sheets	„	£79 10	..
d „ „ Rods	„	£67 10	..
d „ „ H.C. Wire	per lb.	8 1/16d.	
f Ebonite Rod	„	3/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1/8	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/9½	½d. dec.
l Iron Pig (Cleveland warrants)	per ton	53/6	..
l „ Wire, galv. No. 8, P.O. qual.	„	£16	..
g Lead, English Pig	„	£19 15 0	..
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£11 5 0	..
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e „ „ „ medium	„	3/- to 5/	..
e „ „ „ large	„	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10¼d.	..
r Steel, Magnet, in bars	per ton	£65	..
g Tin, Block (English)	„	£154 to £176	..
n „ Wire, Nos. 1 to 16	per lb.	2/4	
p White Anti-friction Metals	per ton	£44 to £194	.
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

METAL MARKET.

Fluctuations in December.



Russia's Copper Production.—The output of copper in Russia has increased considerably in recent years, and if the rate of expansion which has taken place hitherto is maintained it would appear that the country will become independent of external supplies in the course of a few years, unless the demand increases in a greater ratio than the output. As the position is at present, the only material imported is said to be electrolytic copper, although the production of this quality was begun in Russia by the Rosenkrantz works in 1907, and was followed by the Kyshtym works in 1911. The development of the copper industry, as a whole, is illustrated by the fact that the imports declined from 20,300 tons in 1904 to 6,100 tons in 1913, whereas the native production increased by over three times in the same years to 34,300 tons in 1913. The Caucasus was responsible for 10,000 tons of the output in 1913, the Urals for 17,300 tons, Siberia for 5,700 tons, and the remainder of Russia for 1,300 tons. Most of the copper producers formed themselves into a syndicate (Medj) in 1907, and the accession of new members raised the quantity controlled by the syndicate to 95·7 per cent. of the total production in Russia in 1913. The great development of the industry is attributed to the systematic management of the syndicate, whose prices, in contradistinction to the South Russian Coal and Iron and Steel Syndicates, have apparently not formed the subject of Government complaints on the ground of being excessive.

Large Glass Switchboard.—Recent developments in the making, bevelling and drilling of massive slabs of glass have made it possible to utilise this substance in the construction of switchboards.. A glass switchboard built for Dodge Bros., Detroit, Mich., by the Mutual Electric and Machine Co., Wheeling, W. Va., is declared to be one of the largest switchboards of this type ever made. The board is of white Carrara glass, and is 1·5 in. thick. All instruments are finished in golden bronze to add to the pleasing appearance of the apparatus as a whole. The board is in the engine room, and is used only for control purposes. The generator and feeder switches are operated by solenoids and motors, and are on additional switchboards in the basement and other parts of the factory. Mounted on the switchboard is a set of remote-control field discharge switches and "I-T-E" motor-operated circuit-breakers. To the left and right of the control switches on the glass board are mounted red and green signal lamps. The board is used in connection with the control of two 480-volt, 750-KW. three-phase 60-cycle steam-turbine units, one 500-KW., three-phase Corliss engine directly connected unit, one engine-driven exciter and two motor-generator exciter units.—*Electrical World.*

TRADE OF NEW ZEALAND.

The following remarks relative to the trade of New Zealand in 1913 and Great Britain's participation therein, are extracted from the recently-issued report to the Board of Trade by H.M. Trade Commissioner (Mr. W. G. Wickham). This report (Cd. 7,693) can be purchased from Messrs. Wyman & Sons, Ltd., price 2½d.

General Trading Position.—The year 1913 was remarkable in several respects. It was a year of high prices, and a year of record trade in nearly every country. The total imports and exports of New Zealand for 1912 and 1913 were as follows:

	1912.	1913.	Increase.
Imports	£20,977,000	£22,286,000	£1,309,000
Exports	£21,771,000	£22,987,000	£1,216,000

The above figures include bullion and specie exported and imported, and it may be noted that, while the value of these latter exported has fallen by £82,600, the value imported was greater in 1913 by £234,675. The margin of gross exports over imports is slightly reduced on the year, but if specie be left out of account it is greater, as appears below:—

	1912.	1913.
Imports, excluding specie	£20,576,500	£21,652,000
Exports " "	21,511,600	22,810,000
Excess of exports	935,100	1,158,000

The general boom in trade had its usual somewhat inconvenient corollaries, namely, dear money and slow delivery of goods. The effect of a tight money market has been naturally to restrict public expenditure on development where this entailed further borrowing, this being reflected in a limitation of imports. It has doubtless also had the wholesome effect of promoting a spirit of commercial introspection. Communities and individuals are alike apt in times of cheap money to forget that credit is not the same as cash, and that liabilities have to be met in the long run.

Criticisms of British Method.—The other direct result of a trade boom is the difficulty experienced in getting reasonable delivery. During the past year much adverse criticism was levelled at British manufacturers, in contrast with those of other countries, on account of the impossibly distant dates they name as the earliest shipment they can give. Consequently, they are blamed for lack of initiative in not expanding their works when they have the chance. Firms who are in the groove of a level turnover do not realise that in a period of boom they can, by giving prompt delivery of their goods, get trade at the expense of old-established goods, and have the opportunity of getting a footing in a new market, which they could not get without difficulty otherwise, but which, having once secured, they can retain in slacker times. America is quick to take advantage of this class of opening and is a particularly dangerous rival in times of booming trade. It would seem that the British manufacturer can be too cautious. His disinclination to take part in the expansion of a boom is doubtless due to his foreseeing the prospect of idle hands and plant during the lull in trade, if he has installed additional machinery in order to take boom orders. But if he do not venture, let him remember that he is not merely allowing a commercial rival to sell his wares during the boom period, but is permanently increasing competition and his own difficulty in selling in normal or slack times. Added to which he has allowed his customers to acquire a suspicion that the newcomer is more pushing, more up-to-date, and more likely to adapt himself to requirements.

It is probable that quite as much business is lost by manufacturers through worn methods of attacking markets as through lack of initiative. But the old generalisations as to British manufacturers refusing to adapt themselves and their goods to foreign requirements still persist, [illegible] those who have British goods to sell must face criticism and [illegible] and be ready to prove their ability. Occasional stupidities are apt to be exaggerated into national characteristics and so damage British trade [illegible] A feature, which is probably a heritage from the days when very few manufacturers did their own exporting, lies in the matter of packing. [illegible] not realise that the ultimate retail price is the factor of import- [illegible]

[illegible] middleman is being ousted and direct trading resorted to in his place. This change has, so far as one can judge, come to stay. [illegible] an agent in the, at present, limited or scattered market of New Zealand, it would appear likely to pay better [illegible] as the market grows.

The following are, roughly, the alternative methods of dealing with the Dominion of New Zealand:—

1. A manufacturer may sell only in the United Kingdom to warehousemen, indent agents, and buying agents of the large retailers.

2. He may even limit himself by confining sales for export to a single merchant house in the United Kingdom.

3. He may have a trading branch established in the Dominion.

4. He may consider that a single agent for Australasia (*i.e.*, all the States of Australia, New Zealand and some of the Pacific Islands) is competent to find all the business he needs.

5. He may think it preferable to divide his business among several agents to cover the different clearly-defined areas in the Commonwealth and the Dominion.

The consensus of opinion appears to be against the first and second of these equally, except when the manufacturer is working on too small a scale to be able to do his own exporting economically. On the other hand, it is useless to add export to manufacturing unless firms are prepared to study the economics of the former as carefully as they do those of the latter. And further, it must be clearly understood that it is worse than useless to appoint a sole agent unless the manufacturer is satisfied that he is capable, as well as desirous, of doing justice to the appointment; and in spite of the utmost loyalty of intention it is usually impossible to prevent goods reaching the Dominion by devious channels, and so seeming to go past the local agent.

The third alternative calls for no comment. The fourth is more open to argument. That it is a question of some importance is clear from the fact that there are some 700 British manufacturers who have a sole agent for Australasia located in Melbourne or Sydney, or in a few cases in some town in New Zealand. Expression is often given to the opinion that manufacturers have done this owing to a deficient knowledge of elementary geography and history, as shown in the belief that New Zealand is a State in the Commonwealth. While there may not be complete justification for this extreme view, it is true that the areas, the relative distances and consequent slowness of communication between parts of Australasia are not adequately realised. At the same time, it must be admitted that it is almost as difficult adequately to work Western Australia from Sydney as New Zealand. However this may be, there is no gainsaying the fact that many agencies granted for all Australasia are simply not worked so far as New Zealand is concerned; in other cases, again, the agent is content with one visit in two years, or with a periodical visit to the Dominion, not stopping in any but the four chief towns.

Need for Local Representation.—In the Trade Commissioner's view, it is thoroughly bad policy to have a single agent for Australasia, as in most cases it merely means either that the whole area is not effectively covered, or that the whole work is done by sub-agents, and the goods consequently loaded with an extra agency commission. In expressing this view, one class of goods must be excepted, namely, goods which for effective sale need expert knowledge. If an agent having expert knowledge can be found in New Zealand, well and good; if not—and it is by no means easy always to find a firm of experts who are not already fully engaged with agencies—it is better to have local sub-agents who can keep a look-out for local business, and call in the expert head agent, say from Sydney, when expert knowledge is required.

The class of goods referred to is, of course, machinery. It is annoying to a buyer, say the Engineer to a Harbour Board, to find the agent for an engine unable to discuss the technical points in a suggested variation from a standard model, and the local agent having justified his existence by getting into touch with possible business should be able to call in an expert head agent to clinch it. On the other hand, an expert sole agent for the whole of Australasia cannot possibly keep himself informed as to all the possible business over such a vast area, or afford time to follow up single-handed all the possible business of which he does hear. Further, the expert can post up the non-expert sub-agent as to selling points of his plant, and the non-expert can watch the local conditions and keep the manufacturers advised as to modifications necessary to suit those conditions.

It may here be pointed out that business of this kind must be regarded as speculative as compared with the sale, say, of hardware and [illegible], where a regular beat can be canvassed by journeys at regular intervals. In the sale of big plant [illegible] much time and expense [illegible] business which does not materialise. Manufacturers must realise this in [illegible] they should also endeavour to understand the [illegible] as regards distances [illegible] and the [illegible] of money and time involved [illegible]

[illegible]—The New Zealand Import [illegible] the country from which [illegible] the country whose [illegible] goods [illegible] the preferential tariff [illegible] reliably stated. Consequently the comparative figures which we give elsewhere in this issue must be taken merely as a general guide to the trend of the trade. The following remarks by the Trade Commissioner, however, refer to goods which are affected by the preferential tariff and whose real origin is therefore clear.

The statistics on the whole represent a very distinct improvement, but in a few lines there is an unsatisfactory loss of trade. The most noticeable item is hardware and hollowware. Tinware also shows disappointing figures. Another heading where the United Kingdom's share is poor is "Metal, manufactured goods unenumerated." In the two last-named categories, Germany lost ground as well as Great Britain, the United States being the country which improved its position.

In portable and traction engines, we find a somewhat disconcerting transference of trade in a peculiarly British line. A severe drop in the share of the United Kingdom is accompanied by a strengthening of the United States' position.

There was a considerable drop in imports of gas-making plant and pumps and mining machinery, but these lines depend rather on chance orders, and a small import one year may be followed by a large one the following year. Cement is being satisfactorily manufactured locally, which accounts for a drop in imports having taken place in spite of the increasing demand for reinforced concrete.

In steam engines, other than locomotive, portable, and traction, the very heavy fall is difficult to explain. The increase in gas and oil engines was less than half of this fall, and the only explanation seems to be that tightness of money during the year has caused a check in industrial expansion needing steam engines as prime movers. No ground, however, has been lost in proportion to relative sources of supply.

A year ago attention was called to the extent of foreign competition in lamps, especially from Germany and America. In 1913, however, both of these countries lost ground, and, in spite of a slight reduction in total imports, the United Kingdom has improved her position.

The above remarks refer to important lines where the total trade of the year has shrunk. Turning now to those where there has been expansion, and especially lines where the proportion from the United Kingdom has improved, there is a good deal that is noteworthy under iron and steel manufactures. In such lines there is very little competition with the United Kingdom, partly, no doubt, because the very considerable extra duties on foreign goods cause the inferior Belgian and German makes to cost as much as better British qualities, and so take away the only inducement to buy them.

Canadian competition in drawn steel pipes and tubes has been maintained. Imports of wire rope increased considerably. In nails we have less than half the trade, but have slightly improved our position. British wire appears to be tougher than foreign and so better for tensile purposes; but for nail making the harder and more brittle German and American wire would seem to be better liked.

In the machinery group there is no sensational change. Gas and oil engines again increased by £10,000. Imports of belting other than leather have increased to £40,000, and the proportion from the United Kingdom has advanced from 75 per cent. to 85 per cent. at the expense of Japan and Germany. The former is the chief competitor.

In connection with the growing trade between New Zealand and the North-American Continent, it is interesting to note the increasing freight facilities for this interchange. As bearing out comments previously made on the operation of the preferential tariff in indirectly assisting the United States in competition with the United Kingdom, it may be of interest to quote the statement, to which considerable publicity has been given in the New Zealand press, of an ex-Governor of Massachusetts who is manager of a large American machinery manufacturing concern. He states that all over the United States "the tendency among the principal manufacturing concerns is towards the establishment of plants in Canada." He adds that this movement has been going on for many years, and estimates that from three to five hundred million dollars of American capital is now invested in these Canadian plants.

The Electrical Industry in Italy.—From statistics recently published, brought up to the end of March, 1914, it appears that the Italian companies concerned in the production and distribution of electricity number 151, having 302 stations at work, with a production equal to 763,000 H.P., while nine stations are under construction, with a capacity of 125,000 H.P. The capital employed by these companies amounts to 453,000,000 lire; the reserve funds total 32,500,000 lire; debentures, 146,000 lire; debts, 265,000,000 lire; plant, 732,000,000 lire, and securities and credits, 188,000,000 lire. Of these companies, 125 made profits of 34,000,000 lire, 11 made a loss of 8,000,000 lire, and 15 succeeded in making a balance only. The data regarding firms engaged in the output of electrical machinery are as follows:—The number of such firms is 16, employing power to the extent of 3,310 H.P., a capital of 36,000,000 lire, with reserve funds of about 3,000,000 lire, debts of 46,000,000 lire, plant valued at 29,000,000 lire, stock to the value of 29,000,000 lire and securities and credit, 45,000,000 lire. The profits made by 14 of these concerns totalled 2,600,000 lire, while the remaining two made a loss.

THE BARTON POWER SCHEME OF THE MANCHESTER CORPORATION.

As many of our readers are aware the Manchester Corporation Bill, which received Parliamentary sanction last year, allows, amongst other things, of the Corporation proceeding with an ambitious electrical scheme, which has become necessary owing to the rapid increase in the demand for electricity in the Manchester area.

At the present time the city is supplied from three generating stations—Dickinson Street and Bloom Street stations, which supply direct current in the centre of the city, with a combined plant capacity of 14,000 KW., and Stuart Street station, in the Clayton district, which supplies alternating current at 6,600 volts pressure to numerous sub-stations, and has a plant capacity of 55,500 KW.

In connection with the Stuart Street station there are 22 sub-stations—excluding those on consumers' premises—with an nstalled capacity of 33,000 KW. One of these is at Dickinson Street, where the generating plant was unequal to meeting the demand for electricity in the adjoining area.

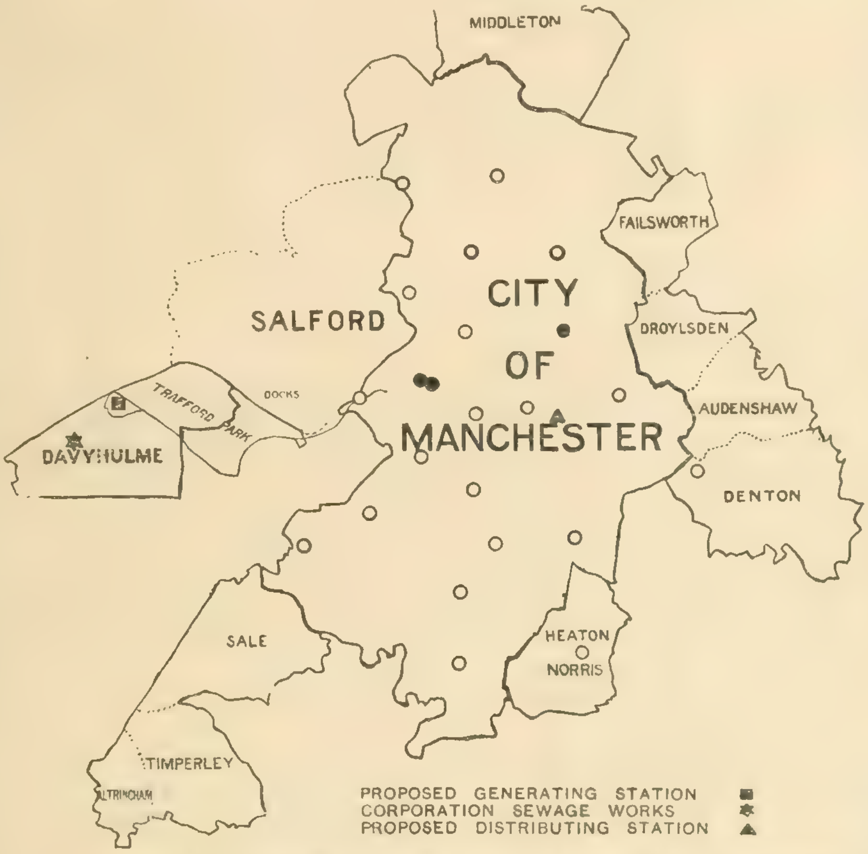


Fig. 1.—Showing the Manchester Supply Area in relation to the proposed Barton Generating Station.

(Supply area includes Middleton (bulk), Failsworth, Droylsden, Audenshaw, Denton, Heaton Norris, and (for traction) Sale, Timperley and Altrincham.

Existing generating stations shown as black spots, and sub-stations as rings.

To meet the requirements of the large power users, the Corporation has also equipped 58 sub-stations on consumers' premises, with an installed capacity of 34,500 KW.

The area over which supply powers are held now amounts to 46 sq. miles, with an estimated population of 750,000, exclusive of the Middleton area, to which a bulk supply is given.

The electrical demands of the area can be gathered from the fact that nearly 155 million units were generated and 118 million units sold during the year ending March 31st, 1914, and that the maximum demand of about 50,000 KW. is increasing at the rate of some 5,000 KW. a year under normal conditions. All the existing stations are limited in capacity by reason of water facilities for condensing purposes, and the existing buildings at Stuart Street will be full up with an installed capacity of 60,000 KW., the adjoining spare land being required for coal-storage purposes.

In view of the limitations mentioned, particularly as regards the Stuart Street station, the effective capacity of

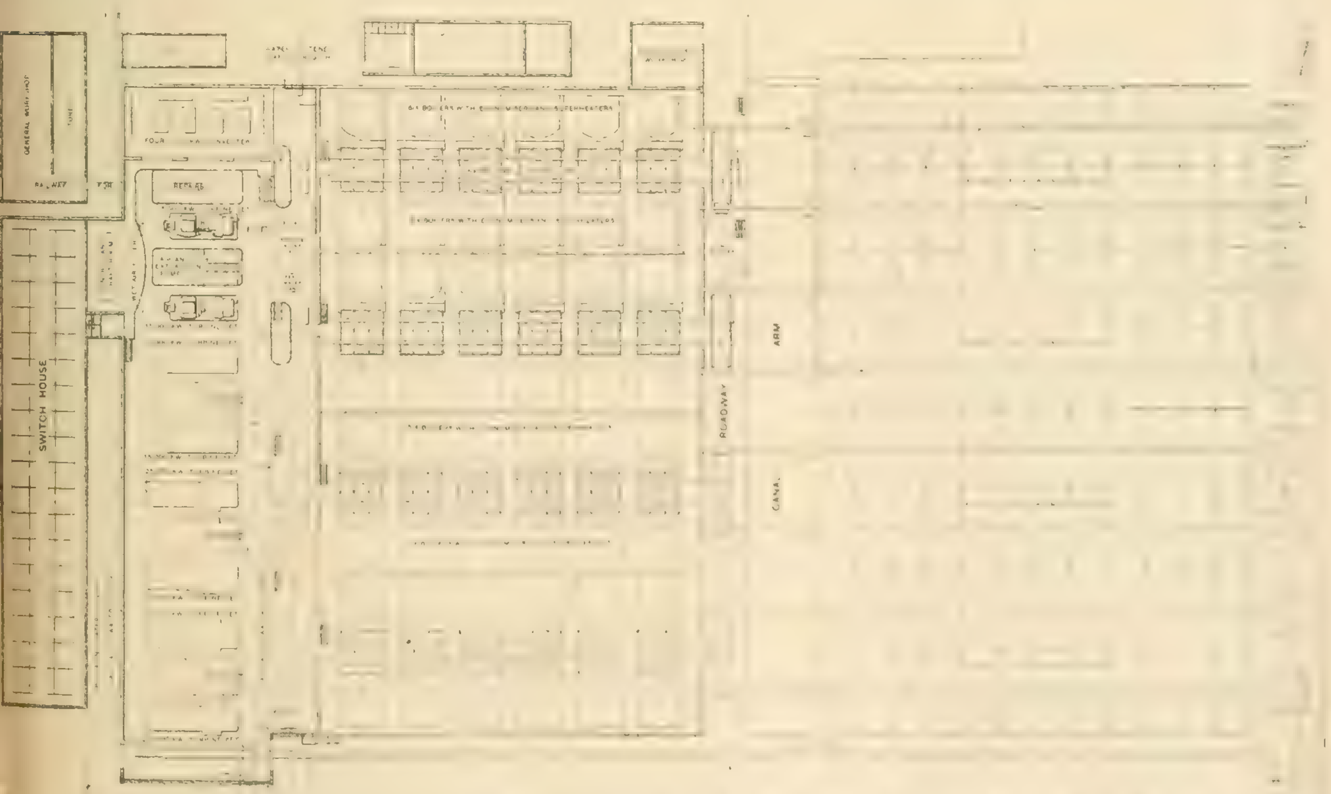


Fig. 2.—Plan of the proposed Barton Generating Station, Manchester complete with Coal Silos, &c.

which for generating purposes will be reached when the maximum demand attains to 45,000 KW., allowing for reserve plant, it was decided that further generating plant in a fourth station should be available by the summer of 1917.

With this object in view numerous sites were inspected by the representatives of the Corporation, who were faced with a problem considerably in advance of anything yet attempted in the way of municipal electricity supply, as the projected ultimate capacity of the new station will be some 160,000 KW.

The site actually selected for what is now known as the Barton generating station covers 12 acres, and is situated at the extreme western end of Trafford Park, on the side of the Bridgewater Canal, and in the parish of Davyhulme.

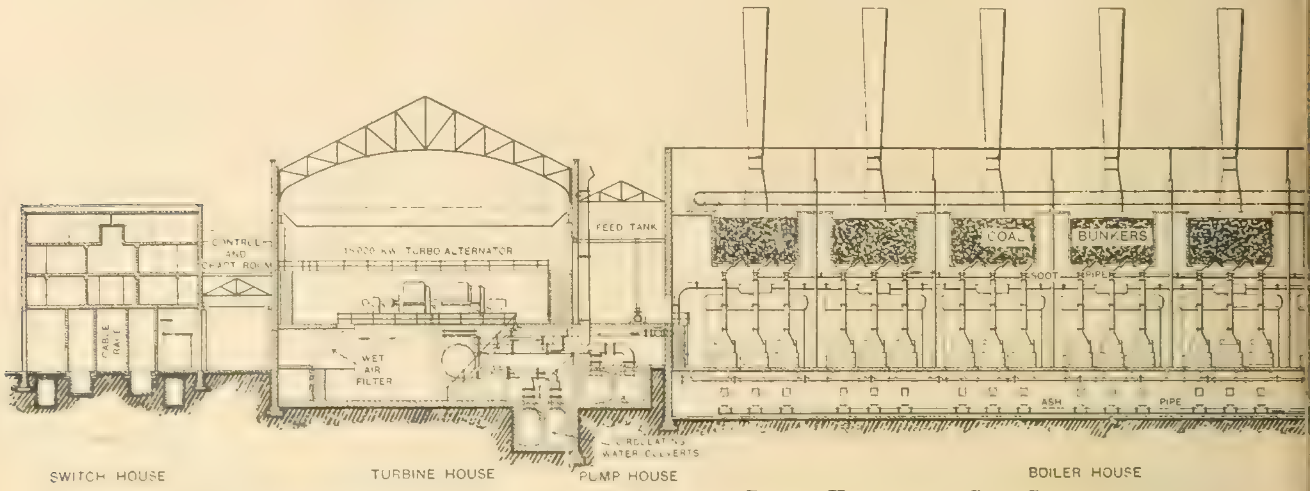


Fig. 3.—Sectional Elevation through Switch, Turbine and Boiler Houses, and Coal Silos of the proposed

This site fulfills the necessary conditions as to fuel, water, length of transmission lines and foundations, as by means of the Bridgewater Canal the West Lancashire coalfields are easily accessible, being only four miles away, while the Trafford Park railways provide through communication with the English coalfields generally. In the matter of water for condensing purposes, the site is also convenient to the Manchester Ship Canal. As, however, the consent of the Canal Co. to the use of the water is at present withheld, it is proposed to use the sewage and subsoil water—in the form of a purified effluent—which passes down the main outfall sewers to the Corporation's sewage works at Davyhulme, situated some 1,400 yards from the Barton site. The Barton site is about five miles from the centre of the city, being actually nearer than an alternative site within the city area, which met with some favour; trial borings have also shown as regards foundations that red sandstone rock underlies the whole of the site at a depth ranging from 7 to 8 ft., and, further, there are good grounds for considering that at least 1½ million gallons of good quality water can be pumped from boreholes in this rock every 24 hours.

It will be necessary to construct a new bridge across the Bridgewater Canal to carry coal and railway traffic to the station.

The preliminary plans of the generating station, which we are able to reproduce, show that not only will it be the largest power station in the kingdom, so far actually projected, but that it will be essentially a "big unit" station.

It is proposed to erect it in four sections, each of which will contain two complete steam-raising, electrical-generating and auxiliary plants, thus providing eight complete plants in the station. This allows of one spare plant, one set aside for repairs, and six plants in commission. As proposed the first four generating units will be turbine sets of 15,000 KW. each, and the remaining four, similar sets of 25,000 KW. each, making a total of 160,000 KW.

The arrangement includes four boiler houses, each with two batteries of water-tube boilers facing on to a central firing floor, *i.e.*, one battery of boilers for each turbine set, and four coal silos practically forming extensions of the boiler houses, but separated from the latter by a canal dock for the reception of water-borne coal.

Preliminary estimates show that 500,000 tons of coal per annum will be required by the complete plant and the canal can handle at least 1,000 tons a day, while over th Trafford Park railways 300 tons of coal an hour can b handled, sidings being provided for its reception.

The coal silos, to which reference has been made, wil hold a two months' supply of fuel; each silo will be equippe with two endless bucket type conveyors into which rail borne coal can be fed through hoppers below rail leve situated at one end of the silo, while water-borne co received in the dock will be fed into hoppers at the othe end. For this purpose the dock between the boiler hous and silos, which will be roofed in, will be provided with travelling crane with a bucket or grab for removing co from the barges. Each silo conveyor will run across th dock and empty into an elevated coal hopper at the en of the adjacent boiler house, returning through a tunn under the dock and silos.

The elevated coal hopper in turn will feed two endle bucket conveyors situated (both lead and return) over th bunkers in the adjacent boiler house, which are designe to carry 36 hours' fuel supply.

Only one section of the station, viz., 30,000 KW. plant, is contemplated in the first instance, and 10 wate tube boilers, each with a normal rating of 50,000 lb. stea per hour, and complete with its own superheater, economise induced-draught plant and chimney – the Prat system bein proposed in regard to the latter.

The suction ash system is proposed for the removal the ashes and soot, the pipe systems leading to receive on the canal dock side, which will discharge into barge and to other receivers at the end of the coal silos, whic discharge into railway trucks.

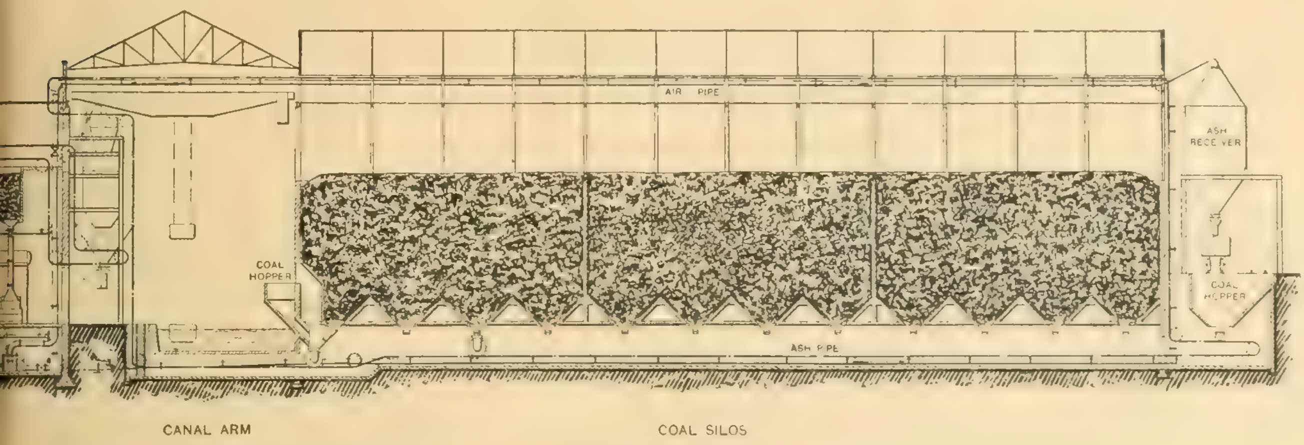
The first section of the generating plant will consist two 15,000-KW. turbo-alternators generating three-phas current at 6,600 volts, 50 cycles, with a speed of 1,50 R.P.M., and developing their normal output at ·85 pow factor.

A generating unit of this size has been in use at th Stuart Street station for some time, and was described an illustrated in the ELECTRICAL REVIEW of July 3rd, 1914.

The main cables from the generators will run direct t step-up transformers for raising the transmission pressu to 33,000 volts. These transformers and the necessar E.H.T. switchgear will be housed in a separate fire-pro switch-house; the switchgear, of the remote-control typ will be operated from a control gallery overlooking th engine house.

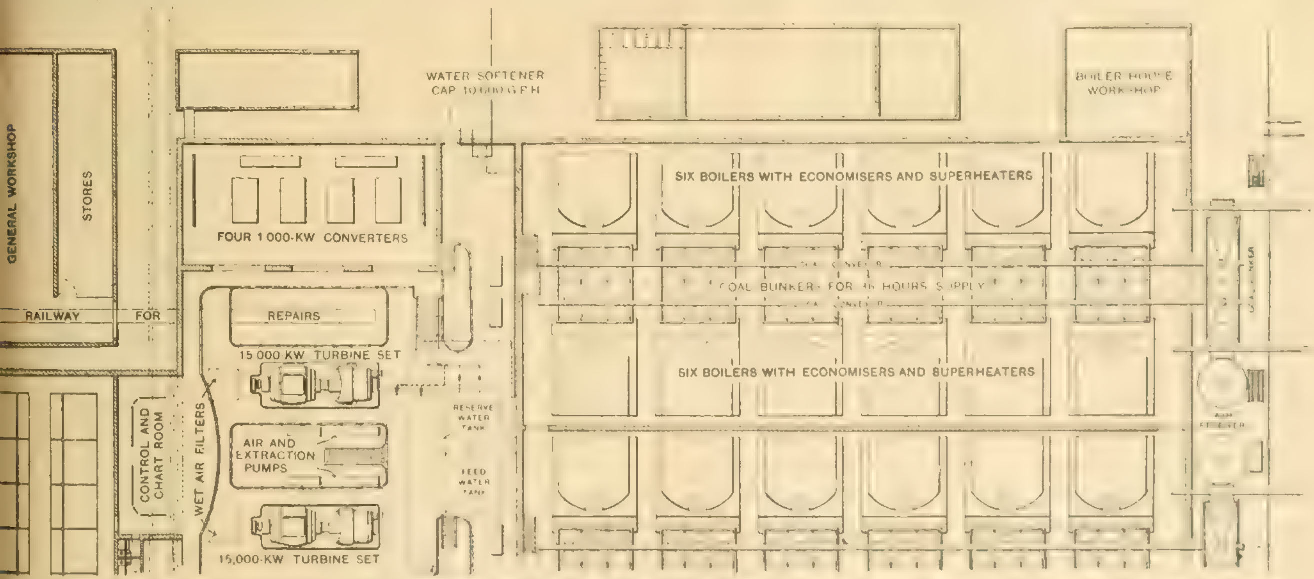
At the north-west end of the station there will be a su station, designed to contain four 1,000-KW. sets of conver ing machinery incidental to the supply and control of th auxiliary current required in the station, &c.; above th sub-station a 3,000 ampere-hour capacity battery for gener direct-current supply and an excitation and switchgear trip coil battery will be accommodated on the first and secon floors. Between the engine house and boiler house a pum hall will be situated containing, as a first instalment, tw steam-driven and one electrically-driven boiler feed pump each with a rated capacity of 25,000 gallons per minut being provided; the upper part of the feed pump bay wi ntain hot-well and reserve feed-water tanks. The feed ake-up will be obtained from the Bridgewater Canal and eated in a water-softening plant. Between each pair of rbine sets there will be an open well containing the ndenser auxiliary plant, and between the first turbine and b-station there will be a repair well, with a railway track low at ground level, connecting with a general workshop rming a continuation of the switch house, but detached om it.

The dismantled machinery will be transferred by an overad travelling crane on to a trolley in the repair well and ssed straight into the workshop. At the other extremity the engine house a similar unloading well will be provided, e railway track being in connection with the general railway tem. The design adopted provides a spacious engine om, as the pump hall at the side is open to the main ilding below the crane girders, and the sub-station will o be visible through three open arches.



Barton Generating Station, for the Manchester Corporation Electricity Department.

Reference to the sectional elevation shows two circulating ter inlet culverts below basement level, and adjacent to em two corresponding outlet culverts at higher level. ese will be connected to the Davyhulme sewage works, it ing proposed to erect a pumping station there, equipped th electrically-driven high-lift pumps, and with a subtion overhead for controlling the supply to the sewage rks. The purified effluent at these works will be drawn om a large storage reservoir, which will also fulfil the nction of a settling tank, and pumped up to the generating tion, where it will pass through extra filters before tering the condensers; the discharge to the sewage works r final treatment will take place at a higher level than the take, and, owing to this increased head, the capacity of e sewage works will be greatly increased. Moreover, the scharge effluent will gain some 15° in temperature, which will result in important ecomomies in the subsequent purification processes. The roadway separating the engine room and switch-house will be roofed in and equipped with a travelling crane for lifting and moving the transformers from the adjacent switch-house.



ig. 4.—Plan showing roughly the Turbine and Boiler Arrangement of the First Section of the proposed Barton Generating Station, at Manchester.

The present designs contemplate for the complete station eight generators, and eight 33,000-volt feeders, running to a central distributing station in the existing area of supply —near which a large number of the existing H.T. feeders from Stuart Street station pass—where it is proposed to step down the pressure to 11,000 volts.

It is intended to utilise the existing Manchester H.T. 6,600-volt three-phase feeders for 11,000-volt working; the existing feeders adjacent to the proposed distributing station will be coupled to the 11,000-volt bus-bars in the latter, and suitable transforming arrangements provided at Stuart Street station and elsewhere in the area to utilise the higher voltage.

We understand that the switch arrangement at Barton provides for coupling the generator direct through the step-up transformer and duplicate oil-switches to its outgoing feeder. The machines will also be connected to a coupling bus-bar through 5 per cent. reactances, and a transfer bus-bar will be provided between the feeders.

Alternative routes are available for the feeders running from Barton, *i.e.*, along the towpath of the Bridgewater Canal into the city at Cornbrook, and by the main road through Trafford Park to Old Trafford, and thence to the city.

The new distributing station will, if the present proposals mature, consist of two main switch and transformer buildings divided by a bay, which will be equipped with a travelling crane and lifting appliances for removing the transformers from the adjacent buildings. Each half of the station will be coupled to four 33,000-volt feeders and equipped with 33,000-volt and 11,000-volt ring bus-bars.

Parliamentary estimates of the operating cost of the Barton station, on a 40 per cent. station load factor, and with coal at 9s. per ton, show works costs ·138d., capital charges ·088d., or a total cost per unit, apart from administration charges, of ·226d., this figure comparing with a similar total cost for Stuart Street station, with a 37 per cent. station load factor, of ·383d. per unit.

On the present annual output from Stuart Street the difference in favour of the new plant would be nearly £57,000 a year.

The estimated capital cost of the completed Barton station, including the culverts to Davyhulme, is £11 per KW.

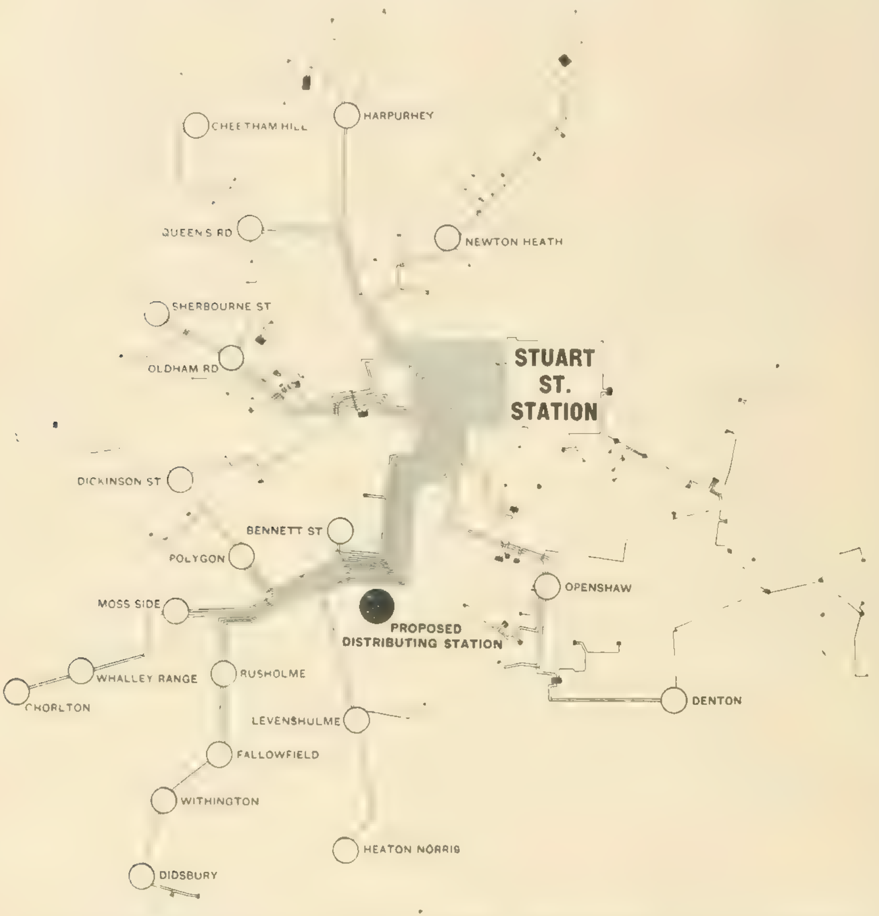


Fig. 5.—The Manchester 6,600-volt Three phase Network, with Proposed Distributing Station, existing Corporation and Consumers' Sub Stations.

Except as regards its adjacent situation, the Barton station will, under present arrangements, have no connection with the growing manufacturing area of Trafford Park, where, at the present time, many concerns possess their own power plants, and the local power supply in the Park averages under 3,000 KW., representing some seven million units a year.

We believe it is no secret, however, that the existence of the huge plant at Barton, in close proximity to the Ship Canal and this favoured manufacturing area, is expected to lead to far-reaching developments in the future.

In conclusion, we are indebted to Mr. S. L. Pearce, the chief engineer of the Manchester Electricity Department, for permission to publish these preliminary details of the scheme for which he is responsible, and which is a considerable advance on anything of the kind in this country. We have drawn where necessary on his Parliamentary evidence in support of the scheme, and are indebted to him for the plans and drawings which we reproduce.

A Fifty Years' Anniversary.—On January 1st, Messrs. W. J. Stokvis, Ltd., of Arnhem, Holland, specialists in electrical fittings design from the old Dutch masters, celebrated the completion of 50 years' establishment of their business as an industrial concern.

THE TELEPHONE INDUSTRY IN SWEDE AND ELSEWHERE.

It is well known that Sweden occupies a leading position in th telephone industry, and as the present state of affairs is no altogether satisfactory in some branches, it is of interest to se how the matter is regarded by the Swedes themselves, as indicate in an article in the *Affarsvarlden.*

In the spring of 1912 there was keen interest on the Stockhol Stock Exchange in telephone shares, and especially in the share of the L. M. Ericsson Co., which resulted in a considerable lo to the "bulls." The market was infected by a certain nervousnes which was very likely due to the new technical methods whic during recent years, have been discovered, and which hav threatened to disturb even the fundamental principles on whic the Swedish telephone industry has been built and prospered.

The automatic telephone of Betulander has been disposed of the Marconi Co., which, no doubt, intend to make a big thing out of it, althoug the experiments with it have not been con cluded as yet. The large electrical com panies in Germany have also a number new inventions in hand, and have bee making preparations in order to put the on the market. In the case of the Englis L. M. Ericsson Co., it will be seen in the la report that the sale of their products h been found to be insufficient, and it has co sequently been decided to take up the manu facture of cheaper apparatus of a mo simple construction. The subsidiary America Co. has for some years up to, and includin 1912 been run at a loss, for which reason t Swedish Co. has been obliged to write off large amount on the shares in the subsidia company. There are also certain sympton which show that the free markets for tel phone materials are tending to become mo restricted, and sales are thus not so easy no because they are becoming more and mo dependent on the interests, which the buye or the large consumers, who have monop lised concessions in various forms, have common with the sellers.

In America the Bell Trust rules with near despotic authority over 8 millions of su scribers, and is able to control sales alt gether. On the other hand, the Swedi industry has been able to hold its positio and has even made good progress. The val of goods exported from the L. M. Ericss factories rose in 1913 to £444,450, compared with £405,550 in 1912 and £388,9 in 1911, and the turnover of the Russi subsidiary company has grown considerabl as is also the case with the companies Vienna and at Buda-Pest. A considerab portion of the Swedish exports is, howev going to the subsidiary companies at Wars and Moscow, and in Mexico.

The supply of telephone materials h lately become more and more dependent the financing of new telephone systems. such systems are promoted by the State, t latter is always inclined to favour the home manufacturers much as possible, and if the concessions are held by private co panies, these are sure to favour the telephone manufactories wi which their leaders may have financial connections of so sort.

The telephone industry thus stands in intimate contact wi finance, and it is a fact that the greatest victories of the Swedi telephone industry during recent years are partly due to t co-operation of Swedish financiers. The concessions at Mosc and Warsaw of 1900 were secured chiefly by the direct work a by the personal visits of the financiers, Mr. Wallenberg and M Glückstadt, and the Mexican concession of 1905 was also due Mr. Wallenberg, while the erection of the branch works Paris, Vienna and Buda Pesth may be attributed to bank direct Fränekel, and his connections and personal visits to the sa places. All these represent splendid examples of what can done, when men of the industry and finance are working co-operation. At the present time it is rare to get a large conce sion for telephone lines without the concessionaire being prepar to offer the State or the municipality concerned a substanti reward in the form of a loan.

This was the case with the important concession at Co stantinople, and the tendency in this direction seems to gro There is a considerable amount of capital in the country, a Sweden has managed to finance a number of enterprises abroa but there is also a requirement for foreign capital, and the case of the Russian concession a sum of 15 million francs w obtained in France in the form of a mortgage at 4½ per cent. the Swedish telephone industry is going to retain its positio it will thus have to seek co-operation with the world of finan and the amounts in question at the present time are more th Swedish capital alone can supply. By a prudent combinati of the Swedish technical superiority in the telephone indust and the financial resources of England and France splendid results ought to be achieved.

In China, in 1911, a plan was prepared on a large scale for a rearrangement of the entire telephone service, comprising plans for the building of telephone lines and of telephone manufactories. It has, however, been impossible to do anything owing to lack of capital and on account of the political conditions. The latter are now gradually improving, but the want of capital is now greater than ever before, and there is an unprecedented bargaining with concessions against ready cash. The L. M. Ericsson Co. during the years 1911 and 1912 took the trouble to investigate the Chinese conditions at an expense of nearly £2,000, and should thus be fairly well acquainted with the state of things there. There ought now to be a good opportunity to get hold of important concessions, in which French and English capital might co-operate with the Swedish industrial ability, and both secure excellent profits. It is not the intention to give the details of such a plan here, but our contemporary says France, for instance, might very well give large loans on the concessions, and the most important places could thus be supplied with telephones and telephone lines, while the materials for the same could be supplied either from Sweden or from local manufactories to be erected in various places. The State or the municipalities in China ought also to be interested by being offered a certain portion of the profits, or by getting a certain number of free shares in the prospective companies. It could also be regarded as a certainty, that the Chinese capitalists would contribute to the investments and the more so, as the main company would be of Swedish nationality, which in political respects must be regarded as a neutral country altogether.

It would, of course, be advisable to proceed with great caution and not quicker than the political conditions might warrant. It also stands to reason that such a scheme would be very complicated. But there is much to gain from such an enterprise, and it would mean a grand future to the Swedish telephone industry, if it were able to secure a large portion of the sale to a country with 400 million inhabitants. There are also certain Balkan States, which no doubt would be quite willing to entertain a proposition in the direction indicated above owing to their financial difficulties.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Jowers's Protective Leakage Device.

To obviate the inconvenience and loss caused by a small motor breaking down to earth and tripping the switch controlling the supply to a whole group of motors, the GENERAL ELECTRIC CO., LTD., of Witton, Birmingham, have introduced a device which

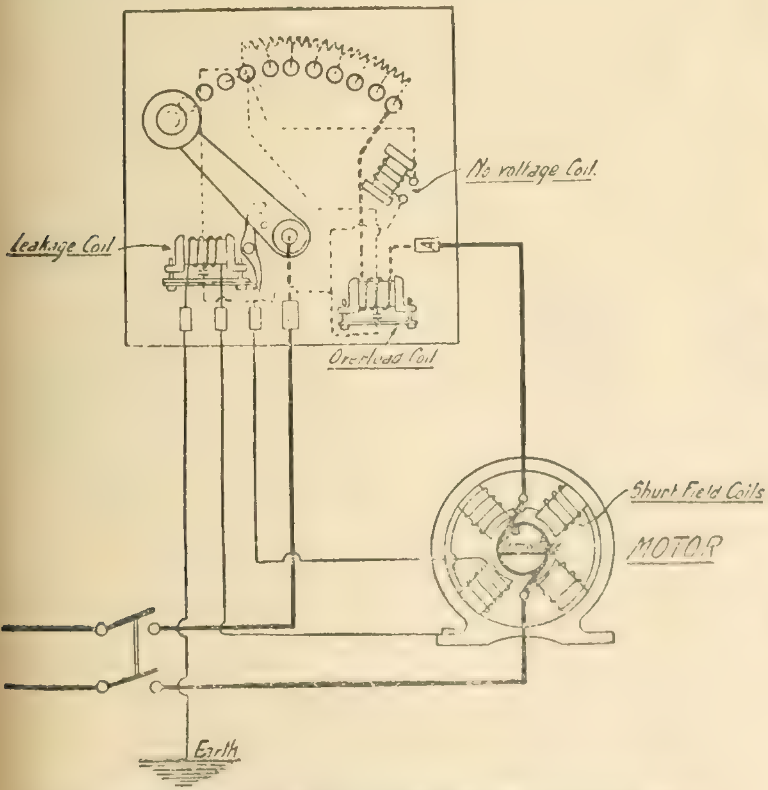


FIG. 1.—CONNECTIONS OF WITTON MOTOR STARTER EQUIPPED WITH THE JOWERS PATENT LEAKAGE DEVICE.

can be fitted to their standard D.C. motor starters. With this device the motor is completely insulated from earth, except through the usual earthing conductor, in series with which is inserted a low-resistance trip coil.

Leakage current flowing through the trip coil actuates a mechanism which short-circuits the no-volt coil if the motor is running, and shuts it down; while if the motor is standing, the leakage current actuates a catch which locks the starter arm, preventing any attempt at starting.

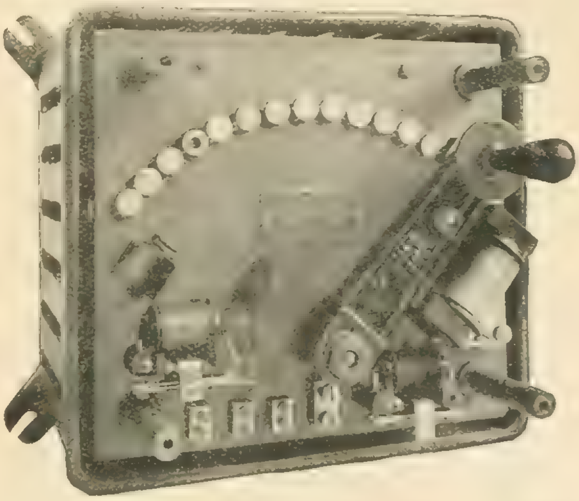


FIG. 2.—WITTON STARTER EQUIPPED WITH THE JOWERS DEVICE.

The Jowers device is claimed to safeguard the supply and the operative, since a faulty motor is immediately cut out of circuit.

The connections for this device and the additional coil on the Witton starter are shown in the accompanying views.

New Street Lighting Reflector.

With a view to improving street lighting whilst still complying with the requirements of the authorities as to reduced illumination, by cutting off the upward rays and producing a minimum illumination over a maximum area, MESSRS. A. W. BEUTTELL, LTD., of 109, Victoria Street, Westminster, S.W., have designed an aluminium reflector, whose general appearance is shown in fig. 3. The reflector is provided with a suitable opening at the top, so that it may be slipped over the existing lamp or lamps and adjusted in the correct position relatively thereto. The performance of the reflector is shown by the light distribution curve given in fig. 2, from which it will be noticed that it is of the extra-intensive type with the maximum illumination at an angle of 30°, and as nearly ideal for street lighting as is practicable under the circumstances. This reflector is now ready for the market, and the makers will be pleased to co-operate with central station engineers with a view to adapting it to their individual requirements.

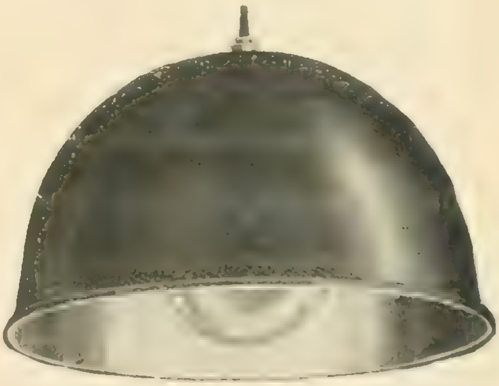


FIG. 3.—BEUTTELL REFLECTOR.

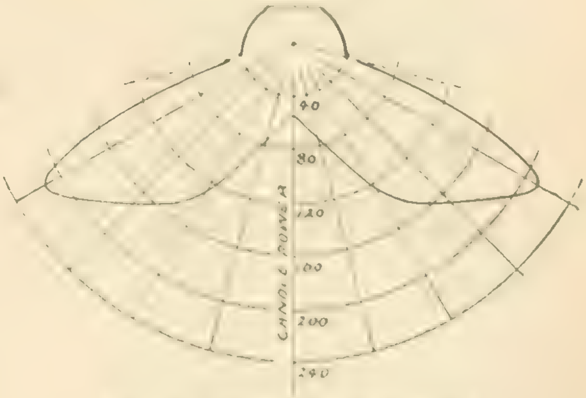


FIG. 4.—LIGHT DISTRIBUTION CURVE.

Reactive-Factor Meters.

Although instructed to keep the power-factor of the circuits over which they have control as near unity as possible, switchboard attendants often think that a power-factor of 1 or 2 per cent. less than unity is good enough and do not try to improve it. If instead of the power-factor meter use be made on the circuit of a reactive-factor meter, a condition of 98·5 per cent. power-factor is indicated as 17·5 per cent. reactive factor, and the attendant will be more apt to improve it.

A reactive-factor meter, which has recently been introduced by the WESTINGHOUSE ELECTRIC AND MANUFACTURING Co., East Pittsburg, Pa., operates on the rotating-field principle in a manner similar to that of a power-factor meter placed on the market by the same company. A rotating field is produced in angularly placed coils connected in shunt with the metered circuits, one being used for each phase of the system in the case of polyphase meters. A movable iron vane or armature is placed in the field and is magnetised by a stationary coil, the current in which is proportional to and in phase with that of the line current in one phase of the circuit. As the iron vane is attracted or repelled by the rotating field of the angularly placed coils, it takes up a position in which the zero of the rotating field is indicated at the same instant as zero of its own field. Thus its position gives the phase angle between the voltage and the current of the circuit.

The reactive-factor meter is calibrated to read the sine of the angle indicated, while the power-factor meter is calibrated to read the cosine. In the three-phase meter the rotating field is produced by three coils spaced 60° apart and in the two-phase meter by two coils 90° apart. In the single-phase meter the rotating field is produced by means of a split-phase winding connected to the "voltage" circuit. The meters are enclosed in round dust-proof cases and are built in two sizes, the diameter of one of which is 7 in. and of the other 9 in.—*Electrical World.*

G.E.C. Opal Shades.

THE GENERAL ELECTRIC Co., LTD., of 67, Queen Victoria Street, E.C., have, in conjunction with an old-established firm of English glass manufacturers, introduced a new opal shade, in the "Ogee" shape, as shown in fig. 5. The shape is adapted to the needs of the tungsten lamp, and is stocked in two sizes, 7 in. diameter and 9 in. diameter by 4 in. deep; the glass is claimed to be an improvement in colour on the usual foreign-made conical pattern.

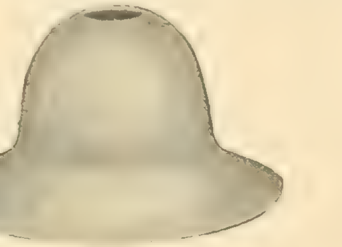


FIG. 5.—NEW G.E.C. OPAL SHADE.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

24,368. "Fuses or cut-outs for electric circuits." V. HOPE. December 21st. (Addition to 22,575/13.)

24,388. "Attachment for the illumination of prismatic or plain compasses or other surveying instruments." S. M. [illegible]. December 21st.

24,398. "Process for the removal and recovery of tin and solder from tinned-iron scrap and the like." S. O. COWPER-COLES. December 21st.

24,419. "Moulded compositions and the process of making the same." BRITISH THOMSON-HOUSTON Co., LTD. December 21st. (General Electric Co., United States.)

24,428. "Sparking-plug tester." G. W. KING. December 21st.

24,441. "Cord-gripping devices." R. J. QUAINTON. December 21st. (Complete.)

24,475. "Electrical vibrator contact-makers and breakers." J. GARDNER. December 22nd.

24,496. "Apparatus for cooling electric motors." J. W. NOLAN. December 22nd. (Convention date, February 2nd, 1914, United States.) (Complete.)

24,498. "Telegraph systems and apparatus therefor." BRITISH INSULATED & HELSBY CABLES, LTD., and H. H. HARRISON. December 22nd. (Complete.)

24,502. "Incandescent mercury vapour lamps." F. BOUSSON. December 22nd. (Convention date, September 3rd, 1913, France.) (Complete.)

24,506. "Selecting mechanism." B. F. MERRITT. December 22nd. (Convention date, January 24th, 1914, United States.) (Complete.)

24,511. "Wire grip and contact for incandescent electric-lamp holders and other uses." H. MADDICK. December 23rd.

24,512. "Self-locking electrical lampholder." F. W. ROBERTS & H. GERSHAM. December 23rd.

24,537. "Double magnet." H. GROB. December 23rd. (Complete.)

24,543. "Electric meters." O. T. BLATHY. December 23rd. (Convention date, December 23rd, 1913, Hungary.) (Complete.)

24,545. "Switch-operating mechanisms." C. BURTON. December 23rd. (Complete.)

24,552. "Electrical resistances." A. H. CURTIS. December 23rd.

24,553. "Automatic and semi-automatic telephone systems." BETULANDER AUTOMATIC TELEPHONE Co., LTD., & D. C. CROWE. December 23rd.

[illegible]. "Automatic and semi-automatic telephone systems." BETULANDER AUTOMATIC TELEPHONE Co., LTD., & D. C. CROWE. December 23rd.

24,589. "Attachment for connecting the plug-tester to the sparking-plug in internal-combustion engines." F. SIRETT. December 24th.

24,604. "Variable-speed dynamo-electric machines." A. H. MIDGLEY & C. A. VANDERVELL. December 24th. (Complete.)

24,629. "Regulating means for electrical installations. SOC. ANON. DES ETABLISSEMENTS L. BLERIOT. December 24th. (Convention date, December 27th, 1913, Belgium.) (Complete.)

24,631. "Electric insulators." SOC. CERAMICA RICHARD-GINORI. December 24th. (Convention date, April 30th, 1914, Italy.) (Complete.)

24,637. "Control devices for electric [illegible]." G. C. HATTON. December 24th. (Complete.)

24,644. "Sparking-plugs." R. Q. C. HURST & F. B. MILLS. December 24th.

24,659. "Automatic magnetically-operated clutches for electric motors." J. G. STIRK. December 28th.

24,678. "Automatic switch-gear for reversing motors on planing machines and the like." J. G. STIRK. December 28th.

24,692. "Liquid rheostats." D. WELGE. December 28th.

24,697. "Electric connection boxes." SUNDERLAND FORGE & ENGINEERING Co., LTD., and G. C. REED. December 28th.

24,740. "Apparatus for the application of electric current to surgical purposes." H. W. HILL. December 29th.

24,741. "Cable winders." L. V. S. BLACKER. December 29th.

24,742. "Fittings for conduits for electrical conductors." A. W. SCLATER. December 29th. (Complete.)

24,744. "Series incandescent electric lighting circuits." G. A. GORANSSON. December 29th.

24,746. "Telegraphic transmitting apparatus and the like." S. WECHSLER. December 29th. (Complete.)

24,766. "Construction of solid-metal vapour lamps." H. J. S. SAND. December 30th.

24,780. "Electrically-operated alarm apparatus." J. F. X. MILLER. December 30th. (Complete.)

24,787. "Electro-magnetic circuit-controlling devices for railway signalling and other purposes." J. GARDNER. December 30th.

24,792. "Electricity meters." W. HAMILTON & FERRANTI, LTD. December 30th.

24,830. "Electric fire-control." A. H. POLLEN & H. ISHERWOOD. December 31st.

24,837. "Alternating-current dynamo-electric machines adapted for synchronous working." L. J. HUNT & SANDYCROFT, LTD. December 31st.

24,838. "Dynamo-electric machines." L. J. HUNT & SANDYCROFT, LTD. December 31st.

24,839. "Dynamo-electric machines having cascade-connected windings." L. J. HUNT & SANDYCROFT, LTD. December 31st.

24,841. "Machines for cutting the globes of electric incandesence lamps and the like." ALLIES ELECTRIC LAMP Co., LTD. December 31st. (— le Naour, France.)

24,844. "Portable mechanical electric flashing-device worked by clockwork." J. S. BENNETT.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1913.

24,871. VARIABLE CANDLE-POWER INCANDESCENT ELECTRIC LAMP AND SWITCH. W. G. Rhodes. November 1st.

25,171. ELECTRIC FURNACES. F. T. Snyder. November 4th.

27,477. CONTROLLING DEVICES FOR VARIABLE-SPEED DYNAMOS AND THEIR CIRCUITS. L. Renault. November 28th. (December 7th, 1912.)

27,571. FIRE EXTINGUISHING AND ALARM APPARATUS FOR USE ON BOARD SHIPS AND IN LARGE BUILDINGS. F. W. Smith & H. S. A. Warren. December 1st.

28,111. TRIPPING DEVICES FOR ELECTRIC SWITCHES AND THE LIKE. J. G. Statter. December 6th.

28,292. REGULATING DEVICES FOR ELECTRIC MOTORS. W. G. Haywood. December 8th.

28,409. TELEGRAPHY. F. G. Sargent. December 9th.

28,413. RECEIVERS FOR USE IN WIRELESS TELEGRAPHY. Marconi's Wireless Telegraph Co. & H. J. Round. December 9th.

28,527. ELECTRICAL CONTROL SYSTEMS AND SWITCH MECHANISM THEREFOR. R. Amberton. December 10th.

28,559. TELEGRAPH TAPE TRANSMITTER. D. Murray. December 11th.

28,897. VACUUM CLEANING APPARATUS. F. G. Hicks. December 15th. (Cognate application, 14,200/14.)

1914.

186. METAL VAPOUR ELECTRIC RECTIFIERS. Akt. Ges. Brown, Boveri et Cie. January 3rd. (March 22nd, 1913.)

1,154. ELECTRIC CIRCUIT CONTROLLING APPARATUS. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). January 15th.

1,972. DRY-CELL BATTERIES. C. W. Simmons. January 24th.

2,059. METHOD OF AND APPARATUS FOR AMPLIFYING AND REPRODUCING SOUNDS. L. de Forest. January 26th. (June 24th, 1913.)

2,249. ELECTRO-MAGNETIC UNLOCKING APPARATUS FOR MINERS' LAMPS. Oldham.

3,436. DRIVING MECHANISM FOR MULTIPLEX DISTRIBUTORS OF ELECTRIC TELEGRAPHS. D. Murray. February 10th.

3,530. ELECTRICAL SWITCH. L. Beretta. February 11th.

3,650. ELECTRIC CIRCUIT CONTROLLING DEVICES. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). February 12th.

4,167. MEANS FOR SUPPORTING RESISTANCE WIRE AND THE LIKE. Credenda Conduits Co. & V. Summerhayes. February 18th.

4,590. ELECTRIC LIGHT BULB. W. C. M. Pettingill. February 23rd.

7,677. ELECTRICAL RESISTANCES. J. Collinson. March 26th.

8,656. KEYBOARD TAPE PERFORATING APPARATUS. E. E. Kleinschmidt. April 6th.

8,699. ELECTRIC MOTORS AND ELECTRO-MAGNETIC CLUTCHES FOR DRIVING MACHINES. B. Graemiger. April 6th. (May 26th, 1913.)

8,855. ELECTRIC LIGHTING SYSTEMS OF MOTOR-CARS. B. Brooks & W. Holt. April 8th.

8,957. CIRCUIT-CONTROLLING DEVICES FOR ALTERNATING CURRENTS. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). April 9th.

9,351. NON-MAGNETIC COMPASS. E. Klahn. April 15th. (May 12th, 1913.)

10,619. TRAVERSERS AND THE LIKE FOR ELECTRIC RAILWAYS. T. F. Mullaney. April 29th.

11,492. IRONCLAD ELECTRO-MAGNETS. E. Gengenbach. May 9th.

11,610. SUSPENSION OF ELECTROLYTIC ANODES. H. R. Boissier. May 11th. (May 9th, 1913.)

11,920. ELECTRIC BATTERY LAMPS. W. J. Mellersh-Jackson (Interstate Electric Novelty Co.). May 14th.

12,057. ELECTRIC FURNACE PARTICULARLY ADAPTED FOR THE MANUFACTURE OF NITRIDES. G. Coutagne. May 15th. (May 23rd, 1913.)

12,605. ELECTRIC HEATING APPARATUS. J. P[illegible] & A. R. Wood. May 22nd.

15,221. ELECTRICALLY-OPERATED WINCH, SPECIALLY APPLICABLE AS AN ASH HOIST. June 25th. (Addition to 20,853/13.)

THE ELECTRICAL REVIEW.

Vol. LXXVI. JANUARY 15, 1915. No. 1,938.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: January 15, 1915. [No. 1,938.

Page
Business as Usual ... 65
Copper ... 66
Manufacturing Ability of British Electrical Firms ... 66
Censorships of Cable Telegrams ... 67
South African Winding Accidents ... 67
Swiss Engineering and the War ... 67
The Loss of the *Formidable* ... 67
Technical Teaching as a Profession, by a Teacher ... 68
Electricity in the Purification of Coal Gas (*illus.*) ... 69
Correspondence—
  Advertising and Character ... 69
  Salaries of Junior Engineers ... 70
  Wonderful Accumulator Cells ... 70
  Garage Heating ... 71
  Contracts with Alien Enemies ... 71
  Cab-Signalling Systems ... 71
  London County Council's Electricity Bill ... 71
  Over-Pressure Protective Gear ... 72
  Individual Driving of Looms ... 72
  The City Guilds' Electrical Exams ... 72
  A.C. *v.* D.C. for Lighting ... 72
Our Legal Query Column ... 72
Expenditure under Electrical Private Bills ... 73
War Items ... 73
Business Notes ... 75
Recent Developments at the Salford Electricity Works (*illus.*) 79
Reinforced Concrete ... 81
Notes ... 86
City Notes ... 89
Stocks and Shares ... 89
Electric Tramway and Railway Traffic Returns ... 90
Notes on Switchboard Arrangement and Equipment ... 91
Automatic Protective Switchgear for Automatic Current Systems, by E. B. Wedmore ... 92
New Electrical Devices, Fittings and Plant (*illus.*) ... 95
Legal ... 96
New Patents Applied For, 1915 ... 96
Abstracts of Published Specifications ... 96
Contractors' Column ... Advertisement page xx

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND, N.Z: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

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MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

IN PREPARATION.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C

BUSINESS AS USUAL.

It is difficult for the most strenuous advocate of the doctrine, "Business as Usual," to prevent his thoughts from wandering to the great War which is at present convulsing Europe.

And this is well; for when he is trying to devote one part of his mind to his business, and another to the fortunes of British soldiers in the field, he must inevitably be led to consider what is meant by the phrase: "Business as Usual." It was written of old that "to the solid ground of Nature looks the hand that builds for aye"! And so, war being an essentially natural phenomenon, it is not unprofitable even for the man of business to consider it from various points of view.

In the application of the maxim which heads this column, it is essential to remember that this is a *race* war. It might almost be said, without any disrespect to the gallant Allies of this country, that it is a race war between Teuton and Anglo-Saxon. Which shall survive? On August 4th, 1914, the English happened to be in possession of a considerable portion of the more attractive parts of the earth's surface. As a wit was once heard to say, "We came by many of our Colonies in a fit of absentmindedness," but there they are. We are the men in possession. Your twentieth century Teuton says: "True, you Britons are in possession; but let those that have, hold on, if they can."

How, then, if the Germans are going to dispute our title to our possessions, our claim to be rulers of the waves; if they are going to make war against our trade and our commerce in every quarter of the globe, can we afford to conduct our business as usual? Must not millions of British soldiers be ready to meet and slay the legions of the Kaiser? Upon hearing that the manhood of Germany is going to take the field, your armchair alarmist, who is unbiassed by any knowledge of military affairs, is heard to exclaim: "Every Briton capable of bearing arms (except me) should enlist at once."

It is only when one grasps certain fundamental points about the present war that the necessity, the vital necessity, for keeping our industries, or a large number of industries, going on as usual is forced upon our minds.

In the first place, all that is involved in the word *army* is not to be found in the battalions drawn up for inspection. In addition to the Reserves, there is much else to be thought of besides the number of men who are able to take their places in the fighting line. Equipment and reserves of equipment have to be provided. Arms and ammunition have to be supplied, and in these days of the application of science, and in particular of the application of electricity to the needs of warfare, scientific instruments have to be made in enormous numbers, and at enormous speed.

Your amateur strategist who talks airily of an army of a million men forgets the numerous factories which must be kept going if that army is to appear as an efficient fighting force. He is heard to complain of the bad recruiting in certain industrial centres: but he forgets, nay, he never had the wit to realise, that the man who is working 10 hours a day in blue jeans, at lathe or forge, is often serving his

King and country just as well as the man in khaki who is wallowing in the mud of Flanders!

It has been said: "You cannot improvise an army!" The truth of this statement is realised when one appreciates (in the light of what we have said above) the real meaning of the word "army." The private soldier can be trained in a comparatively short period of time; but arms and equipment cannot be conjured up from nowhere. Nor can your "soldier of industry" be improvised. He must be trained, and it takes years from his youth up to make him efficient. To empty the engineering workshops of England at this moment—to allow skilled fitters and mechanics to enlist in the ranks—would endanger the safety of the country in a marked degree.

Another consideration forces itself upon the mind. Although the Germans have called many million men to arms they are still, in one sense, carrying on business as usual. We say this because, for the last 30 or 40 years, preparation for war has been part of the business of the subjects of the Kaiser. They have invested large sums in arms and armament, and in ships; the War Council has expended a large proportion of the vital force of the male population in training youths to arms. For all this expenditure they expect something in return. They expect (or at any rate did at one time expect) to get that return as a result of the present war.

In these circumstances it is necessary for English people to realise the necessity for "business as usual;" and business as usual is not incompatible with sufficient recruiting. It is safe to say that the industry with which this journal is primarily concerned renders most valuable services to the War Office, as well as to the Admiralty. Were our electrical engineering shops shut down through skilled mechanics being called away to the War, there would be panic in Whitehall.

We assert, therefore, that the manager who knows the qualities of his men may be doing a positive disservice to his country if he encourages those who can exercise high mechanical skill to join the Army. The pity of the voluntary system is that it is the most intelligent who are most obedient to the call of patriotism. The cream of the industrial population is skimmed off; the worthless are left behind. The hefty village loafer—the kind of man who is capable but lazy—views the greatest war of all time with supreme indifference. As he watches the battalions of recruits march by to the tune of "Tipperary," he comforts himself with the reflection: "Even if they are killed, and even if the British Army is wholly annihilated, there will still be a public-house for me to lean up against"!

To bring pressure to bear on the strong and healthy labouring classes to join the army is clearly the duty of everyone; but to keep in full swing the industries of the country, particularly those industries which are of primary importance to the naval and military authorities, and thus to carry on business as usual is also an urgent necessity.

Copper. There has been a very strong tendency in the copper market lately, and the extent of the upward movement which has been seen has taken people here quite by surprise. There is no doubt that the worst points of the depression arising from the war have been passed now, but nobody was prepared to find prices soaring skywards as they have been doing of late. The main impulse of the rise came from the United States. There, there has been a continual grumbling by the German-American copper interests, who found that the action of Great Britain and France in declaring copper contraband had had the effect of shutting off their export trade to their friends the Huns. A lot of nonsense was talked by them as to the ill-effects of the contraband declaration upon the United States copper trade, disregarding the patent fact that it was the financial position created by the war which hit American industry as it hit industry in all neutral countries. A sort of grievance was thus set up, and pressure was brought to bear in America to have the British pulled up for interfering with ships carrying copper to "neutrals." The point that the said neutrals were taking huge quantities of copper, which under no possible combination of circumstances could they consume legitimately in the usual way of their trade, was glibly passed over, but American-German opinion is strongly in favour of the British attitude being materially modified, with a resulting large increase in the American copper exports to Germany by way of neutral countries.

Some flagrant cases of smuggling have been detected, and what with the United States Government concealing details of shipments in order to assist the contraband trade, and the issuing of fraudulent manifests and the concealing of copper in bales of cotton and under grain cargoes, it will be seen that the British Government have a very good defence to any action they may have taken to put a stop to illicit shipments of copper. It is hardly to be supposed under these circumstances that the safety of ourselves and our Allies is going to be imperilled by too tender-hearted a regard for the German-American copper millionaires who are now squealing. It is to be hoped not, at all events. It is very curious how these people change their tune. When complaining of the wicked British Navy in stopping their tricks they whine in the usual way, but the next minute tell the newspapers, as Mr. Vogelstein did a few days ago, that the copper shortage in Germany "is not going to have any bearing upon the war. Without denying the fact that the cutting off of supplies of copper is annoying to the highly developed German industry, it is of minor importance to the Germany army and navy. Germany is merely annoyed without being hurt." It is a very different tale, however, which this German-American tells in official circles.

The interim reply of Sir Edward Grey to the Note of the United States contains some very instructive figures, which fully bear out what has been stated in this column from time to time with reference to the rate at which the United States has entered the contraband business. Sir Edward recites the official details given by the United States of the copper exports from that country, showing that for the months during which the war has been in progress up to the end of the first three weeks of December, the exports were 36¼ million lb. against only 15¼ million lb. in the same period of the previous year. Norway, Sweden, Denmark, and Switzerland are not shown separately in the returns, but are included in the heading: "Other Europe." Under this heading the figures for last year are 35⅜ million lb., and for 1913 only 7¼ million lb. It is very justly pointed out that the presumption is strong that the bulk of the copper recently consigned to those countries has been intended not for their own use, but for that of a belligerent who cannot import direct. Under these circumstances, the British Government cannot be expected to abate their efforts to put a stop to the contraband trade in copper.

With America buying warrant copper and producers pushing up their prices in New York, there has been a sharp advance, but prices really look quite high enough. Trade buying is quiet, but general consumption is fully as good as can be expected.

Manufacturing Ability of British Electrical Firms. We have received a letter from one of the largest British electrical manufacturing firms regarding certain statements which appeared in the article on "We Can't take the Risk," published in the Electrical Review for December 25th, 1914. The firm in question express their desire to demonstrate to "R.S.T.V.," the writer of the article, or to anybody else who may be in the market, that the time mentioned by him for the delivery of a 10-h.p. motor is far from representing the present ability of British manufacturers. The firm's own position is that they can meet such a requirement, and any others in reason, in a considerably less period. They feel that, though "R.S.T.V.'s" statement may not have been intended to cast a reflection upon the ability of electrical manufacturing firms in Great Britain readily to supply electrical apparatus, it is likely to have that effect unless it be understood that the writer of the article was merely expressing an individual opinion, and one which, though it might correctly apply to one particular case, cannot be applied generally. We ought, perhaps, to say that we have ascertained that "R.S.T.V." was not personally a buyer of motors. We hope that our readers, both at home and in the Colonies, have gathered from our editorial comments on the position as it has developed since the outbreak of the war, that though our factories are necessarily engaged upon a good deal of Government work, they have in a number of cases adopted measures which will prevent delay in the execution of ordinary electrical business. Any impression, such as gained currency in some parts of the world some months ago, that foreign buyers could not depend upon British works promptly to fill electrical orders, is entirely erroneous. We repeat the appeal to Colonial and foreign buyers that we made in the early weeks of the war, to continue to keep a welcome stream of orders for all classes of manufactures flowing into this country.

Censorships of Cable Telegrams.

The *Daily Chronicle*, on the 9th inst., published an article on "Cables and Commerce: How to Kill the Enemy's Trade," and therein gave it as its opinion that some slackness was shown by cable censors, and that the Government should take possession of the cables as they had done in the case of the railways and wireless stations. It was an easy matter for the Government to take charge of the wireless stations in this country, as they are all British-owned, but the case of the Atlantic cables is far different, they being now the property of and controlled by American companies, who, to judge by recent experience, would quickly obtain the aid of their Government in the righting of any grievance, It seems to us that the greatest danger to the country from a telegraphic point of view is not so much the manner in which the censors perform their duties—we believe they are manfully striving to do their best in a very difficult and complex matter—but the ability of our enemies to conduct their telegraphic correspondence as usual through the media of contiguous neutral countries and the cables landing on our shores. Telegrams, like copper or other commodities, should be treated as contraband and confiscated where there is reasonable belief that they are intended for purposes inimical to our country's interests. In this respect, telegrams passing to and from Holland, Norway, Sweden, Denmark, Italy, Spain, Switzerland and Monaco should be specially scrutinised. It must be evident that if, as reported, the trade of countries washed by the North Sea has so grown that shipping facilities have had to be largely increased, a growth of telegraphic business is bound to occur, and what is the use of having the largest and widest telegraphic system if steps cannot be effectively taken to neutralise the efforts of individuals to profit from the disasters of the war and to our detriment?

We have been informed that the Atlantic cable companies' figures for traffic from Scandinavia have increased to a very large extent, and this goes to prove our contentions above set forth. If necessary, the cables landing on our East Coast should be closed during the war, lest messages should be forwarded to countries from whence supplies are largely obtained, intended for ultimate use by our enemies. There appears to be little use in clearing the seas of hostile fleets if trade with our enemies is to proceed unhampered; every effort should be directed towards diverting trade to Great Britain, and making her the entrepot for supplies, the re-export of which to neutral countries could be then efficiently ordered, and the incidental profits would be earned by those whose resources are being so largely called upon to rid the world of militarism, and to establish conditions making for a lasting peace, conferring benefits on humanity at large. In conclusion, we may say that centralisation of all censorship at the Central Telegraph Office would not, in our opinion, increase efficiency, and the incompetence or slackness of any one censor, if it existed, would not be overcome. In fact, we think confusion would arise, as the number of commercial and private telegrams to be dealt with is far in excess of the number of Press telegrams, and the centralisation of work in connection with the latter is, therefore, an easy matter.

South African Winding Accidents.

In an article commenting on the occurrence of a serious winding accident recently, our contemporary, the *South African Mining Journal*, mentions that there were in 1913 in the Transvaal 81 overwinds or runaways, and that in 13 cases death or injury resulted. Of these overwinds, &c., 30 occurred with electrical hoists, and it would be instructive to learn how far they were responsible for the casualties mentioned. The causes of Rand overwinds have been most carefully considered by the Mines Department, and it has been found that, apart from accidents due to failure or beakage of plant, at least five distinct classes exist attributable mainly to carelessness. Most of the causes cited should not (and may not) apply to electric winders, in view of the automatic safeguards provided, but Class IV: Lowering unbalanced with electric winder on counter-current, too great speed developed, or too sudden application of reverse current, failure of resistance control of rotor, tripping of switch of stator circuit and failure of single brake to control runaway drum, may be of interest to those who are studying the electric winding problem in this country.

Swiss Engineering and the War.

A typical illustration of the manner in which a country that is not directly affected by the war may be indirectly involved in some of its consequences is afforded by the case of Switzerland, which was compelled in its own defensive interests to mobilise on the opening of the war, and subsequently to recall its Reservists from different countries, including Great Britain. How the engineering trade was concerned will be understood from the report issued in December by the directors of the Oerlikon Maschinenfabrik, which may be accepted as a representative example of the conditions which prevailed in the case of all engineering works in that country. The report states that, owing to the mobilisation of the Army, more than one-half of the workmen and officials were called up for service. It was no longer possible for the workshops to effect deliveries, as every working organisation was broken up. The receipt of new orders was brought to a complete standstill, and the forwarding of finished manufactures, as well as the supply of raw materials, almost entirely stopped. Nevertheless, and as a consequence of the large stock of orders, it was possible to maintain working operations without interruption, although with a reduced staff. In the meantime, a slight improvement has taken place in the arrival of orders, although concern as to the future has not yet been overcome. The directors do not mention the fact that a number of workers have been temporarily released from field service in order to resume their normal occupations, so that, for the time being, the supply of labour should now be more favourable than in the first two or three months of the war.

The Loss of the "Formidable."

A good deal of mystery has been made of the communication of news of the sinking of the *Formidable* to Germany by the submarine which is alleged to have caused her loss, and it is suggested in the daily Press that the news must have been forwarded by agents of the enemy within our coasts. Sir Oliver Lodge, in a letter to the *Times*, goes even further, stating that "the public should not suppose that an aerial erection is necessary to wireless signalling; nor need every kind of message be perceptible to adjacent ships. The enemy nation knows at least as much as we do about the applications of science, and has had forethought in employing them." We do not know exactly what suggestion is intended to be conveyed by Sir Oliver's remarks; is it possible that he is referring to the telepathic methods of communication in which he is known to be so deeply interested? Glendower claimed that he could "call spirits from the vasty deep," but Hotspur questioned whether they would come when called, and we really doubt whether the Germans, in spite of their proclivity to Satanic methods, are so closely in league with the nether world as to possess supernatural means of communication.

But there is no need of mystery. The disaster took place at 2 a.m. on January 1st, whereas the German communiqué was dated January 3rd. Mr. P. A. Hislam, in the *Globe*, points out that, assuming that the news was received at Ostend, the nearest German base on the coast, as early as 3 p.m. on January 3rd, the submarine had 60 hours in which to traverse a distance of 200 miles, bringing her within 100 miles of Ostend, at which distance no doubt she could deliver the message. That is to say that she need only travel at an average speed of 3½ miles an hour to effect her purpose. If, on the other hand, the news had been transmitted through this country, it would probably have been received in Germany on New Year's Day.

The foregoing is based upon the Admiralty statement that the disaster was due to a submarine, and not to a mine; but when the conditions are considered—a stormy sea, the ship travelling at 16 knots, and no light but fitful moonlight—it is difficult to believe that any submarine could accomplish the apparently impossible feat of striking the ship twice. It seems more probable that the disaster was due to mines, and that the German claim that it was caused by a submarine was merely bluff.

TECHNICAL TEACHING AS A PROFESSION.

By A TEACHER.

During the last 20 years or so a new profession has been gradually rising in these islands, that of technical teaching, and the purpose of this article is to indicate the opportunities and scope it offers to young men who may think they have a liking for this class of work, as well as to state frankly the disadvantages connected with it. The whole subject is quite modern, for it has grown up naturally with the rise of technical schools and institutes in our midst; furthermore, as such schools and institutes are still being equipped in ever-increasing numbers in all parts of the country, there is likely to be increased scope in the future.

The chief departments into which technical teaching, as a whole, is divided, are Engineering, Physics, Chemistry, and Textiles. There are subsidiary departments such as Mathematics and various trade classes, but the four above-mentioned form the nucleus round which the others move and have their being. Technical teachers, therefore, usually belong to one of the four. The subsidiary classes are often in charge of instructors who during the day are carrying on their ordinary duties in the workshop or factory, and who are paid so much for a couple of hours twice or thrice a week—such occasional teachers being under the discipline of one of the heads of the four main departments.

The Institutes where teaching of a technical nature is carried on are many and varied. The large cities possess their great schools, specially equipped with the latest and best types of experimental machinery and apparatus, while the smaller towns and even villages have their necessarily more limited and circumscribed centres; and the character of the teaching of course varies with the size and importance of the Institute. In such great schools as those of Manchester and Glasgow, for instance, all kinds of day work are carried on, some of it advanced and of University standard. In the smaller places, however, day work is not an important feature. And even in the largest and best of our schools, the instruction given to evening students holds first place; indeed, it is because of, and for, evening students that the technical school may be said to justify its existence.

The man who desires to take up technical teaching as a profession is in for a pretty laborious time. There is plenty of work and very little play. If we take as an example the case of an engineering instructor, we find that the training this man will have to undergo may be outlined as follows:—

(*a*) Good elementary education.

(*b*) Good secondary education.

(*c*) Apprenticeship of five years or so in an engineering works.

(*d*) University or equivalent training in the science and theory of engineering.

A University, or equivalent, degree is essential, and for the most part the former is insisted upon nowadays. It is true there are ways and means of evading the spending of three years at the University, such as taking an external degree, or winning a Whitworth Exhibition or Scholarship; but these are not in the direct line of advance, so to speak, and in general necessitate a terrible time of stress for the successful man. Actual experience in teaching is only obtained after the candidate has secured a position. Perhaps it is just as well. Any theoretical course of teaching in the technical line is, in my opinion, useless and unnecessary. The types of students under instruction are, as a rule, anything but homogeneous as regards their previous knowledge and training, and the teacher has to adapt his methods to each. If he has the gift for this work, he picks it up in the easiest and most natural manner, and if he has not, he can never, no matter how much he tries, be much of a success.

When the candidate has undergone the essential preliminary training, he is ready to take up the first suitable position that offers.

The salaries and the emoluments, as well as the capacities of these positions, vary greatly. The smaller technical schools offer from £200 to £250 per annum to the head of a department, and from £120 to £150 to a subsidiary teacher. The largest Institutes give from £500 to £700 to the head, and from £300 downwards to the other instructors. The principals also receive salaries commensurate with the size and importance of the school; in a few cases up to £1,000 a year is paid, and in the case of the smallest places down to £200. After some years spent in teaching, a technical instructor may take an opportunity presenting itself of becoming the principal of one of the smaller schools, where he will most likely have to combine a lot of organising work with a certain amount of teaching. Principals in the larger schools seldom do much teaching, their time being usually fully occupied with matters of business detail.

Occasionally a teacher may have the opportunity of leaving the technical school for the University, and may in time rise to a Professorship there, but these cases are necessarily limited. Opportunities of going to the Colonies and Dominions also present themselves from time to time, and there is some competition for such positions, because the salaries offered are often more substantial than those ruling at home.

There is also the chance of becoming an Inspector under the Board of Education, where remuneration for the higher grade work commences at about £400, and rises yearly. Then there are by-ways into which the technical teacher may either accidentally or purposely enter. He may go to India or to China and teach elementary stuff to the natives there; he may write technical books; he may, if he can find the time, go in for research or invent apparatus for experimental work; he may review for the technical Press, and so on.

It should be clearly stated that, like other forms of teaching, technical instruction offers little chance of a fortune to the man desirous of taking it up. At best, a comfortable living is indicated, and in the lower positions, that is to say, for three-quarters of those engaged in it, a bare living only. The work is exacting. Nine teachers out of ten are required to teach at least four evenings a week for eight months of the year, and although, of course, a corresponding portion of the daytime is allowed, still the evening hours are not those usually considered most conducive to the best work. The routine is rigorous. A teacher may have a couple of hundred students to look after during the course of the week, students belonging to a dozen different sections and classes; there are laboratory preparations to be seen to, exercises to be marked, and a hundred and one things to be done.

And, speaking generally, the salaries paid are quite incommensurate with the work done and with the previous prolonged and expensive training required; indeed, I might say that, as a whole, technical teaching is badly underpaid. A few—a very few—reach positions of comfort and even of comparative affluence, but for the vast majority there is nothing to look forward to. The reason for this unsatisfactory state of affairs seems to lie in the fact that the supply is greater than the demand—a strange position when looked at in a superficial light. But the truth is that young fellows who have just finished a University course, and who may not have their careers mapped out for them by wise or influential guardians, gravitate into the technical teaching profession as easily as flies into a jar of treacle. The commencing salary appeals to them, for they look upon £120 to £150 per annum as rather princely, after earning nothing at all for years past. And once in, there is little chance of getting out. And so it comes about that the supply is greater than the demand, and that the authorities concerned can advertise for a University degree man to teach engineering for £120 a year.

As a general conclusion, I strongly advise all those who have not a strong and very pronounced bent for this class of work, to leave it severely alone.

ELECTRICITY IN THE PURIFICATION OF COAL GAS.

To the electric lamps which are used to light gas works and the electric motors which are used to supply motive power, there is likely to be added, in many modern installations, electrical apparatus for the separation of tar and other suspended particles from the gas. Successful large scale experiments in this connection have been made by White, Rowley and Wirth, their apparatus and results being described in an address to the Michigan Gas Association. The principles employed are those which have been applied so successfully to the precipitation of smelter and acid fumes. A high-tension continuous current discharge is passed between a "squirrel cage" of fine steel wires and a pipe in which the latter are mounted and through which passes the gas to be purified. Suitable current may be secured by transforming alternating lighting supply up to 20,000 or 40,000 volts and rectifying it mechanically by a synchronously rotating commutator. To eliminate risk of explosion, it is obviously essential that there be no air leakage into the precipitating chamber, and it is found that the liability to disruptive discharge from swaying or eccentric electrodes is least if the central wire electrode is made negative. Alternating-current discharge is almost ineffective in causing precipitation.

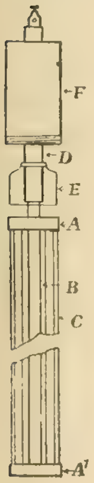


Fig. 1.

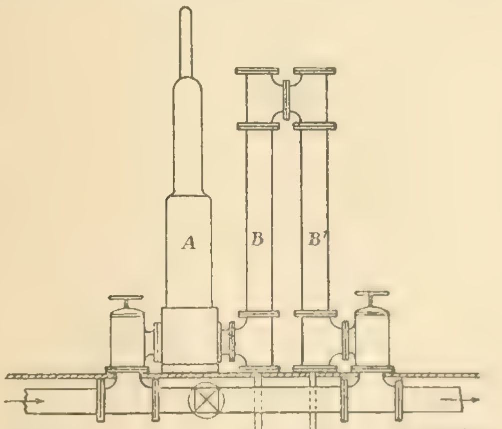


Fig. 2.

Fig. 1 shows the form of electrode found best for commercial use. Into the iron pipe F is cemented an insulator D, the lower terminal of which is shrouded by a glass insulating sleeve E. A half-inch gas-pipe B is screwed into a series of cast-iron disks A A', between which run fine steel wires C forming the active electrode. The whole is mounted in suitable nipples within an outer felt-jacketed pipe, forming the earthed electrode. Large scale tests on the electrical purification of 25,000 cb. ft. of gas per hour were made at the Ann Arbor Gas Works by mounting two 5 ft. × 8 in. diameter separating chambers B B', fig. 2, immediately behind a Pelouze and Audouin fractional separator A. The active electrode disks were 4 in. in diameter and strung with 16 No. 27 piano-steel wires. The effective treating distance was 11½ ft., corresponding to barely 0·4 second's exposure of the gas to electrical discharge. For continuous operation a larger precipitator with longer insulators should be used, but until (after 5 hours' working) tar condensation produced leakage over the short insulators necessarily used in the experimental installation, perfectly satisfactory purification was obtained, and this with an energy input of only 0·2 KW.-hour per 25,000 cb. ft. of gas, using an equipment which cost less than £100, including erection and the necessary alterations in existing pipes. In the Ann Arbor tests, a potential difference of 20,000 volts was maintained between wires and grounded pipe, 2·6 to 3·0 milliamps. then flowing in the high-tension circuit.

By electrical precipitation, coal gas free from tar may be obtained at any desired temperature. If separation be effected before the gas is passed through a condenser, naphthalene and lighter oils are left in the gas. Tar separated at 175° is free from water and resembles the prepared tars used for pavements. Gas thus freed from tar can be cooled in a washer-cooler, any particles of naphthalene then remaining being separated by a second electrical precipitation. Tar cooled in contact with coal gas absorbs some of the illuminants, hence by removing the tar while hot, the illuminating power and calorific value of the gas are improved. By eliminating tarry naphthalene deposits in the scrubbers, cleaner ammonia liquor of uniformly high strength is obtained, and by passing the hot or cold gas up acid towers, ammonium sulphate can be made directly. At present iron oxide purifiers arrest tar fog by mechanical filtration, but at the cost of decreased efficiency in their proper work; with clean gas, oil and tar films are not deposited on the oxide, which therefore works better and longer. In conclusion, it should be noted that the same type of precipitator will purify gas and precipitate smoke, thus preventing the escape of dense smoke during retort filling and producer poking.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Advertising and Character.

In response to your invitation for opinions regarding advertisements, I beg to submit the following remarks.

I may, perhaps, first mention that I have the privilege of supervising and purchasing the plant and stores for several installations. and am directly interested in matters electrically from E.H.T. supply down to electric bells.

I always make a point of going through the advertisement pages of several English and American journals each week, in the hope of picking up something useful, and have to admit that as a rule the English advertisements are not nearly as interesting or as instructive as the majority of the American variety. It is seldom that I see in the home papers anything of sufficient interest to cause me to reflect. Somehow or other the English advertisements do not seem to contain that amount of technical interest or value that many American advertisements possess, and though I am far from saying that all of the American type are interesting—the "Get Acquainted," "Get Together," "Mr. Contractor," and "Mr. Engineer" class are most repellent—I must say that I find myself reading American pages with far more care than I do our own journals.

I think much of this is due to the fact that so many English advertisements contain the sort of bald information that one gets on the card of a manufacturer's representative, *i.e.*, that Messrs. Jones & Co. are manufacturers of every kind of dynamo and motor. As a statement of fact, this may be true, but as an advertisement it is of very little use—lots of people tell the same tale—in addition to which similar information may be found in your classified index.

May I illustrate my meaning from one or two examples in this week's REVIEW (for January 1st)—I take a few at random.

On pages vi, ix, xi and 1 (Supplement), are shown views of various dynamos and motors, but in what way do they vary from thousands of other machines made by different firms? The makers at least do not tell us. It is possible there are a number of points about the turbine illustrated on a later page, which the makers would be glad to place before prospective buyers, but they certainly do not do so in your pages. As it is, the advertisement is a very poor one, and the illustration little better.

On the other hand, the advertisement on page xv is very much better—it contains interesting information, though it happens to deal with an accessory which I suppose is not much in demand just now. The lower advertisement on page 1 (Supplement) is good in its way. It illustrates the article and describes tersely its special features. The advertisement on page 3 (Supplement) is also interesting. I know of several occasions on which a similar page has been cut out for reference purposes—it gives much information in a small space.

Other good advertisements from the reader's point of view are shown on page xx [This is editorial matter.—EDS] (but not on page xix) and page xxx.

A fearful thing is that in the centre of page xxxi, where we are invited to take part in a kind of spelling competition. It may be interesting when you have worried it out, but I doubt it, so I turn the leaf quickly.

One other thought. Some little time ago a friend was criticising the advertisements which appear in the English electrical Press, with those which are published in the leading mechanical journals, to the effect that, as a rule, they were illustrations of comparatively trifling articles. To some extent I felt the criticism was correct. The majority of purely electrical advertisements are for goods which are relatively inexpensive, though numerous, and to secure a good market for accessories and small machinery, it is undoubtedly necessary to advertise largely, and, as already mentioned, in an interesting manner.

Were I a manufacturer, I should occasionally advertise a large plant, or a quite special piece of apparatus, in the endeavour to obtain a reputation for interesting and instructive advertisements. This attained, I should be sure of attention when the every-day manufactures were shown.

W. H. B.

January 4th, 1915.

The correspondence on "Advertising and Character," inaugurated by "Consultant" in your issue of January 1st seems likely to rove over the whole field of advertising generally without any very obvious bearing on the peculiar needs of the electrical and "allied" trades. This doubtless affords not only ample but extremely interesting matter for discussion, but it is necessary to remember that though governed by the same general principles as apply to all other successful advertising, technical advertisements have special considerations to face which materially affect the application of these principles. It is on this point that an exchange of views is most needed and would be most helpful.

Some of your correspondents seem to me to take a more pessimistic view of things than is warranted by the facts. It is quite true that any man of experience, glancing through any number of advertisement pages, can make a pretty accurate selection of those advertisements which have been prepared with some knowledge of advertising requirements, not necessarily complete or extensive. It is also true that these are but a small proportion of the whole. Still it is an increasing proportion, and those who remember what advertising was only 20 years ago, and remember, too, how slowly this old world moves, have no reason to be disheartened at the present rate of progress.

Reverting to the main subject, we are all, I take it, agreed that the first essential of a good advertisement is to attract attention. But what sort of attention? I have seen advertisements which certainly attracted attention, but which were calculated to kill any buying disposition on my part as effectively as a crack on the head from a policeman's baton kills sensation. Obviously, therefore, the principle of attention needs to be applied in its proper relationship with another principle stated by Mr. Hill, as "to give a bias in favour of the advertised article."

If it were not invidious to mention names, I would pillory a recent advertisement of (excision by Censor) which has for some time been occupying a full page in (excision by Censor). The advertisement in question is a big splodge of black, through which emerge five or six lines of curiously shaped letters, the whole forming a puzzle in black and white of most surpassing hideousness. It attracted by its very ugliness sufficient of my attention to induce me to work the puzzle out, but never have I seen energy, and, apparently, enthusiasm, so perversely directed to the production of such an appalling monstrosity. It exemplified exactly the type of advertisement to which you refer in your editorial as "striking the eye but having, in the long run, an unfavourable effect," in this case on the artistic sensibilities.

There is another type of advertisement which seems to me to "border on the offensive," viz., that which tells a man what a wasteful fool he is for not buying such and such an article. In this connection the principles of true salesmanship have considerable bearing. I well remember a gentleman calling on me to try and sell space in his publication. After the usual stereotyped recital of its advantages, I explained that present conditions did not warrant my firm in undertaking any extension. He immediately began with, "That is a very foolish policy," and continued in that strain until I had great difficulty in dissembling my love after the classic manner. When I finally succeeded in conveying to him that the proposition was definitely and unequivocally declined, he left me, but with a feeling that, had his journal been the only one available for our purpose, and the success of my firm depended upon using it, I was to rather commit commercial suicide than consent to pass him an order.

On the question of British and American advertisements, a difference of treatment is rendered necessary by a difference of temperament. Personally, I prefer the British brand, just as for ordinary social intercourse I prefer a gentleman to a costermonger, however entertaining. If the use of slang phrases and "smart" slogans is desired, they are much better placed among their natural affinities than in the columns of the ELECTRICAL REVIEW.

I entirely agree with your strictures on flippant advertisements so far as technical advertising is concerned. A steam turbine needs to be announced with something of its own dignity and importance. It cannot or ought not to be treated as if it were a case of Sapolio. One does occasionally encounter a good joke in connection with electrical or "allied" apparatus, but it is doubtful if the *selling* effect of a good joke is any greater than that of a bad one.

While, therefore, agreeing with Mr. Hill's few functions of any advertising announcement, especial care is needed in the case of appeals to cultured, specialised and technically trained men to see that they are carried out with a common-sense degree of dignity, the temperate use of language, and perfect truthfulness.

We need not despair because sometimes we fall short of our ideals. It is difficult to maintain heights which, in its best moments, "the soul is competent to gain," but we can still keep our ideal in front of us, and (as you yourselves so recently did) vigorously resent the intrusion of vulgarity, of bad taste, of meretricious smartness and statements not in accordance with plain truth.

E. J. Reed.

London, S.W., *January 11th*, 1915.

Salaries of Junior Engineers.

The A.E.S.E. having agreed during last summer to curtail its activities so that electricity supply authorities and owners of private generating plants should not be in the slightest degree embarrassed during the present critical period, the following, forwarded by the Bradford Branch of the A.E.S.E., should be of general interest:—

1. According to the *Times* of January 7th, the price of bread has risen 27 per cent. since July 31st, 1914.

2. According to our own experience, everything that is necessary is dearer than it was before the war.

3. According to the technical Press, the President of the I.E.E. admitted that junior engineers were underpaid, and said he hoped better salaries would be paid in future, and that our engineer managers should try to remember their own early struggles when living was much cheaper than it is now.

4. According to the advertisement pages of the ELECTRICAL REVIEW of January 8th, there are no less than eighteen (18) advertisements for switchboard attendants and shift engineers at starvation salaries of 20s. to 30s. per week, one or two of which had the magnificent prospects of increasing eventually to the abnormal remuneration or £90 to £92 per annum.

There are also one or two advertisers who dare not state the miserable pittance they are prepared to pay.

5. There is a shortage of skilled labour for central station work due to so many having enlisted to serve their country during the war, and, in consequence, many men are doing extra work or otherwise helping to keep things going on as usual, in many cases at considerable inconvenience and self-sacrifice.

What are we to understand from reviewing the facts as stated?

One thing, and one thing only, and that is that our engineer managers have come to the almost unanimous conclusion that the junior engineers are not worthy of the wage of a casual labourer (who gets 7½d. an hour), and that now is an opportunity of bringing a crowd of unskilled labour into the central stations and sub-stations all over the country, and of getting these men or boys taught how to go on when things are "O.K." in a mechanical sort of way, and trusting to luck, when things go wrong, to muddle through somehow.

They, the station engineers, are at their old practice again, a practice condemned by all other business men, of cutting down the wages to cut down the expenses, forgetting that the lower they cut the wage the higher their maintenance and repair bill will go, and the final result is just the reverse of what they want.

The more that Presidents of the I.E.E. and other "men who know," ask that the junior branches be better remunerated, the worse it seems to be for them in the end. Is it spite or ignorance?

W. J. Ebben,
Hon. Gen. Secretary A.E.S.E.

London, N.F., *January 11th*, 1915.

Wonderful Accumulator Cells.

If you will allow me to reply to "A. W. B.'s" satirical criticism of my test cell, I should like to ask the following questions:—

Why does "A. W. B." not state the colour of the positive plate?

Why no mention of the condition of the most important part of any storage battery, viz., the negative plates?

Why no mention of the fact that there is no visible white sulphate on any of the plates?

Had "A. W. B." mentioned these points his letter would have only been a good criticism of his own lack of technical knowledge in regard to small storage batteries which are made up in celluloid cases.

For the benefit of your readers who have not seen this cell, I may state that the positive plate is light brown, which is the usual colour of a discharged positive plate. The negative plates are dark slate colour and quite clean. I cannot follow the inference suggested by the statement: "The positive plate is now of normal size"; perhaps "A. W. B." will oblige. Should he care to have a 4-volt cell with the ordinary celluloid separators in one side and the type used in the "Wonderful, &c.," in the other, he can test it in any way he likes; very soon he will find the peculiar affinity that lead sulphate has for celluloid separators. Sulphate of lead visible as an insoluble white salt is quite a different thing to get rid of to the invisible sulphate, which no lead type of cell can work without.

The "Motorman again" remark I consider is in very poor taste; they are not all lacking in scientific training. It is naturally an advantage to users of storage batteries for inspection lamps, &c., that if they have been forgotten (one case I know of for two years), they are in a condition which enables them to be charged up and used within a reasonable time, without the usual cleaning and repairs.

A. Faraday Hawdon.

Newcastle-on-Tyne, *January 9th*, 1915.

Garage Heating.

The problem suggested by "Interested Inquirer" in your "Correspondence" column of January 8th is complicated, because of the great variety of motor-car habitations known collectively as garages. A garage may be anything, from an open shed to a well-built brick house with a very wide intermediate range, so that the heating of each must be treated on its merits, it being quite impossible to propose any general form of electrical heating that would meet the economical necessities of most motor users. To prevent the radiator freezing I, myself, use a 60-watt carbon lamp, which, for this purpose, I connect to the heating circuit at the 1d. rate; it is put under the bonnet and the whole covered over with a piece a felt, the result is entirely satisfactory; usually the lamp is on during frosty weather from 8 p.m. to 8 a.m., costing about two-thirds of a penny, if severe frost continued for a whole week, an unusual event, with 24 hours' running per day my liability would be about 10d., not a very serious one. This experience relates to a well-built brick single garage with substantial wooden doors and the motor run in bonnet first. If I wished to heat the whole garage electrically, I should first give very careful attention to stopping up every inlet for cold air, protecting the wooden door by a liner of felt or canvas.

P. 6,817.

Contracts with Alien Enemies.

A short time ago you were good enough to publish a letter of mine in regard to the desirability of commercial men urging the introduction of a Bill, in the coming session, covering the determination of contracts with the enemy.

I pointed out that at the end of last session, the Attorney-General promised to go closely into the matter and possibly introduce a Bill, it only remaining with the commercial world to convince him that there was unanimity as to what was really wanted, and that practical clauses would be formulated.

In connection with this matter it is interesting to note a book, which has just been published by Prof. Finlayson Trotter, on "The Law of Contract during War." The book, of course, covers the whole field of contracts, but it is markedly noticeable in the particular case of continuing contracts (or executory contracts, as they are called in this book), that there is an entire absence of any legislation dealing specifically with the subject, and, in fact, no judgments can be cited which give any guidance by way of precedent.

May I quote a couple of sentences which give full evidence in this respect:—

"An executory contract is a contract which is either wholly unperformed, or in which there remains something to be done on both sides. There is little or no authority in English law as to the effect of war on such contracts concluded with alien enemies before the commencement of hostilities."

The whole state of the intimate commercial inter-relations between ourselves and Germany at the beginning of the war was quite unique. Trading between the two countries had developed to a degree altogether unprecedented. In no case in history has a war taken place with such collateral conditions. We cannot expect, therefore, that legislation should have anticipated all the difficulties which have arisen. Now, however, occasion demands adequate Parliamentary measures—and the electrical industry have considerable interests involved. The only thing likely to endanger any measures going successfully forward is for the commercial world to disagree among themselves and bring forward demands mutually irreconcilable.

T. W. Cole.

Wandsworth, S.W., *January 9th*, 1915.

Cab-Signalling Systems.

Four fallacies were conspicuous in the cab-signal discussion at the recent meeting of the Institution of Mechanical Engineers. These errors are:—

1. Cab signals should be audible only.
2. Cab signals at present employed in England are satisfactory.
3. Railway electrification presents difficulties to ramp systems.
4. Wireless systems possess practical value.

Of these four mistakes, the first is the only one for which there ever was any excuse; but that excuse has been destroyed by repeated publication of proof of the fact that a cab signal ought to be both visual and audible. It has, for instance, frequently been shown that a driver can watch the track more constantly and more vigilantly with a cab signal that is both visual and audible than he can with fixed signals alone.

Cab-signals of the kind at present employed in England have produced dangerous errors. It is well known that such cab signals fail to fulfil an exceedingly important requirement, viz., that any one or more earths, and for open circuits, must not produce a dangerous error. Two cab systems that fulfil this specification have been proposed in England, but, strange to say, preference has been given to cab signals that are admittedly inferior to them.

The third fallacy is quite novel—and equally surprising, in view of the fact that experience has conclusively proved its utter baselessness. The London underground railways present the maximum difficulty (?) that could arise—two-power rails, in addition to the two track rails. There would be, if anything, even less trouble to find room for cab-signal ramps than there has been in finding room for the stop-arm cylinders, &c.

Wireless cab systems, whether Hertzian or Faradic, are worthless. None have yet appeared that could stand a proper test. In those that have been publicly tested (?), two earths will suffice to wreck a train. If such cab systems could be used at all, tuning on the locomotive would have to be resorted to; and such tuning is as impossible signally as it is possible electrically. No Hertzian nor Faradic system has as yet appeared which gives three distinctive indications—one for "clear," a second for "run slow," and a third (plainly different from both of the others) denoting "stop." The writer has tested full size, in England, ramp cab signals that fulfil this important stipulation, by which all wireless cab systems have thus far failed.

It has been said that at recent wrecks at Rugby and London Bridge, the driver knew the distant signal was against him, and that "a cab signal could not tell him more." *Per contra*, I have tested cab signals that not only could tell but have told the driver more. A proper cab signal would have prevented both of these wrecks, for such a signal would have given both distant and home information.

Detonator-placing machines are not nearly so safe nor reliable as cab signals. None of the train crew can hear the momentary report of a detonator any more clearly than they can the continued blowing of the audible cab signals. In the best detonator systems an exhausted magazine or a broken or dirt-clogged detonator-arm means an imperilled train; but an exhausted battery or the presence of dirt or frost could not produce any errors but safe ones in the best ramp-type cab signals.

Wm. H. Dammond.

Nottingham, *December 29th*, 1914.

London County Council's Electricity Bill.

Now that the time of petitioning against the London County Council's Bill (viz., February 12th) is drawing near, it is gradually becoming clear that the Bill has very little chance of success. The opposition appears to be getting so pronounced that it seems really questionable whether the London County Council itself will proceed with it even as far as Parliament.

There is still one more occasion on which the Council has to give its consent before the Bill can finally proceed, and even the supporters of the Bill seem to be getting somewhat lukewarm, if one may judge from the debate which took place when the Bill was last before the Council.

The root of the trouble appears to be that the scheme is unnecessarily ambitious, and that practical thoroughness has been sacrificed for theoretical completeness. For instance, a great part of that huge weight of the opposition from the Councils in outer London could easily have been dispensed with without touching the scheme vitally. There seems to be no point in including a very large portion of this outer London, since the inclusion does not benefit the scheme (except in this purely theoretical idea of completeness), while it naturally raises strenuous opposition, since it means possibly commandeering from the rates of those districts.

Then as to the existing municipal undertakings in London itself, the proposal that they must in future carry on their business of electricity supply subservient to the new electricity authority, naturally makes these also into enemies even outside other points.

Further, the Councils who own no electricity undertaking, and who have always resisted municipal trading, naturally are violently opposed to this thinly disguised scheme of municipal trading, which has all the disadvantages but none of the advantages, namely, that its losses must be paid out of the rates without any of the benefits of exclusive ownership and exclusive profits.

Then as to the companies. It is only natural that these should strenuously oppose. They have expended so many millions of capital on the strength of the existing Acts and Provisional Orders. The London County Council now proposes either to take these over under entirely unsatisfactory conditions, or else to domineer their working and possibly authorise competition.

Then as to the ratepayer and public generally. The proposal to embark on a scheme ultimately involving, say, 40 to 50 millions in which the security of the rates plays a great part, naturally, at this time of national stress, they view as an entirely unwarranted risk.

It would indeed be interesting to know what individuals are really in favour of the scheme, except the engineers who have prepared it and a small proportion of the Electricity Committee itself, and possibly a very meagre sprinkling of London County Council members.

Balancing up all the foregoing facts, it certainly seems very unlikely that the Council will proceed. They would have to say to Parliament that nobody wanted the Bill, that it was supported very lukewarmly in their own Council, and that there was no immediate necessity at the present moment for floating such a colossal financial scheme, and that the only good they could promise for a large number of years is the possible small reduction in the cost of electricity, and this is only in certain districts and to certain people.

It certainly seems unfortunate that the early good promise which was given when the London County Council first undertook to formulate a scheme has reached this stage of fiasco. One factor in it certainly is that the London County Council Electricity Committee proceeded somewhat too independently and rode roughshod without practical consultation over the interests of existing undertakings. This certainly was most markedly so in the case of municipal undertakings, and these from the very first have protested against the way in which the Council ignored them when formulating the scheme. Probably the same line of procedure elsewhere has resulted in this wholesale opposition.

Londoner.

Over-Pressure Protective Gear.

In some articles of mine on "Over-Pressure Protective Gear for High-Tension Circuits," which you recently published, I drew attention to the oft-repeated fallacy that the horn gap discharger tended to produce over-pressures on breaking the circuit. I pointed out that not only was this not the case, but that, on the contrary, nearly all other forms of gap, such as the electrolytic and the Giles valve, were much more likely to cause pressure rises, although generally credited with opening the circuit at zero current, in the same way as an oil switch.

Some tests have recently been published by Dr. Linke (*E.T.Z.*, 1914, Part 27), which I had not seen when writing, and these so fully confirm my conclusions that I think it may be of interest to allude to them. Oscillographic and other methods were employed for measuring the rises of pressure which occur on closing as well as on opening a circuit. Both a horn break and an oil break were tested in this way.

One typical experiment may be cited. In this case a low-tension inductive circuit carrying 1,000 amperes was opened by the blowing of a fuse across the gap. In the case of the horn break, the pressure rose to twice the normal, whereas with the oil break the rise was to no less than 50 times the normal.

The author points out that a pressure rise depends, more than anything else, upon the rapidity with which the current is broken and that, consequently, it is far safer to break the circuit at a horn gap, with its gradually lengthening arc, than by means of any form of quenching gap.

I would add that, even if it could be conceded that a particular form of gap did actually open the circuit at the instant of zero current, it does not by any means follow that the stored energy (*i.e.*, magnetic) is also zero at that instant, and unless this is the case a sudden break will cause a serious rise of pressure.

In a further series of experiments, a 10,000-KW. high-tension generator was short-circuited at a horn gap. An oscillogram shows that the pressure across the gap falls to zero, and then gradually increases to the normal as the arc lengthens and breaks. The entire process occupies only a few cycles, and the smoothness of the voltage curve is remarkable. On repeating the experiment with an oil break switch, the current was found to fall suddenly to zero, with the result that severe over-pressures were set up, and the arc was re-started across the gap a few cycles later.

The above experiments seem entirely to confirm the conclusions given in the articles in question, viz., that the horn gap breaks the arc so gradually that no over-pressures are produced, whereas with those forms of gap which break the circuit rapidly the reverse is found.

I may add that since writing these articles, I have received some instructive statistics from one of the largest supply companies, having a very extensive E.H.T. underground system (the name of which, I am, unfortunately, not at liberty to mention) and which is equipped with a number of Brazil resistances and horn gap dischargers. Up to the end of 1913, these gaps were set to spark across at 50 per cent. above normal pressure to earth. In January, 1914, the settings were reduced to 30 per cent. above normal, with the interesting results given in the following table which shows the number of discharges recorded, as well as the number of breakdowns which occurred to the end turns of the motor-generator sets.

Year.	*No. of breakdowns.*	*Discharges recorded.*
1911	5	6
1912	6	14
1913	11	10
1914 to October 1st	1	70

It will be seen that the breakdowns, which in 1913 with the 50 per cent. settings amounted to 11, were reduced to 1 for the first nine months of 1914, a reduction to practically one-tenth of the former number. At the same time the discharges recorded increased from 10 to 70, showing conclusively, I think, that the reduced number of breakdowns was entirely due to the arresters.

Kenelm Edgcumbe.

January 11*th*, 1915.

Individual Driving of Looms.

In the "conclusion" of the abstract of Mr. Crowley's lecture before the Halifax Textile Society given in your issue of the 1st inst., it is stated:—"It is exactly four years since experiments were carried out which led to the putting down of the first large individual driving installation in this country—that of 800 motors in the shed of Messrs. Frears, Lord & Brother, Bradley Fold. When the order for this pioneer plant was placed, only one British firm could manufacture loom motors, and that firm got the order." A similar misstatement to that at the beginning of the above quotation appeared in the *Manchester Guardian* some two or three years ago, and the Westinghouse Co. then correctly pointed out that prior to the Frears, Lord installation they had completely equipped and put to work an individually driven shed for Messrs. Edward Hibbert & Co., of Hyde, all the apparatus having been manufactured in Lancashire. Mr. R. Blackmore, of Stalybridge, was, I believe, the consulting engineer. This being so, Mr. Crowley's second statement is obviously incorrect, since the Westinghouse Co. were not responsible for the Frears, Lord equipment.

Weaver.

The City Guilds' Electrical Examinations.

The examinations conducted by the City and Guilds of London Institute in all branches of electrical engineering work constitute an annual event of some importance in the electrical world; the more so as considerable developments take place in nearly every branch year after year.

This being so, it is surprising to find that most of the electrical journals entirely ignore these examinations; and in so doing we venture to suggest that they miss "matter" that would be of great interest to various sections of their readers.

Surely more than half the readers of a journal would be interested to know the nature and scope of the year's questions appertaining to their particular branch of work; and the publicity would certainly help to increase the number of candidates year by year. There is need, we believe, of encouragement in this direction.

The perusal of carefully-set examination questions will often convey valuable points to the reader; and perhaps a little tempered editorial criticism of certain of the questions would not be amiss when the opportunity arose.

The examiners' reports on the results of their respective examinations are quite interesting matter; and the successful efforts of those examinees who have distinguished themselves by gaining medals and prizes should be noted as a matter of course.

In brief, we would submit that we do not make enough fuss of our technological examinations.

A. P. Lundberg & Sons.

London, N., *January* 11*th*, 1915.

A.C. v. D.C. for Lighting.

I note in the "Correspondence" columns of your issue of January 8th, under the heading of "A.C. *v.* D.C. for Lighting," a letter from "Ex-Gas." I would refer him to an article which was published in your paper describing a similar lighting scheme at Messrs. Elliot Bros.' works at Lewisham, which is, in my opinion, one of the most successful examples of works lighting that has ever been carried out. Though I advised on the general lay-out of the scheme, I am certain that my judgment in this matter is not in any way prejudiced, as I have had every opportunity of examining similar schemes which have been carried out on the direct-current system, and have not been so effective owing to the high candle-power and fragility of the lamps necessitated by the higher voltage.

Haydn Harrison.

[The article appeared in our issue of July 24th, 1914, p. 141.—EDS. ELEC. REV.]

OUR LEGAL QUERY COLUMN.

"O. H." writes: "I have a recollection of having read a report of a case in your paper connected with a supply of electricity being given outside the area of supply covered by a 'Provisional Order,' or rather the supply was given at some point within the area, but the electricity was actually used outside. The decision, as I recollect it, was that the supply was being given outside the area of supply and was illegal."

⁂ There is no case in which it has been decided that the use of electricity supplied within, but consumed outside, an area is illegal. It has, however, been held that gas cannot be so used. By the Metropolis Gas Act, 1860, Sec. 6, the limits of each of the gas companies then supplying the metropolis were defined, and in the result, each company enjoyed a practical monopoly in its own district. One of these companies, at the request of a railway company, placed a meter on a part of a railway station lying within the gas company's limits, and through it supplied gas to other parts of the premises situated outside the company's limits, and within the limits of another gas company. The Court of Appeal held this to be lawful on the ground that the sale and delivery of the gas took place at the meter; but the House of Lords reversed this decision, holding that the gas was supplied where it was consumed, and therefore that the company were transgressing their authorised limits (Gas Light and Coke Co. *v.* South Metropolitan Gas Co. (1889) 62 L. T. 126). This decision was followed in the case of a water company, and it is conceived that it would also be followed in the case of electricity. It is important to note, however, that by Sec. 6 (1) of the Electric Lighting Act, 1909, a supply may now, by leave of the Board of Trade, be authorised outside the area of supply.

Rail Manufacture in Australia.—A Reuter dispatch from Adelaide, dated January 9th, states that the first shipload, comprising 2,800 tons, of iron-stone from the huge deposits of Iron Knob has left Port Pirie for the Broken Hill Proprietary Co.'s iron and steel works at Newcastle (N.S.W.). It is expected that the works will be open in March and that rails will be manufactured by May.

EXPENDITURE UNDER ELECTRICAL PRIVATE BILLS.

The following information is contained in the deposited estimates in connection with the Private Bills for the coming session or in the Bills themselves so far as they concern electrical undertakings:—

	£
Dewsbury Corporation (Mr. H. Dearden, borough engineer).—Purchase of land, £400; building tramways and omnibuses depôt, £7,135; construction of tramways, £8,390	15,925
London County Council Tramways and Improvements (Mr. G. W. Humphreys, engineer).—Tramways, £96,700; reconstruction of Whitechapel High Street terminus, £2,500; reconstruction of Tower Bridge Road to Lower Road line, £68,000; street widenings and improvements, £73,500	240,700
Aberdare Urban District Council (Mr. S. Sellon, engineer).—Construction and equipment of tramways and tramroad, £43,752; installation of rail-less traction and reversing apparatus and plant, £5,906; provision and equipment of motor omnibuses, £8,500; street works, £3,600; lay-out of recreation ground, £2,600; land and buildings, £1,502	65,860
Metropolitan District Railway (Mr. A. R. Cooper, engineer).—Construction of 1 furlong 3.35 chains of single line (including £47,740 for land, buildings and easements)	73,429
Dunfermline and District Tramways Extensions (Mr. C. Don, engineer).—Construction of eight sections of tramway, of which the longest is 1 mile, 2 furlongs, 3.61 chains, double throughout	48,898
Edinburgh Corporation (Mr. A. H. Campbell, borough engineer).—Construction of 4 miles, 6 furlongs, 7.10 chains of tramway, £89,069; erection of tramway shedding and depôt and tramway leads into same, £7,500; street widenings and other works, £20,154; land and street widenings, £45,406	162,129
Sheffield Corporation (Mr. C. F. Wike, engineer, Mr. A. R. Fearnley, manager of tramways).—Construction of 4 miles 4.9 chains of tramway, £10,366; construction of 1.3 chain tramway, £1,165	11,531
Rhondda Urban District Council (Mr. E. Hazeldine Barber, engineer).—Construction of 2 miles 5 furlongs odd of tramway	25,568
Rotherham Corporation (Mr. E. B. Martin, borough engineer).—Streets, £4,311; tramway No. 1, £4,311; tramway 1A, £509; tramway No. 2, 5 miles, 2 furlongs, 6.92 chains, mostly single line, £49,537; alterations of levels of roads, £341	60,099
South Shields Corporation (Mr. L. Rosencare, borough engineer, Mr. W. Tuke Robson, tramways manager).—Tramways	16,711
Halifax Corporation (Mr. J. Lord, borough engineer).—Permanent way for tramways, £109,909; tramway rolling stock, £14,000; electrical equipment of tramways, £11,174; electrical feeders, £8,673; electrical equipment of trolley vehicles, £5,255; electrical feeders, £1,182; trolley vehicles, £5,100; extension of tramshed depôt, £6,000; motor omnibuses, £3,600	164,893
Sunderland Corporation.—Tramway over reconstructed Wearmouth Bridge	712
Stalybridge, Hyde, Mossley & Dukinfield Tramways and Electricity Board (Mr. R. Blackmore, engineer).—Tramway No. 1, 1 mile, 1 furlong, 6.70 chains, £11,625; No. 2, 1 mile, 7 furlongs, 9.60 chains, £17,860; No. 3, 1.20 chains £166; No. 4, 1 mile, 3 furlongs, 6.50 chains, £12,376; No. 5, 1.40 chains, £183; No. 6, 1 mile, 5 furlongs, 0.60 chains, £15,069	57,270
London and District Electricity Supply (Mr. G. W. Humphreys, engineer, L.C.C., Messrs. Merz & McLellan, consulting engineers).—Railway siding (Work 6), £2,944; railway siding (Work 7), £2,464; works other than railway sidings, £270,100	275,508
Lincoln Corporation.—Provision of trolley vehicles, £10,200; electrical equipment of trolley vehicles, £5,500; omnibuses, £10,800; construction of tramway shelter, £2,300; construction of buildings, and purchase of plant and machinery in connection with extension of electrical generating station, £43,000	71,800

WAR ITEMS.

Telegraphs at the Front.—The *Times* recently published a letter from an officer regarding the Field Telegraphs, or Signal Service, as it is now known, from which we quote the following:—

"Most of the important towns in the North of France, and also London and Paris, are in direct touch with General Headquarters. These are called the main lines of communication, and over their wires day and night passes a continuous flood of traffic for the hospital bases, ordnance, remount and store depôts. From General Headquarters radiate wires to the various army corps headquarters, and again, each army has its communications to the divisions, which, further, have wires right up to the brigades. It will thus be seen that in the space of a few minutes the War Office is fully and clearly informed of what is going on in the firing line. In fact, were the lines joined straight through it would be possible to hear the roar of artillery and the bursting of shrapnel in St. Martin's-le-Grand.

"As the tide of battle turns this way and the other, and headquarters are constantly moving, some means have to be provided to keep in constant touch with General Headquarters during the movement. This emergency is met by cable detachments. Each detachment consists of two cable wagons, which usually work in conjunction with one another, one section laying the line whilst the other remains behind to reel up when the line is finished with. A division is ordered to move quickly to a more tactical position. The end of the cable is connected with the permanent line, which communicates to Army Headquarters, and the cable detachment moves off at the trot; across country, along roads, through villages, and past columns of troops, the white and blue badge of the Signal Service clears the way. Behind the wagon rides a horseman, who deftly lays the cable in the ditches and hedges out of danger from heavy transport and the feet of tramping infantry, with the aid of a crookstick. Other horsemen are in the rear tying back and making the line safe. On the box of the wagon sits a telegraphist who is constantly in touch with headquarters as the cable runs swiftly out. An orderly dashes up with an important message: the wagon is stopped, the message dispatched and on they go again.

"At Le Cateau the situation was so desperate that signal companies were sent to the trenches to assist the infantry in repelling a heavy attack. For this piece of work we were highly complimented by General Smith-Dorrien, who, at the same time, expressed his great satisfaction at the way in which his communications had been established throughout the campaign.

"Telegraphists are often left on duty in the trenches and lonely farmhouses, chateaux, &c., close to the firing line, and I leave it to your imagination to picture how difficult it is to concentrate one's mind on the signalling and reception of important messages while the air is filled with the deafening roar of artillery and the screaming and bursting of shells. . . . . . Wireless telegraphy, of course, plays an important part in this war, most of the larger aeroplanes being equipped with apparatus, by which means they swiftly communicate important observations to headquarters. The Germans also make elaborate use of this system."

Board of Trade Electrical Exchange Meeting.—We have referred on previous occasions to the "Exchange Meetings" organised by the Commercial Intelligence Branch of the Board of Trade for the purpose of bringing before manufacturers samples of goods manufactured in Germany, and placing them in touch with purchasers of such products. The object of these meetings is, of course, to assist British manufacturers to capture trade that has hitherto been in German and Austrian hands, and last week the meeting was devoted to the electrical accessories trade. A collection of samples had been got together, not, perhaps, imposing in magnitude, but representing a great variety of articles, and in the aggregate a still greater volume of trade—for a single small sample may stand for an import value of thousands of pounds per annum. The samples were all labelled for reference, and many of them bore prices, which seemed in many cases absurdly low. It would be exceedingly interesting to set alongside this collection a similar display of British-made articles with prices attached; this, however, though enlightening to the inexpert, would be superfluous to the specialists in particular branches, who have the British prices at their fingers' ends, and are able to effect comparisons without such aid. While many of the items exhibited were of the character commonly understood to be implied by the phrase "made in Germany," it cannot be denied that others were of high-class manufacture, and in some branches, such as medical apparatus, glassware, enamelled iron shades, &c., the Germans have hitherto had it all their own way.

There was a great variety of porcelain parts, fuse-blocks, ceiling roses, insulators and similar accessories, which appeared to be of good quality and finish. Many lampholders and other brass goods were shown, which did not impress us favourably. The samples of insulated wires and cables were in no way representative of the large imports under this head. Large globes, well glasses, ornamental glass shades, and opal or opalescent glassware made a much better impression, and there was a small exhibit of arc lamp carbons which stood for a very big trade. Specimens of wood pateras, base-boards, &c., also probably signified a great deal more than might appear, as large quantities of woodwork have been imported from the Continent in the past.

Bell pushes and pressels and small bell switches were shown in a variety of patterns; many of these were of poor quality, but some had handsome cast brass covers. A few electricity meters and small volt and amperemeters, small motors, magnetos and fans reminded us of the very large import trade in these items; near them was a collection of electric toys, more or less rubbishy.

A time switch made by ingeniously modifying a common alarm clock was noticed amongst samples of air blowers for hair drying, electric irons and kettles, motor-car lamps and ignition plugs, and one neat little iron in a leather case which would make a "useful present" to a lady. Many patterns of cheap electric bells and indicators, a few telephones and parts, pocket lamps and portable bull's-eye lamps, conclude the list—though perhaps by no means least in importance as representing a considerable annual value. It will be noticed that in many instances similar articles have long been manufactured in this country, and the only question in such cases is how to get down to the German prices without sacrificing quality; in other instances, pocket lamps and glassware, for example, the trade has been almost entirely foreign, and strenuous efforts are being made by British firms to fill the gaps.

We hope that the result of the efforts of the Board of Trade will be the development of new manufactures in this country and the extension of existing businesses; manufacturers and representatives of wholesale houses who were not able to be present need only communicate with the Commercial Intelligence Branch of the Board in order to obtain the fullest possible assistance within its power, as the Board is anxious to leave no stone unturned to promote the national interests.

We extend a cordial invitation to manufacturers and their representatives to send us any observations that they may feel able to make as a result of their inspection of the exhibits. The publication of the views of experienced minds regarding these articles would, we feel, be most valuable to the British electrical industry at the present important juncture in its history.

An Urgent Appeal for Assistance.—We wish to appeal to our charitably disposed readers on behalf of a very deserving couple who are in sore straits. For some time past they have been enabled to keep a roof over their heads through the generosity of one of the electrical benevolent funds, but circumstances have now arisen which make assistance of other kinds necessary. The man, who was formerly a telegraph instrument inspector, lost his eyesight some years ago, and all he can do is to earn a trifle by typewriting or knitting. His wife is a Swiss, who speaks French and English well, and is a hard-working woman prepared to take in lodgers, and so keep a home together. Belgian refugees who were with them have returned to Belgium, and they have no means of meeting rent charges. It occurs to us that there may be some of our readers who could recommend them lodgers (the house is described as a pleasant one and is situated in Stockwell), or who would be prepared to place with them, and pay the charges for, some respectable Belgian refugees. We believe the latter course will commend itself as an excellent way of "killing two birds with one stone," as the doctor said when he visited two patients in a remote neighbourhood. We shall be pleased to put any reader in touch with the parties referred to, or communications may be addressed to Mr. F. B. O. Hawes, of the Electrical Trades Benevolent Institution ('Phone No.: Brixton 1833).

Trade Follows Travel.—It is stated that the ss. *Finland* has been chartered by the Fidelity Trust Co., of Baltimore, and will sail on January 27th for a cruise completely encircling South America, with the object of establishing better trade relations between U.S.A. and South America. The *Financial Times* in discussing the movement, quotes the president of the New York Central Line, to the effect that "trade undoubtedly follows travel." He speaks, of course, as a railway authority, but he merely says what we have urged upon the notice of British manufacturers scores of times, and many of them have testified to its absolute accuracy in recent years, as they have experienced better business as the result of their efforts. There will undoubtedly have to be much more of the most capable British travelling to all quarters of the globe in the interests of our industries directly. We hope that those destined to fill such engagements will not overlook the necessity for being prepared with linguistic and other qualifications in good time. We, of course, do not suggest that "travel" is the only matter of importance—there are many others, but this is one of the things that will be needed, whatever developments take place in general trade policy.

An Appeal.—The Belgian Chamber of Commerce in London (Incorporated), 24, St. Dunstan's Buildings, St. Dunstan's Hill, E.C., appeals to British manufacturers and merchants for support. Since the beginning of the war its task has naturally become much more arduous than in previous years. After the cessation of hostilities the Chamber will have very important duties to perform in helping the commerce of the two countries by bringing together manufacturers and buyers of goods and in many other ways. But we are informed that the Chamber finds great difficulties in carrying out its duties through lack of funds, as the demand has been greater than ever before and Belgian supporters are unable now to send their usual remittances. Applications for membership and contributions may be sent to the general secretary, Mr. P. Dorchy, at the above address.

German Tires.—At a recent meeting of the Halifax Tramways and Electricity Committee of the Halifax Corporation, Alderman Whitley Thompson directed attention to a charge made by Liga Tires, Ltd., of £56 for tires. He understood that this was a German firm, and, therefore, he supposed that cheques would not be issued to the concern until after the conclusion of the war. Ald. Spencer explained that Liga Tires, Ltd., was a London firm which existed for the circulation of German tires. He believed the company was now in liquidation, and, as the Committee had a large claim against the firm, the cheques would not be handed over to the liquidator until that liability had been met.

Belfast Electricians and National Relief.—The electrical department of Messrs. Harland & Wolff, shipbuilders, Belfast, is well represented in the list of contributors from the various departments to the National Relief Fund.

Old Briars Wanted.—We read in a Scottish newspaper that the Glasgow tramways Department are collecting pipes for the soldiers at the front and in the hospitals abroad, and also for the men of the Navy. "Up to date 31,409 pipes have been received, most of these being old briars. This number is very small compared with the number required, as, in many instances, one pipe has to satisfy many smokers. The tramways staff are still prepared to receive at 46, Bath Street, Glasgow, any pipes, and have them thoroughly cleaned and dispatched to the front."

Oldham Tramway Contracts.—The Town Clerk of Oldham has informed the Tramways Committee that the High Court, on the hearing of a test case for the recovery of the price of goods sold and delivered, has held that the plaintiff company incorporated in England was entitled to recover payment, although the shares were mainly held by alien enemies. He added that he had settled the action of the Polack Tyre Co. by payment of the debt without costs. The Tramways Committee has approved this action, and has instructed the borough treasurer to pay the accounts due to the Tudor Accumulator Co., Ltd., Dukinfield, which had been held over.

Relief Allowances to Municipal Employés.—The Rochdale Tramways Committee has been considering the case of a man who in June last was allowed to go on the tramcars to learn the duties of a conductor; he was not actually employed and receiving wages when the war broke out, nor for some time after. Now he has joined the Colours, and the question the Committee has had to decide is as to whether he is entitled to the half-pay granted to men enlisting who were on the staff when war broke out. By a majority of one, it has been held that he is entitled to the half-pay.

Cable Manufacturing at Perivale.—At the meeting of the Greenford District Council last week, Mr. L. Roberts wanted to know whether the firm of Messrs. Geipel & Co., whose plans for the erection of works at Perivale had been recently passed by the Council, was a German one. He understood that before the war the firm got its cables from Germany, but the intention now was to manufacture them at Perivale. The surveyor replied that the head of the original firm was naturalised in 1848. That gentleman was now dead, but he (the speaker) had made inquiries and was of opinion that the firm was "all right." Ultimately it was agreed to enter a minute to the effect that Mr. Roberts had raised a question on Messrs. Geipel's plans, and that the chairman had ruled the matter out of order.

Trade with Australia.—The Agent-General for New South Wales (123-5, Cannon Street, E.C.) published the following advertisement in the *Times* the other day:—"Notice to British firms. Manufacturers and others wishing to extend their business in New South Wales are invited to make known their wishes to the undersigned, from whom forms for the purpose can be obtained, and to whom all communications should be addressed. The forms when received will be sent to Sydney, where proper inquiries will be made as to the openings for placing the manufactures in which applicants are interested, and the result will be made known to inquirers."

The Council of the Sydney Chamber of Commerce has appointed a Sub-Committee to consider the practicableness of inaugurating a movement to take advantage of the suspension of trade with the enemy countries, and to develop such trade within the Empire and with the other allied nations.

Rawtenstall Employés with the Colours.—Nearly 40 per cent. of the staff at the Rawtenstall Corporation electricity works and about 25 per cent. of the tramwaymen have joined the Colours.

Personal.—Mr. Frank P. Lacey, consulting engineer, has been given a temporary commission in the Royal Garrison Artillery, and the Infirmary Committee of the Salford Board of Guardians has decided to accede to a request by him that on the termination of the war he shall be retained as electrical adviser.

Mr. R. H. Klein, hon. sec. of the Wireless Society of London, although having a name with a somewhat Germanic sound, is a Belgian and a naturalised British subject. He is a Licenciate in Consular Sciences of Antwerp.

Mr. M. C. Shepherd's friends will be interested to know that he is Corporal Instructor in the 14th (Service) Battalion of the Rifle Brigade, in training at Southend-on-Sea. Mr. Shepherd has long been an energetic supporter of National Service, and a promoter of the National Reserve, and has evidently seized the opportunity of bearing his share of the burden. Business will be carried on as usual in his absence.

Col. H. S. Holt, a former partner of Mr. James Swinburne, in Swinburne & Co., has been gazetted major in the Expeditionary Force, and has left for the front. He is attached to the Royal Flying Corps, for the purpose of instructing them in the fitting and use of his reconnoitring parachutes and other inventions.

Mr. John Ridley, who was amongst the survivors of the *Formidable* disaster, was the ship's chief electrician, and was formerly on the staff at the electricity works at Carlisle, where his home is. He entered the Navy about eight years ago, and prior to his transfer to the *Formidable* was on the H.M.S. *Commonwealth*. Before he was rescued he was 21 hours in an open boat. He is safe and well at Lyme Regis.

Mr. A. H. Campling, son of Mr. Frederick Campling, managing director of Messrs. Joslins, Ltd., electrical engineers, Colchester, has been gazetted second lieutenant in the 12th Service Battalion Essex Regiment. Mr. Campling has for several months been serving at Epsom with the Public Schools and Universities Corps.

It is stated that Private Lonsdale's death sentence has been commuted by the Court of Appeal to one of 20 years' imprisonment, but it is understood that he will be released with the other British prisoners at the end of the war.

The Electrical Engineering and Equipment Co., Ltd., inform us that they have three directors—Mr. Bowlby, Mr. Higgins and Mr. Leven. Mr. Bowlby's son is a captain in the Norfolk Regiment, and has been missing for three months; Mr. Higgins is a captain, and has been at the Front for some time, whilst Mr. Leven's two sons are both in the Army, the younger one, Lieutenant Charles Leven, having recently been invalided home. In addition, there are also a number of members of the staff serving in the Army.

Mr. S. W. Carty has just resigned his position as overhead superintendent to the Liverpool Corporation tramways department, and has obtained a commission as a lieutenant in the Army Service Corps Motor Traction Department, where his duties are to control the workshop units attached to the anti-aircraft guns. Mr. Carty held a similar position with the Newcastle Corporation before going to Liverpool, and in both cities he has been secretary to the local Automobile Clubs.

Roll of Honour.—Private W. Macdonald, of the Mechanical Army Service Corps, Highland Division (T.F.), has died at Bedford, aged 20. He was employed as an apprentice electrical engineer with Messrs. Millar Bros., Aberdeen.

Mr. Joseph Dunn, who was for some years employed as a conductor on the Salford Corporation tramcars, has been killed in action.

BUSINESS NOTES.

Consular Notes.—BAGDAD.—In his report for 1913 on the trade of Bagdad, the British Consul-General gives the total value of machinery imported as £169,000, of which £106,000 came from the United Kingdom. This represents a total increase of 62 per cent. over the value during the previous year, the advance being partly due to the inclusion of some railway construction material. Nevertheless, there has no doubt been a real and substantial improvement. As in preceding years, the bulk of the machinery, consisting of irrigation plant, was of British manufacture.

KOBE.—According to the British Consular representative, there was a large increase in machinery imported at Kobe during 1913, the total being approximately £380,000 more than in 1912. This item forms, he says, one of the most satisfactory features in the import returns, and is, moreover, one that must eventually increase in value as industrial development progresses, though the existing depression in trade, and other causes, will probably prevent any notable advance in the immediate future. There is no doubt that the Japanese spinning industry has a bright prospect before it, and that the fast-growing markets in China and Corea will be the cause of still further additions to machinery importation.

As regards electric motors, alternators, &c., the main part of the business was divided about equally between the United Kingdom, United States, and Germany. The completion of the Ujikawa hydroelectric works has to some extent increased the demand for motors for running small power plants. The construction of electric railway systems continues, but most of the orders for equipment appear to have gone to the United States and Germany.

Dissolutions and Liquidations.—The Electro Steel Foundries, Ltd., Booth Street, Darlaston.—Under a compulsory winding up order made against this company, the statutory first meetings of the creditors and shareholders were held on January 8th, at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C., Mr. H. E. Burgess, Official Receiver, presiding. The petition to wind up was lodged by Messrs. Tunbridge & Co., solicitors, Birmingham, on behalf of Mr. Alfred Ernest Owen, The Lawn, Streetley, near Sutton Coldfield. A statement of affairs was presented showing liabilities £3,200, assets valued at £5,000, representing unpaid calls on shares £7,500, and as regards contributories, a deficiency of £3,200.

The company was incorporated as a private company in June last with a nominal capital of £45,000 to carry on the business of iron, steel and brass-founders, casters, moulders, and metal-workers, the object being to work a particular electrical process of steel manufacture which had been successfully worked in Germany. The promoters were Mr. Francois Victor Bernand, electrical engineer, of Houldsworth Wood, who was to act as managing director for six years, at a salary of £500 per annum, and Mr. Alfred Ernest Owen, the petitioner. The issued capital was £30,000, the whole of which was subscribed for in cash and called up to the extent of 5s. per £1 share. An agreement was entered into on July 22nd, 1914, between the Rheinische Electrostahl Werke, of Bonn, on the Rhine, Mr. Owen, and the company, whereby the German Co. agreed to supply instructions and drawings for laying down plant for the manufacture by a special process of electric steel castings; to supply certain Electrostahl furnaces, and to apply for the allotment of £10,000 shares in the company. Mr. Owen being the proprietor of land at Darlaston agreed to sell a certain part thereof to the company and to apply for the allotment of £20,000 shares, which were issued as to £17,000 to Mr. Owen and £3,000 to Mr. Bernand. The outbreak of hostilities made it impossible for the German Co. to carry out the agreement, and the company is unable to enforce payment of the call upon them in respect of the £10,000 shares. Mr. Bernand issued a writ against the company for salary as managing director, and proceeded to judgment, whereupon Mr. Owen took the necessary steps to protect himself, and presented the petition to wind up the company. The failure is attributed by its officials to the European crisis, whereby the persons connected with the German Co. became alien enemies, which prevented the objects of the flotation being carried into effect. The Chairman remarked that this was essentially a case for the parties to come to an amicable settlement, seeing that the general public were not involved in the proceedings, and he counselled a friendly meeting, at which, if necessary, he would give them any advice or assistance. Mr. Owen and Mr. Bernand appeared to endorse that view, and by general consent the liquidation was left in the hands of the Official receiver.

The General Electrolytic Parent Co., Ltd.—This company is winding up voluntarily with Mr. J. Barron, of Middlewich, as liquidator. A meeting of creditors was held on January 14th.

The Dry Gas Electric Fire Extinguisher Co., Ltd.—A meeting will be held on February 11th, at 109, Colmore Row, Birmingham, to hear an account of the winding up from the liquidator, Mr. H. Keeling.

Grindell Matthews Wireless Telephone Syndicate, Ltd.—Liquidator (Mr. H. Woodburn-Kirby Bassishaw House, Basinghall Street, E.C.) released December 16th, 1914.

Messrs. W. J. Clent and J. R. Halliwell, flash lamp battery makers and commission agents, 19a, Corporation Street, Manchester, who have traded as W. J. Clent & Co., have dissolved partnership. Mr. Halliwell is continuing the business under the style of Halliwell & Co.

Sending Receipts on Account.—In the City of London Court, on Thursday last week, before Judge Rentoul, K.C., in the case of Minchin *v.* Strauss, plaintiff, Mr. W. S. Minchin, 20, Hanover Square, claimed £8 2s. 6d. against the defendant, Mr. Julius Strauss, 32, Seething Lane, for the balance of £40 for trade goods supplied. Mr. Woodgate appeared for the plaintiff, Mr. Beechcroft for the defendant. Mr. Woodgate said that defendant disputed that goods to the amount of £40 had been supplied or work done and sent the plaintiff a cheque for £32 1s. 11d. "in full settlement of account." Plaintiff accepted the cheque, waited until it was cleared, and then wrote and said he did not accept the condition on the cheque, giving a receipt "on account."—Mr. Beechcroft said there was a *bonâ fide* dispute about the balance deducted, but defendant would not go into that now, as the time and trouble involved would be out of all proportion to the amount at stake. They had had three different accounts from the plaintiff. Plaintiff could not retain the cheque, pay it in, and then say he would not accept the condition attached to it. Plaintiff gave no opportunity to the defendant to withdraw his cheque when he said he would not accept the condition. A cheque was not money, but a negotiable instrument for money. If a man did not accept the condition the only honest course was to give the defendant a chance to take back his cheque.—Judge Rentoul agreed that that would have been better, but plaintiff would have been out of the bulk of his money for some months if he had done that.—Mr. Woodgate urged that plaintiff was quite within his rights and within the legal decisions.—Judge Rentoul agreed and found for the plaintiff, with costs.

Catalogues and Lists.—The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.—Two booklets: No. 264, a 12-page pocket pamphlet, in which are illustrations and prices of a new range of "Electric Cooking Apparatus de Luxe," especially for table use (kettles, water-heaters, grill, toaster, boiling-ring and irons); and No. 263, which is an 8-page priced publication showing a number of their registered designs of British-made fittings for half-watt lamps, the majority with opalescent globes, but two with Holophane glassware.

Messrs. Marples & Leach, 26-30, Artillery Lane, London, E.C.—Eight-page stock list of c.c. and a.c. motors, dynamos and portable electric tools in London ready for delivery.

Messrs. Electric Installations, Ltd., 27 and 28, Martin's Lane, Cannon Street, London, E.C.—Folder relating to intercommunication telephones for business premises, and a list of installations supplied by the firm.

Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—Pamphlet No. 37 gives particulars, prices, code-words, &c., for ironclad oil-break switchgear for mining and sub-station work.

Messrs. A. P. Lundberg & Sons, 477 to 489, Liverpool Road, London, N.—Ten-page pamphlet (No. S 24), containing very full and illustrated matter relating to their various types of ceiling roses—"Biflex," "Detachable," "Triflex," "Quadruflex, "Multiflex," and "M.I.P." Prices are stated, and examples of their uses given.

The Edison & Swan United Electric Light Co., Ltd., of Ponder's End., have prepared some most artistic and effective transparencies for fixing to their customers' windows, show-cases, &c., in all parts of the country. Reproduction here would hardly do it justice—it requires to be seen printed in colour—but for the purpose for which it is intended it must be an excellent advertising agent for Royal Ediswan drawn-wire lamps.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Leaflet No. H 1,882 gives some particulars of the "County" half-watt lantern with Holophane globe.

Bankruptcy Proceedings.—S. Brookes (The Netherton Tube Fittings Co.), tube fittings manufacturer, Netherton, Dudley).—Discharge suspended for two years, on December 8th, 1914.

George Edward Hipkins, electrical engineer, 11, Bath Street, Dudley, appeared at the Dudley County Court last week for his public examination in bankruptcy. The liabilities were set down at £510, and the deficiency at £386. Debtor attributed his failure to "loss on picture palaces, loss on trading through the war, law costs, and interest on borrowed money." The examination was subsequently adjourned to close

Book Notices.—*The Electrical Engineer's Diary for* 1915. Edited by J. H. Johnson. London: S. Davis & Co. Price 3s. 6d.—Whilst the bulkier portion of this volume is certainly a diary, interleaved with blotting paper, the remainder is a reference book containing a mass of useful information with regard to electricity supply and electric lighting, heating, cooking, and power. In addition to a collection of tables and data of general application, and the principal sets of official regulations, there are sections dealing with power station plant and management, illumination, and domestic uses of electricity, and a valuable set of tables on the power required for a great many industrial applications of electrical energy. A list of London streets in which electric mains are laid forms a unique feature of this publication, and a list of electricity supply authorities in the United Kingdom is included. Altogether it is a very creditable production, and should prove useful to a wide range of electrical men.

Magnets and Electric Currents. By J. A. Fleming, F.R.S. London: E. & F. N. Spon. Price 3s. 6d. net.—It is generally reckoned that electrical books are obsolete when they are, say, 10 years old, owing to the rapid march of progress; happy, therefore, are the publishers, and proud should be the author of one which, first published 17 years ago, can now be re-issued apparently without the least alteration except in the preface and the title-page. In passing, we may point out that in both places it is referred to as the third edition; this is hardly correct, as it is, strictly speaking, only the third *impression.* Prof. Fleming states, in explanation of the absence of change, that the book "deals with the fundamental and elementary principles on which Electrical Engineering is based, and these are not subject to variation"; this is true in the main, but it is not advisable to go too far along these lines. For instance, nomenclature changes, and we do not now speak of "micrometres," but microns, nor are the abbreviations grm. and kgr. recognised; the weber as the unit of magnetic flux is not in general use, and the accepted value of the British thermal unit is not 779, but 778 ft. lb. The "modern two-pole dynamo" illustrated on p. 349 was modern 17 years ago, but, like most of the commercial apparatus illustrated, it is now ancient. We praised this book when we reviewed it in 1898; and—it *was* a good book.

The Kinematograph Year-Book, Diary and Directory for 1915 (London: *Kinematograph and Lantern Weekly*) is an interesting and useful volume, which, by its bulk, affords some indication of the extraordinary development of the new industry which has so quickly established itself amongst us; the directory alone occupies 100 pages, and includes particulars of the systems and voltages of electricity supply throughout the United Kingdom. Moreover, this is only the second issue of the year-book—yet it contains a mass of information on all matters connected with the picture play that does great credit to the producers. The industry may justly claim to be inseparably associated with electricity supply, seeing that the electric arc is almost invariably used as the source of light, and the theatres are usually electrically lighted; we are therefore interested in its prosperity, which may be gauged by the fact that during 1914 500 new companies were registered and 300 new theatres were opened in Great Britain. A large number of the establishments are called "Electric Theatres." The year-book contains a note concerning new electric lamps, and we regret to notice that the invention of the half-watt lamp is ascribed to Germany; this is wholly erroneous, the lamp having been developed entirely in the United States. The early work of Mr. R. W. Paul, the pioneer of the kinetoscope in this country, as well as of the kinematograph, is described, and the book is illustrated with numerous excellent half-tones from films, admiring which has prevented us from making further notes on the literary contents.

Willing's Press Guide for 1915 has made its appearance. It is published at the popular price of one shilling, at 125, Strand, W.C. On the whole, it is a very serviceable directory, but it ought to be more accurate in its entry, in "Metropolitan Newspapers" section, relating to the date of an electrical contemporary's birth.

"How to Pay for the War." By Wilfrid Stokes.—London: British Engineers' Association. 6d.

"*Proceedings* of the Physical Society of London." Vol. XXVII, Part 1. December, 1914. London: The *Electrician* Printing and Publishing Co.

"Science Abstracts." Sections A and B. Vol. XVII, Part 12. December 30th, 1914. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each net.

Trade Announcement.—MESSRS. MOSSAY & CO., LTD., have removed from Horseferry Road to Queen Anne's Chambers, Westminster, where they are continuing their engineering business. As already announced, they have made arrangements with Messrs. Ransomes, Sims & Jefferies, Ltd., of Ipswich, for the manufacture to their designs, of electrically-driven vehicles. Under these arrangements Messrs. Mossay are also acting as selling agents for these vehicles in the United Kingdom, and all inquiries relating thereto should be addressed to them. The first series of chassis is already in hand, and early deliveries can be given.

Canada.—The *Times* states that an important new steel plant, owned by the Armstrong, Whitworth Co., of Canada, Ltd., is now in operation at Longuenil, opposite Montreal, in the Province of Quebec. About 200 workmen will be employed at the outset, under the supervision of experts from British works. For the present the company will confine its operations to the manufacture of high-grade crucible steel for machine tools.

Private Arrangements.—REDGLO, LTD., 647, Royal Liver Buildings, Pier Head, Liverpool, and 34, Great Ancoats Street, Manchester, electrical stove manufacturers.—Pursuant to Sec. 188 of the Companies' (Consolidation) Act, 1908, a meeting of the creditors herein was held at Liverpool last week, when a statement of affairs was presented showing liabilities amounting to £548 and net assets estimated to realise £599, the estate disclosing an apparent surplus. It was reported that the company was formed 18 months ago, with a capital of nearly £1,000. The trading up to the present time amounted approximately to £855, while the sales of patents amounted to £1,500. It was explained that the greater portion of the loss was owing to the initial expenses in the formation of the concern. The patentee, Mr. Martin, was at present on active service, and the business was being conducted by the liquidators, Mr. Ernest J. Walker, of Messrs. Lloyd Walker & Evans, and Mr. P. Hutchinson, a creditor. Mr. Hutchinson stated that he had several purchasers in view for the patents, and it was hoped that ultimately the creditors would receive 20s. in the £. It was decided that the matter should be left in the hands of the joint liquidators. The following are creditors:—

Hutchinson, P.	£232	Evans, E. W.	£17
Lloyd Walker & Evans ..	21	Peyton & Peyton, Ltd... ..	17
Winfane Art Metal Co. ..	20	Tyreman, W. H.	18
Simpson, North & Co. ..	22	Drinman & Cooper	15

Foreign Electrical Trade in 1914.—The *Chamber of Commerce Journal*, in the course of its trade review for last year, gives the following figures showing the course of the export and import trade in electrical goods for the eleven months ended November 30th, 1913 and 1914:—

	1913.	1914.
EXPORTS.		
Electrical goods and apparatus (other than machinery and uninsulated wire)—		
British	£5,05[illegible]207	£2,833,330
Foreign	220,719	176,670
Electrical Machinery—		
British	24,873 tons. £2,076,092	23,679 tons. £2,040,578
Foreign	711 tons. £86,495	461 tons. £63,195
IMPORTS.		
Electrical goods and apparatus (other than machinery and uninsulated wire)	£1,431,771	£1,152,017
Electrical machinery	1,223,501	1,353,851
" "	10,433 tons.	11,178 tons.

Trade Openings in Buenos Ayres.—With a view to increasing Italian exports to Buenos Ayres, the Italian Chamber of Commerce in that city has instituted an inquiry, and formulates the following list of articles for which there is a demand in the Argentine market:—Electric motors, dynamos, explosion engines required in electric stations, accumulators, malleable steel and iron tubes for internal wiring, with accessories, metal-filament lamps, and armatures for same, 220 and 240-volt current-breakers, and general accessories for electric installations. The requisites for successful sales are: moderate price, æsthetic appearance, judicious advertising, choice of expert representatives having good *clientèles* and of good repute, having a knowledge of where to grant facilities for payment. The factors which have worked against foreign, and particularly Italian trade, have been lack of discernment in the choice of agents, smallness of the means placed at the agents' disposal, lack of initiative in the agent, and oftentimes lack of knowledge of the branch of goods handled, at times also too little liberty and too exacting contracts, too much exigence on the part of manufacturers and absence of facilities for payment. Packing and forwarding are governed by the article and the transport convenience available, and also the Customs regulations, which in some cases are fixed by weight and in others by number. Packing itself should be the object of special study, as upon it depends the good condition of the articles on arrival, and therefore of the higher or lower scale of cost. The conditions of payment usually exacted by German houses is 90 to 180 days in shipping documents, paid by bills drawn on German branch banks, without interest. As the effect of the war will be to paralyse for an indeterimate period the industry of many countries, and especially of Germany and Austria, the former hitherto enjoying a large share of Argentine trade, the present time affords an excellent opportunity for other countries to forward their goods and secure a footing in the progressive Argentine market.

Australian Tariffs.—Various representations were made to the Inter-State Commission in Melbourne recently for alterations in the tariff with respect to electrical apparatus. Mr. W. J. Mountain, secretary to the Melbourne Electric Supply Co., applied for a reduction of the duty on electrical incandescent lamps. These lamps (he said) were not made in Australia, though they provided the most hygienic light. The duty on them hindered their sale. Mr. F. W. Clements, chief engineer to the Melbourne Electric Supply Co., asked for a reduction of the duty on electric generators for direct coupling to steam turbines. Mr. James Wilson, manager of the British General Electric Co., Sydney, asked for a British preferential tariff of 10 per cent. on certain electrical appliances. There had been very serious competition to contend with (he said) from America and Continental manufactures. Continental manufacturers did not supply goods nearly up to the British standard.—*Australian Mining Standard.*

Calendars and Diaries. — The Diamond Coal-Cutter Co., Wakefield.—A wall calendar with monthly slips has been issued. A Diamond cutter figures in the design.

From the Dussek Bitumen Co., of Empress Wharf, Bromley, E., we have received as usual a very presentable pocket diary with card and letter case, and insurance coupon. We are interested in the general information which it contains, especially where there are some "Things One Wants to Know." That it is copyrighted by Collins' clear-type Press relieves the Dussek Co. of responsibility, and the war exonerates both, but one of the things that one very much "wants to know" is that the income-tax is "1s. 2d. in the £." We certainly want to know that more than that "an airship going at 50 miles per hour would take 210 years to reach the sun from the earth," though there is some timely interest in the fact than an inch of rain means about 100 tons per acre, and far more in the inspiring statement that February is one of the driest months of the year. We congratulate the Dussek Co. on continuing to issue a most acceptable pocket souvenir.

From The Electro-Motor Hiring, Ltd., of Greenmount Works, Halifax, there has come to hand a wall calendar with monthly slips. The design is a Union Jack in colour forming a background for five half-tone illustrations of Wright & Wood motors.

A very serviceable and clearly-printed calendar with monthly sheets for 1915 has been received from the Selson Engineering Co., Ltd., of 85, Queen Victoria Street, E C.

Crane Contracts for India.—Amongst the Government orders recently received by Messrs. Pyne, Hughman & Co., engineers, of London and Calcutta, are the following :—

Thirteen 2-ton electric goods lifts for the new sheds now being erected by the Port Commissioners, Calcutta. north of the Howrah Bridge, amount of contract over £6,000. These lifts are being manufactured by Messrs. A. & P. Steven, of Glasgow, for whom the firm are agents. The Port Commissioners have also placed an order with the same firm for 11 2-ton electric roof cranes for the new sheds and jetties being built at Garden Reach, amount of contract over £12,000. These cranes are being manufactured by Messrs. Geo. Anderson & Co., of Carnoustie.

A repeat order has also been placed with Messrs. Pyne, Hughman and Co. for a further 19 electric cranes (13 semi-portal and six roof cranes) amount of contract over £24,000. The cranes in this instance are being manufactured by Messrs. John Grieve and Co., of Motherwell.

Warsaw.—H.M. Consul reports that a local firm wishes to get into touch with United Kingdom manufacturers of electrical goods, such as dynamos, fans, lighting accessories, installation materials, telephones, bells, &c. The names can be ascertained at the Commercial Intelligence Branch of the Board of Trade, London, E.C., but further communications should be addressed to the British Consulate, Warsaw.

LIGHTING and POWER NOTES.

Aberdeen.—During November, 1,138,140 units were generated at the Corporation power station, an increase of 63,250 units compared with the corresponding month in 1913.

Argentina.—It is reported that the electric lighting company has notified the Municipality of Mar del Plata of its decision to suspend the public lighting service at the end of the present month, owing to the Municipality having made no payment for the last 1½ years' service. The residents of Dolores are protesting against the excessive charges of the Italo-Argentine E.L. Co., and a technical inspector is to be appointed.

It is proposed to construct electricity works at Irigoyen (Santa Fé), which would also supply Barrancas, Diaz and Casalegno.—*Review River Plate.*

Australia.—The Parramatta Council has concluded a contract with the Parramatta Electric Lighting Co. for the lighting of the town by electricity.

The Mount Lyell Power Co.'s hydro-electric scheme is now nearly completed. At the blower house at the smelters four electrically-driven turbo-blowers, each of 25,000 cb. ft. capacity, and two of 3,500 ft. capacity, have been installed, with satisfactory results.

The Sydney Municipal Council has authorised the city electrical engineer, in view of the possible necessity for additional plant required to meet the demand for electricity in the winter of 1915, to prepare specifications for two 12,000-kw. turbo-generators and the boiler house equipment necessary to provide steam for one of these machines.

At Wollongong (N.S.W.) the installation of an electric plant at Mount Pleasant colliery is being proceeded with, and a transmission line for three-phase current is being erected. It is stated that in a few months there will be energy produced at this colliery far beyond its own needs, and the company will, no doubt, be prepared to supply outside consumers.—*Tenders.*

Bacup.—Street Lighting, &c.—The Lighting Committee has accepted the terms of the electricity department for electric lighting of street lamps—34s. per annum plus 3s. 6d. for each 1,000 hours during which the lamps are lighted.

The Electricity and Tramways Committee has resolved that in respect of installation work executed by the Corporation on private consumers' premises, a charge of 10 per cent. above actual cost price be made for establishment charges, supervision, management, wages, &c., and, where specifications, quantities, &c. only are prepared, and the works not carried out by the Corporation, a charge of 5 per cent. on the estimated cost be made.

A scheme for lighting the fire station by electricity has been approved.

Bath.—The E.L. Committee recommends that Messrs. Mirrlees, Bickerton & Day, Ltd., be asked to inspect the Diesel engine at the works and to submit their suggestion for altering, completing and reassembling the same, together with an estimate of the costs.

Blackrock (Co. Dublin). — L.G.B. Inquiry.—Mr. P. C. Cowan, of the Irish L.G.B., will hold an inquiry on 26th inst. into the U.D.C.'s application for sanction of a loan of £13,000 for an electric lighting scheme.

Bridlington.—The T.C. has decided to seek the approval of the L.G.B. for the use of a site adjoining the electricity works for the erection of a dust destructor.

Boston.—E.L. Scheme.—The T.C. has asked the B. of T. to receive the deputation to discuss the option of purchase to be given to the Council, and the maximum price to be charged for current, under a prov. order being applied for by Mr. Robert Arthur Smith. The Council has received the sanction of the L.G.B. to a loan of £3,600 for the erection of a refuse destructor.

Cheltenham.—Street Lighting, &c.—The Electric Lighting Committee has reduced the charges for street lighting by £500, and transferred £352 from the profits to the relief of the rates.

Chingford.—Prov. Order.—The U.D.C. has decided to withhold its consent to the prov. order for electric supply being applied for by the County of London Electricity Supply Co.

Clacton.—New Battery.—The Council has decided to install a new battery at the electricity works, at a cost of £1,634. The Electricity Committee's report on the past year's working showed steady progress, the gross profits being £360 more than in the previous 12 months, whilst £114 was carried forward, as against £24 in the previous 12 months.

Continental. — Holland. — A concession has been granted to the Province of Overijssel for the construction and exploitation of works for the supply of electricity.—*Board of Trade Journal.*

Dartford.—The Electric Lighting Committee has resolved to petition against the London Electric Supply Bill.

Denton.—Public Lighting.—The U.D.C. has decided to have the bandstand in, and entrances to, the park lighted by electricity, the cost to be included in the estimates for the ensuing year.

Doncaster.—Sale of Fittings, &c.—At the statutory meeting of ratepayers to consider the provisions of the Corporation's Parliamentary Bill, a resolution was moved, on behalf of the Tradesmen's Association, for the deletion of clauses empowering the Corporation to sell meters and fittings connected therewith, and to sell, let for hire, and fix, &c., electric fittings and appliances. On behalf of the Corporation, it was contended that the municipality were, in the clauses, endeavouring to protect the interests of individual traders as against trusts and big companies. The deletion of the clauses was agreed to by a large majority.

Edinburgh.—Effect of War.—An interesting statement as to the effect of the war on the electric light undertaking has been made by Councillor Stevenson, who said their revenue was heavily hit, due to the restricted public lighting on the one hand and the modified private lighting, but during the seven months since May last they had connected 97,507 8-c.p. lamps, while during the whole of the year 1913-14 they had only connected 148,027 lamps, so that in spite of the war the figures showed that the business had been growing more rapidly than in the previous year.

Essex.—The County Council has decided to oppose in both Houses of Parliament the Bills of the London and District Electric Supply Co., the Woodford and District E.L. Co., and the two London Electricity Supply Bills.

Farnham (Surrey). — A Committee of the Council having made inquiry of the Gas Co. as to an extension of cables to the Hale Ward, has been informed that the demand for current would not be sufficient to justify the expenditure. It has therefore been decided that inquiries be instituted by the Council with a view to securing a supply of electricity otherwise than through the Farnham Gas and Electricity Co., upon terms which will impose no undue burden upon the existing rates. One Councillor remarked that they might just as well remain in the dark as have the gas at present being supplied.

Gillingham (Kent).—School Lighting, &c.—Owing to consumers not being allowed to use outside lamps, the T.C. has decided to reduce the charges for hire during the period of non-use to 1s. each per quarter, and to make no charge for the hire of the meter during that period. At the request of the secretary to the Education Committee, a report is to be prepared on the installation of the E.L. at five non-provided schools in the borough, on the basis of the Education Committee paying for current at a rate covering the cost of the installations and the hire of fittings.

Glastonbury (Somerset). — Prov. Order.—At a meeting of the T.C. the town clerk reported the deposit of plans and notices with regard to the proposed E.L. order for which Messrs. Christy are applying and it was decided to ask that the compulsory area should be enlarged.

Greenock.—Loan Sanction.—The Corporation has been notified that the Secretary for Scotland has given his sanction to the application to borrow £30,000 for the electricity undertaking.

Hayward's Heath.—Prov. Order.—The U.D.C. has decided to request the B. of T. to grant an extension of time for carrying out the prov. order for E.L. granted to the Mid-Sussex E.L. and P. Co., Ltd.

Hazel Grove and Bramhall.—Proposed E.L. Scheme.—The U.D.C. has decided to engage Mr. T. L. Miller to report upon a scheme of electricity supply for the Council's district, at a fee of 25 guineas, plus out-of-pocket travelling expenses.

Henley-on-Thames.—Prov. Order.—The T.C. has empowered the town clerk to take the advice of the Parliamentary agents before any further steps are taken respecting the prov. order for E.L. being applied for by the Reading Electric Supply Co.

Hereford.—The T.C. has applied to the B. of T. for consent to the supply of current along a route in the city, by overhead lines at a pressure of 440 and 220 volts.

The R.D.C. has consented to the T.C. supplying electricity to Tupsley Court, which is outside the borough, subject to cables passing along or across any highway being placed underground.

Holme.—The U.D.C. has considered the Bill of the Yorkshire Electric Power Co., and has decided to ask for an assurance that the Bill will not prevent the Council or a local company from running an electric plant in Holme.

Holmfirth.—E.L. Scheme.—B. of T. sanction has been received to the scheme of the Council for supplying electricity.

Hove.—Plant Extensions.—It is proposed to install a 500-kw. mixed pressure turbine set, a new battery, booster sets and switchgear at the Leighton Road Works. Superheaters would also be fitted to the boilers, and the engineer estimates an improvement of the efficiency of the present plants of some 20 per cent. The estimated cost of the work is £6,970. It is suggested that energy be supplied to local wiring contractors, for showroom purposes, at 3d. per unit.

Keighley.—Half-watt Lighting.—It has been decided to erect two additional 2,000-c.p. half-watt lamps in East Parade, the annual cost for current and maintenance being estimated at £10.

Kingstown.—On Thursday, last week, in London, Mr. S. L. Brown, K.C., as Arbitrator, opened the proceedings in connection with the amount to be paid as compensation by the Kingstown U.D.C. to the Dublin Southern District Electric Supply Co. under a prov. order obtained in Parliament last Session for the transfer of the undertaking to it within six months on its paying the expenses incurred by the promoters.

Lees.—Proposed E.L.—With reference to the promotion of a Bill by the Stalybridge Joint Board seeking powers to extend its supply of electricity to Lees, and other districts, the Oldham T.C. has appointed a special sub-Committee to confer with the Lees D.C. on the matter.

Limerick.—Proposed Loan.—The Corporation has made an application to the L.G.B. for sanction to a loan of £5,000 for additional plant and machinery at the electricity works, and the inquiry will be held on the 22nd.

Liverpool.—Electrical Pumping.—It has been decided to replace the drainage pump at the Canada Graving Dock pumping station by a larger one, electrically driven, at a cost of £550.

London.—Greater London Supply Scheme.—In view of the opposition, most prominent on the part of Borough Councils who are electric suppliers, to its scheme, the L.C.C. has appealed to such Councils for their views on the advisability of obtaining uniformity and establishing a bulk supply, and asking on what terms the Councils would support the Bill. The Hammersmith B.C. has intimated, in reply, that it cannot support the Bill.

Hackney.—The B.C. is recommended to present petitions against the London and District Electricity Supply Bill and the London Electric Supply No. 2 Bill.

Battersea.—The B.C. has been advised that the Port Authority has fixed the rental of the suction and discharge pipes in the Thames in connection with the water-condensing plant at the generating station, at £75 per annum for a period of five years.

Lytham.—The Bulk Supply Proposals.—The St. Annes and Lytham's Councils have not been able to come to terms in connection with the bulk supply of electricity. The St. Annes Council has now declined to admit the right of the Lytham Council to supply electrical energy to the Tramways Co. in Lytham after June, 1917, and has intimated that as it sees no hope of arriving at a mutual understanding, it is not disposed to discuss the matter further, and was willing, if Lytham assented, to drop the agreement altogether. The Lytham Council has now written to St. Annes stating that the papers have been sent to their Parliamentary agents for them to arrange for a reference to counsel of the differences between the two Councils.

Maidenhead.—The T.C. has agreed to supply current to the motor works of G.W.K. Ltd., who it is anticipated, will pay at least £300 a year for energy.

Nelson.—The T.C. has approved a proposal to give a supply of current to Barrowford, and the electrical engineer is to prepare estimates, &c.

Newcastle West (Co. Limerick).—E.L. Scheme.—It was reported to the T.C. that the ratepayers had decided by a large majority in favour of the lighting of the town by electricity, and the clerk was directed to communicate with Mr. Wm. Phelan in reference to a scheme submitted by him.

Oldham.—Heating Tariff.—The T.C. has reduced the price of electric energy in the town for cooking and heating purposes to a flat rate of 1d. per unit.

Randalstown (Co. Antrim).—Camp Lighting.—The military camp lately constructed here is to be lighted by electricity supplied locally, the adjacent river providing the power for the local lighting and the camp.

Ripon.—Camp Lighting Scheme.—In connection with the arrangements which are being made for the reception of a large number of soldiers at the military camp, it is intended to install an electric lighting plant and to erect a power station near the Pateley Road. The Corporation is to have the opportunity of a supply in bulk and to undertake the distribution, with possible eventual purchase of the power station.

Salford.—L.G.B. Inquiry.—An inquiry was held on January 8th into the application of the Corporation to borrow £22,910 for new plant and equipment, and for an extension of the Frederick Road electricity works. There was no opposition, and the inquiry closed.

Sevenoaks.—The R.D.C. has decided to formally oppose the London Electricity Bill in order to permit of action being taken.

Skelton and Brotton (Yorks.).—Supply Inaugurated.—The supply of electrical energy by the Council under its lighting order of 1913 was officially commenced on January 1st, and on the same day the ordinary lighting consumers of the Cleveland and Durham Electric Power Co. in Carlin How were taken over by the Council's undertaking. The area of supply contains a population of about 16,000 inhabitants, and embraces half-a-dozen distinct parishes somewhat widely separated from one another. On economic grounds, therefore, overhead lines have been adopted almost exclusively, only a small length of underground mains having been used for a few special "crossings." A bulk supply is taken from the Cleveland and Durham Power Co. at high pressure at several sub-stations and there transformed by the Council. The general supply is given on the four-wire three-phase system with a frequency of 40 periods and at a pressure of 250 volts for public and private lighting, and 440 volts for power purposes. A small section of the lighting supply in the parish of Carlin How hitherto given by the Power Co. at 110 volts is being maintained at that pressure. Solid copper wires are used throughout, the sectional area of the main line being ·05 sq. in. for each of the three-phase wires and ·025 sq. in. each for the two neutral wires. The public lighting and small branch lines are mainly No. 11½ S.W.G. with a split neutral of the same section. The greatest span on the line is about 180 ft., and the average 140 ft., the height of the wires above ground being 22 ft. The lines are protected by lightning arresters fixed at the various sub-stations. Both steel and wood poles have been used, the latter being restricted to the more rural roads in the district. Each pole is fitted with a double safety cradle formed of No. 3 copper wire connected to the neutral wires, and insulated from the supports. Special "cradling" has been provided where the lines cross railways and telephone and telegraph wires. The length of route provided with distributing lines is about 16 miles. The substations are equipped with Berry transformers, B.T.H. high-pressure switchgear and Westinghouse low-pressure switchgear. All the public street lamps, numbering close upon 400, are being electrified with "Mazda" lamps, the poles carrying the lines being utilised for the fittings. The lamps are controlled by special line wires and Venner time switches. Only a part of the public lighting has yet been started. Messrs. Graham Bros., of Middlesbrough, were the contractors for the overhead lines, sub-station equipment, switchgear and public lighting fittings. Messrs. May and Hawes, of Westminster, are the consulting engineers for the scheme, and they have also been appointed by the Council as administrative engineers of the undertaking for a period of 15 months from the commencement of the supply, with authority to appoint the necessary staff and conduct the working operations of the undertaking. Mr. George Dixon is their resident electrical engineer. The rates of charge fixed by the Council are as under:—Lighting, 4½d. per unit for the first 100 units per quarter, and 4¼d. for additional units; power and heat, 2d. per unit for the first 100 units per quarter, and 1½d. for additional units. A minimum quarterly charge for metered supply is 5s. Slot meter supplies are available for premises of a rateable value not exceeding £20, with installations not exceeding 500 watts at 5½d. per unit, while contract supplies are given under special conditions to premises of a rateable value of not exceeding £20, at an inclusive charge of 7d. per week for an approved installation of not more than five lamps, with an additional charge of 1d. or 2d. per week for each additional 20 or 40-watt lamp respectively. Already over 250 private consumers are being supplied, many of them on the contract principle for a fixed inclusive weekly payment according to the number of lamps installed, a method of supply which the Cleveland miners appear to appreciate.

(*Continued on page 83.*)

RECENT DEVELOPMENTS AT THE SALFORD ELECTRICITY WORKS.

The Frederick Road generating station of the Salford Corporation electricity department will live in the memory of those who were familiar with it as it appeared a few years ago, if only for its imposing vistas of medium-speed reciprocating sets and Lancashire boilers.

These works which were established in 1902, and described in our pages at the time, had a total plant capacity of 6,400 kw. of direct-current generators, supplemented by batteries of 270 kw. capacity on a three-hour discharge; the station was erected at the time when the electrification of the Corporation tramway system was being carried out, and it superseded the little single-phase alternating-current plant which represented the Corporation's first venture in electric supply works.

Since that time the demand for electrical energy in the area, which is a purely industrial one, has advanced at a great rate, and the $1\frac{1}{4}$ million units output of 1902 has expanded to 20 millions, of which about 8 million units represent the tramway demand. There are, at the present time, some 16,700 h.p. of motors (exclusive of tramway motors) connected to the mains, including over 5,300 h.p. of hired motors.

In the interval three 1,000-kw. direct-current turbine sets and a battery with a three-hours' discharge capacity of 675 kw. have been added to the original equipment, and more recently—in 1913—owing to the insufficiency of plant to meet the winter demand and the necessity of doing something, an agreement was entered into with the Lancashire Electric Power Co. for a bulk supply up to 3,000 kw. for a period of three years.

It was realised, however, that the whole question of future supply would require to be dealt with on a comprehensive scale if the growing demand for cheap electricity for power purposes was to be successfully met, and that this would necessitate the introduction of large turbine plant and h.t. three-phase generators and distribution to sub-stations in the borough, and the Electricity Committee, faced with the alternatives of re-equipping the Frederick Road station on modern lines, or erecting an entirely new one, has made a first installation of three-phase plant at the existing station to meet immediate requirements, although we understand that no final course has been definitely adopted. Thus, on the advice of Mr. J. A. Robertson, the borough electrical engineer, it was decided in June last to place the order for a 5,000-kw. three-phase turbo-alternator, to make room for which one of the original 800-kw. direct-current sets was removed. The new turbine plant, which we illustrate in fig. 1, was supplied by the British Westinghouse Co., and officially started up on December 2nd last.

It consists of a Westinghouse-Rateau impulse turbine running at 1,500 r.p.m., driving a 6,600-volt, 50-cycle alternator of the compensated type and an exciter on the end of the main shaft, together with surface-condensing plant below, the necessary space to accommodate the latter having been obtained by mounting the new turbine some 12 ft. above the original engine-room floor level.

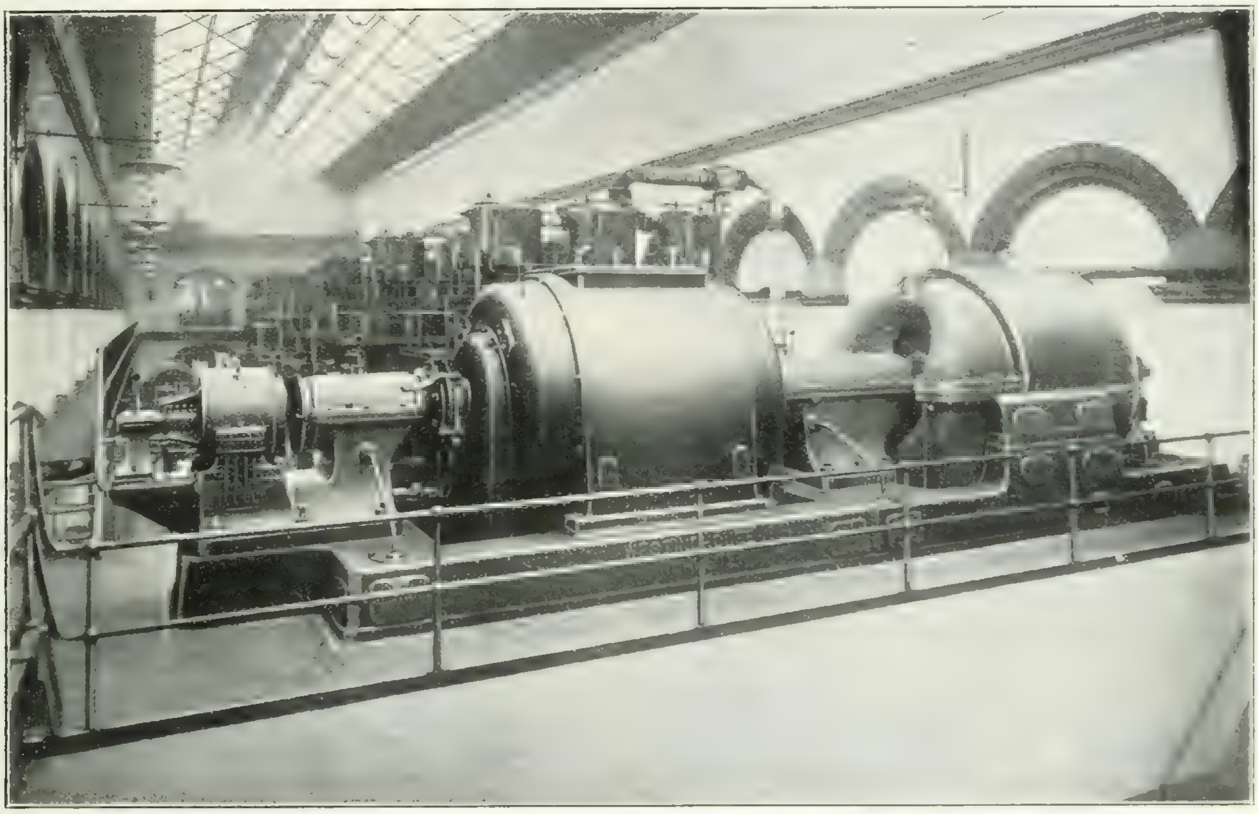


Fig. 1.—Interior of the Frederick Road Generating Station of the Salford Corporation, showing 5,000-kw. Turbine Set in Foreground.

The condenser is designed for a normal vacuum of $27\frac{1}{2}$ in. on full load, and is provided with two sets of air and extraction pumps, each driven by a 35-h.p. steam turbine running at 2,500 r.p.m., and each capable of doing the whole load. The circulating pump is driven by a 50-h.p. motor running at 475 545 r.p.m.

A view of the condenser auxiliaries taken from engine room floor level is shown in fig. 5.

The three-phase switchgear in connection with the new turbine and rotary converter plant, the latter installed for the bulk and local supply, has been supplied by the British Westinghouse Co., and consists of oil-switches in brickwork cubicles, situated in a switch chamber at one side of the engine room, and operated by electrical remote control from a control board in the main switch room at one end of the engine room.

The transforming plant installed at Frederick Road works consists of three 1,000-kw. G.E.C. and two 750-kw. Westinghouse rotary converters and transformers, while in connection with the outside supply a sub-station is almost completed at the Salford Docks, which will contain three 1,000 kw. rotary converters, and allow for three similar machines being installed later. This will supply power and lighting to the No. 9 Dock, where a large grain elevator is nearing completion. A static sub station has been equipped at Pump Street in the Ordsall district to supply local works, and it is proposed to build another rotary sub-station in the Greengate district for lighting and tramway supply. It has, moreover, been decided to add a second 5,000-kw. three-phase turbine set alongside the present one, to be in readiness for the winter of 1915-6, by which time the three-phase H.T. system of supply will be definitely established.

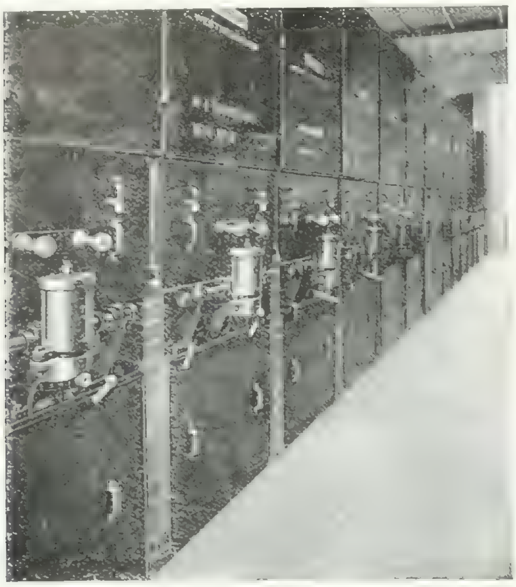


Fig. 2.—E.H.T. Switch Cubicles.

As various improvements and alterations have been made at the Frederick Road station from time to time, some reference to its general equipment may be of interest.

The boiler house contains 16 30 ft. × 9 ft. Lancashire boilers, equipped with superheaters and Hodgkinson machine stokers, also one Babcock boiler of twice the steaming capacity of the other units.

Coal is obtained from barges on the adjacent canal, and stored in overhead bunkers from which the stoker hoppers are fed through spouts in the usual way.

The coaling equipment includes an electrical jib crane for transferring the coal from barge to the hopper of a Babcock tray conveyor, which rises from the canal bank passing along the top of the bunker structure.

At either end of the boiler house are economisers and a brick chimney, also a pump room with electrical and steam-driven feed pumps, to which a turbine-driven pump is being added.

The original engine plant is of the jet condensing type, the water for which was obtained from the canal at one time. The increasing water requirements of the station, however, led to the adoption of cooling tower plant and the sinking of a deep well for the supply of make-up water for all purposes.

At present four Balcke towers are in use, and an adjoining pump house contains four 60-H.P. Mather & Platt motor-driven centrifugal pumps for forcing the water over the towers.

All the four turbine sets have been fitted with surface condensing plant, the condensate from which is used for boiler feed purposes, supplemented when required from the jet condenser hot well, the water of which is treated to remove any oil.

In the engine room, in addition to the 5,000-kw. turbine set mentioned, there are three 1,000-kw. Willans turbines coupled to one Brown-Boveri and two Siemens direct-current generators.

Six of the original 800-kw. Browett, Lindley-Mather and Platt direct-current sets remain, but one has been converted to the "Unaflow" type.

As our readers are aware, an unfortunate fire caused great damage to the switchgear at Frederick Road a year or two back; this has led to a complete reconstruction of this part of the plant, which now includes only modern boards, installed in the switch-room at one end of the building.

The upper floor of the switch-room contains a Ferranti single-phase switchboard and a Bertram Thomas direct-current traction board, while on the ground floor are installed a Bertram Thomas direct-current lighting and power board, battery switchgear and a Westinghouse control board for the three phase switchgear.

A single-phase supply is given to certain outlying districts and in the Prestwich area, being taken from the three-phase plant through two "Scott" connected Ferranti transformers, giving a two-phase (twin single-phase) 50-cycle supply at 3,000 volts.

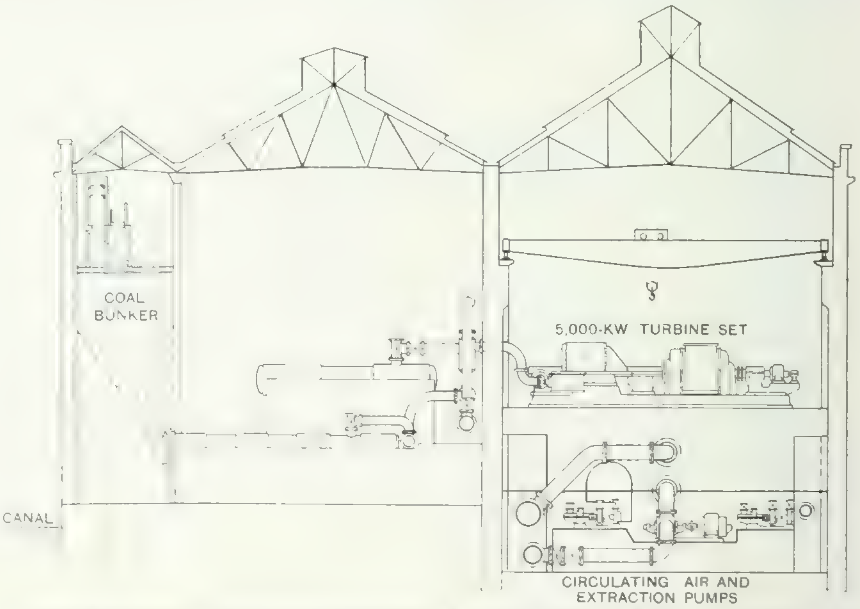


Fig. 3.—Sectional Elevation, showing Arrangement of 5,000-kw. Turbine Set, with Condensing Plant, &c.

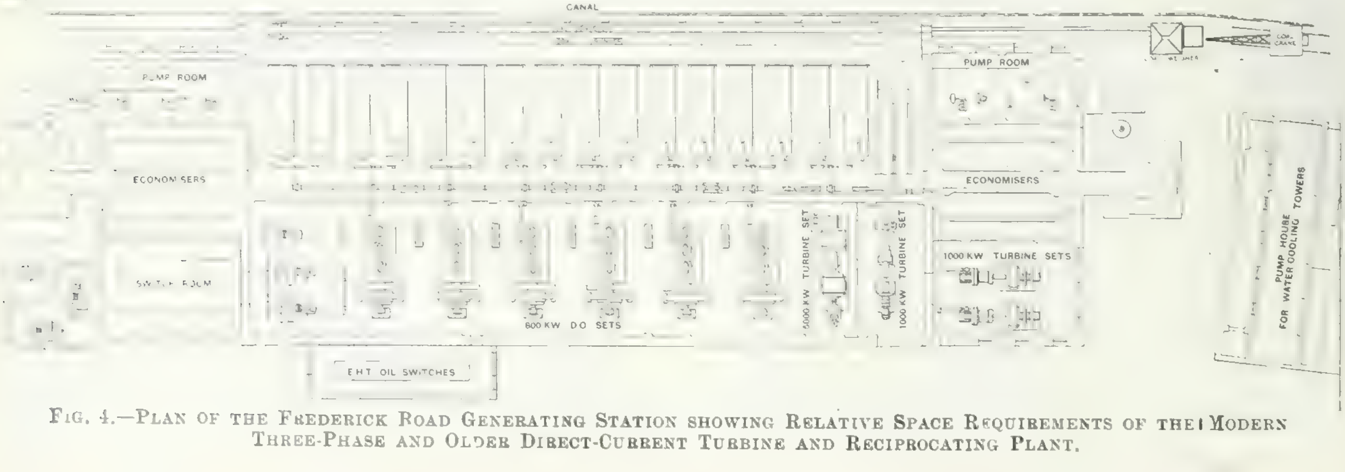


Fig. 4.—Plan of the Frederick Road Generating Station showing Relative Space Requirements of the Modern Three-Phase and Older Direct-Current Turbine and Reciprocating Plant.

Each transformer consists of two units, and a spare unit is provided.

The switchboard is built up of standard Ferranti non-interlocked H.T. single-phase ironclad panels, including six transformer, two booster and eight feeder panels, some of them being spare. The automatic boosters and their switches were supplied by Messrs. Switchgear & Cowans, Ltd.

The Bertram Thomas traction board carries six 3,000-ampere generator and 20 feeder circuits equipped with reverse and overload circuit breakers respectively, of the loose handle type.

The feeder panels are entirely positive, a negative bus-bar for the feeders and generators being placed in the basement. The upper portions of the generator panels are positive, and separate lower portions carry the equaliser switches.

Bare copper strip connections from the top of the board pass down the wall to join lead-covered feeders at floor level.

The direct-current lighting and power board by the same firm on the floor below was designed with a view to accommodating a large number of feeders in a limited length. This provides for 12 3,000-ampere generator circuits and 68 (34 positive and 34 negative) 1,000-ampere feeder circuits, the former being at 12-in. and the latter at 9-in. centres.

The positive and negative sections of the board are separately grouped; the bus-bars are mounted on the front of the panels, and the switches make direct-contact on them.

The circuit breakers, of the reverse current type on each generator pole and of the overload type on each feeder, are all mounted on the back of the board and operated from the front.

The connections leaving the board are all in bare copper, and at top or bottom only, and in the case of both direct-current boards non-inflammable insulation has been provided for all small wiring and for the iron frameworks of the panels, in order to minimise the risk of accidental contact and fire. All the instruments were supplied by Messrs. Elliott Bros. We reproduce in figs. 7 and 8 views of the upper and lower switch-rooms, showing the single-phase and direct-current boards installed there.

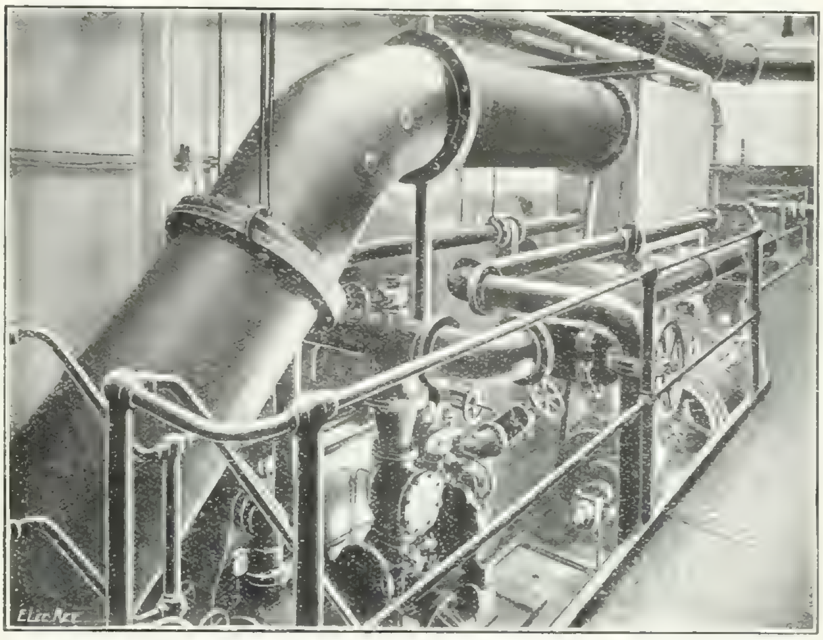


Fig. 5.—View of the Rotary Air and Circulating Pumps, 5,000-kw. Westinghouse Turbine.

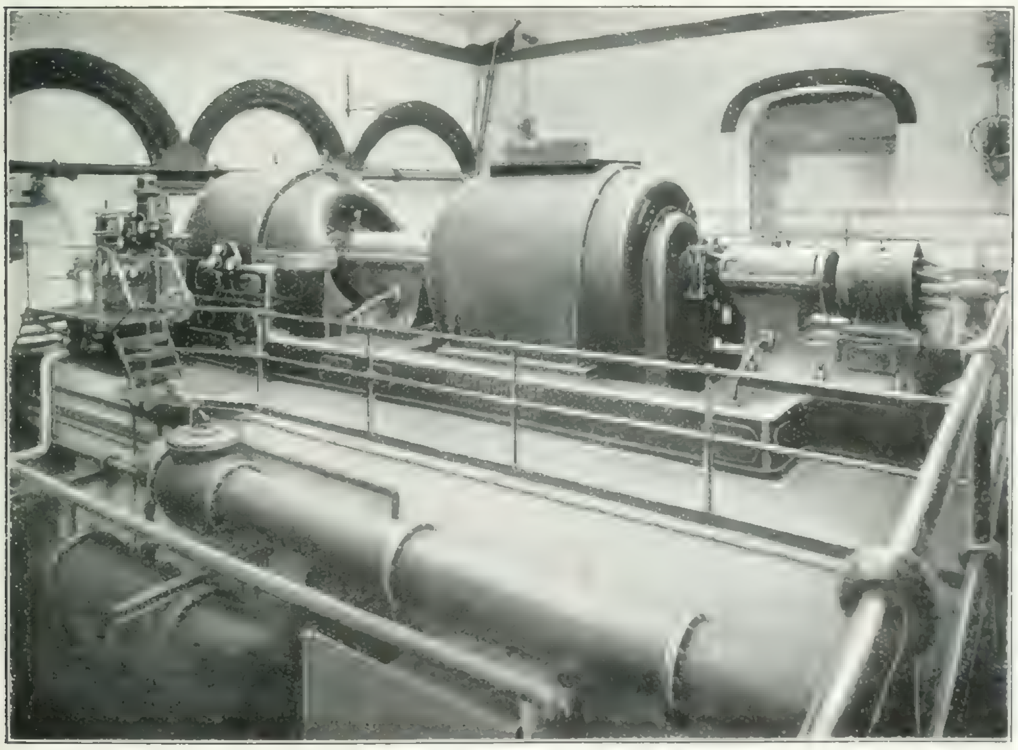


Fig. 6.—5,000-kw. Westinghouse Three-Phase Turbine Set.

In conclusion, we are indebted to Mr. J. A. Robertson, the borough electrical engineer, and to his deputy, Mr. Dickson, for giving us every assistance in the compilation of this description.

REINFORCED CONCRETE.

We are given to understand that the Local Government Board is setting its face against reinforced concrete to a very great extent, and refuses to sanction loans for this material for such periods as it would for other materials of construction, such short terms as ten years being what the Board will only allow in cases where, ordinarily, 25 years would be the period. Many a concrete building is ugly and unsightly and has the appearance of something which has failed to find a suitable body shape in which to live. Arched bridges are structures for which concrete appears to be a very suitable material, and in which it acts under the best conditions; it is under such conditions that any material shows to the greatest advantage, and such structures, carrying in their form the elements of stability, must inevitably present an artistic appearance, like the windmill tower, whose form and figure are fitted to the work to be done, and which is, therefore, necessarily artistic.

It is fortunate that the dictum of the Local Government Board on matters of engineering does not carry very much weight, though it may have serious effects because of the results which arise out of the Board's bad judgment; but a protest ought to be made against the Board's ruling. Properly constructed, reinforced concrete is a safe and sound material, and the metal rods which it encases are very effectively protected from all external influences. All the weight of evidence is, we believe, in favour of the safety of the material, and probably the Concrete Institute will see to it that the evil influences of the Local Government Board are curbed.

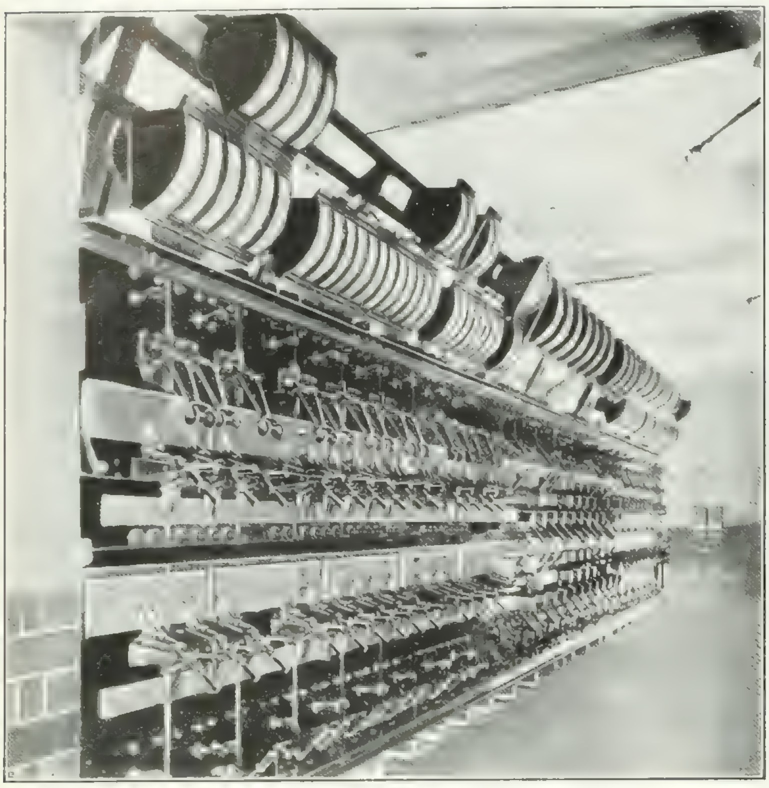


FIG. 7.—BERTRAM THOMAS D.C. LIGHTING AND POWER BOARD, SALFORD ELECTRICITY WORKS (see page 81).

But a word of warning may be given as to the unnecessary use of the new material. There is a tendency for it to be employed where bricks and mortar would be cheaper. Quite recently a case came under notice where two quite independent tenders were sent in for reinforced work. They differed considerably in amount for the same work, but the same firms quoted alternative prices for brickwork; the two offers were remarkably close and were a long way below the lowest offer for the reinforced concrete. Like so many new things which at the outset are supposed to be extraordinarily simple and cheap, ferro-concrete is by no means simple and is not always cheap. Where a structure can be so designed then concrete may be brought in usefully, but, though there is no great time required to tip the stuff into its moulds, a very great amount of time may be occupied in preparing the moulds and placing the many bars and hooks in position. The secret of good reinforced construction is to arrange the metal cores so that they occupy the direction of the lines of stress and failure which would develop in a homogeneous solid of like form under like stress application. Probably the true field for reinforced concrete work is in large and heavy work and in repetition work rather than in small work, for which the moulds involve a cost out of proportion to the small weight they contain.

There is a good deal of what may be termed the charlatanism of the tradesman in some reinforced concrete practice. Special bars are urged as the only really safe bars; the bars must be twisted, so as better to grip the concrete, but if twisted to the right instead of to the left, they will not hold the cement at all, and so on. Needless to say, most of these pretensions are mere twaddle. Any man who is an expert in steel girder work stresses should know how to dispose his tension material in concrete. The fact that metal bars are to be embedded in the concrete should not serve as an excuse for the slightest carelessness in the mixture. It is more than ever important that the aggregate should be good and clean; that the sand should be the same and in quantity more than enough to fill the voids, and that the cement should be well burned and slow setting, and in quantity more than ample to fill the sand voids. Cement ought not to be given its slow setting quality by the admixture of gypsum—that German method of adulteration for which there is no excuse, tending, as it does, to unsound cement.

The aggregate should be reasonably moist to begin with, enough cement to colour it all cement colour being put in before adding the sand and cement, which should be thoroughly mixed by machine before adding the aggregate and water. The time-honoured mixing by turning twice dry and thrice wet, or even doubling this amount of turning, is not to be considered as mixing, for it does not eliminate the brown streaks of the sand. Important work should be machine-mixed dry, and then the mixing continued wet.

Once Bit, Twice Shy.—At the meeting of the Illinois Electric Railways Association at Chicago, November 21st, Mr. W. F. Carr, Ottawa, Ill., advised against the policy of discharging men who had made mistakes which caused accidents, for, he declared, a serious accident for which a man is to blame leaves an indelible impression upon his mind and makes him a more careful and thoughtful operative in the future. If, on the other hand, this same man were to be discharged, his place must be given to a new man, and it is very possible that the whole lesson of safety and carefulness will then have to be learned all over again.—*Electrical World.*

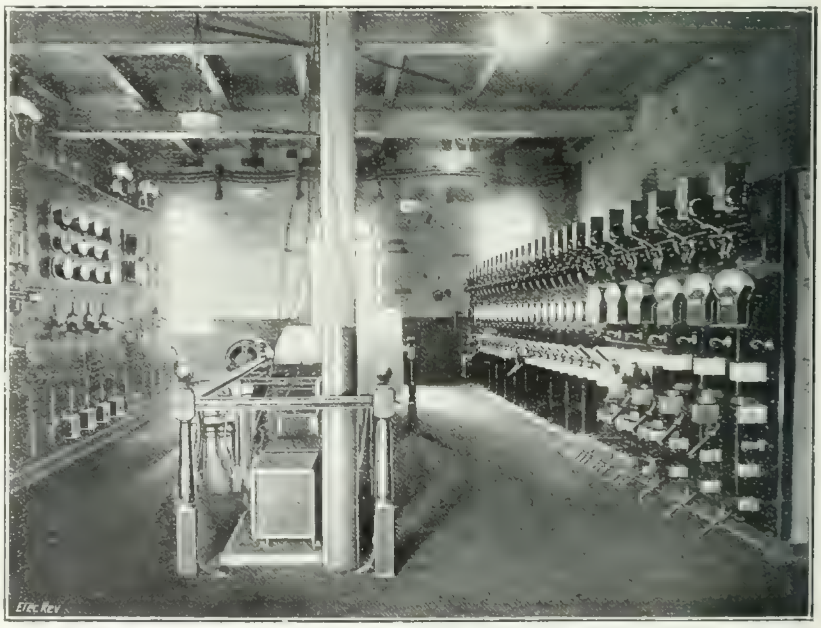


FIG. 8.—THE UPPER SWITCHROOM, SALFORD, SHOWING SINGLE-PHASE AND D.C. TRACTION BOARDS (see page 81).

LIGHTING and POWER NOTES.

(*Continued from page* 78.)

Sheffield.—An Opposed Inquiry.—The electrical contractors in the town are instructing counsel to represent them at the L.G.B. inquiry to-morrow (Saturday), in opposing the application of the City Council for a loan for the erection of the electricity department's new premises in Bow Street, it being contended that the existing accommodation is sufficient if the department limits its operations to what the traders consider legitimate business.

South Africa. — The Victoria Falls and Transvaal Power Co. reports that the amount of power now being delivered shows an increase over that for June last. In connection with the erection of new plant at Brakpan, the first extension set will be in commission within a month, and the second set will be available for service two months later. Fresh demands for power requirements are being received.

Stockport.—L.G.B. Inquiry.—An inquiry has been held respecting an application of the T.C. for permission to borrow £17,000 for the electricity undertaking—£12,500 for turbo-generating plant, and £4,500 for two water-tube boilers. The inquiry was closed.

Torpoint.—Street Lighting.—The U.D.C. has definitely decided to substitute electricity for gas for public lighting, and has accepted the tender of the Electricity Supply Co. for a term of three years at £2 2s. per lamp per annum. The alternative was 3d. per unit. The Gas Co. tendered at £1 19s. 6d. per 100 c.p. lamp, or 3s. 9d. per 1,000 cb. ft., and it was stated that with mantles, &c., the cost per lamp would work out at £2 16s. 2d.

Torquay.—Proposed Loan.—The T.C. is to make application to the L.G.B. for sanction to a loan of £13,808 for new plant and machinery at the electricity works.

Tunbridge Wells.—Half-watt Lighting.—The Lighting Committee proposes to substitute two 300 c.p. half-watt lamps for each of the nine arc lamps in three streets.

Walsall.—The Council recently adopted the bold policy of replacing the old generating station and plant by a modern station on a new site; the erection of this is now progressing, and together with the proposed alterations of system of distribution is expected to result in a great reduction in costs. Under the advice of the recently-appointed manager (Mr. H. A. Howie), the scale of charges for lighting, heating and cooking has been revised and alternative tariffs provided, including a rateable value scheme of charging for domestic supply. A sales department has also been instituted, and a showroom opened in the centre of the town.

Warrington.—Extended Supply Area.—The R.D.C. has decided to grant the necessary declaration of support to the T.C.'s application for powers to supply electricity to the districts of Great Sankey and Penketh. The Stockton Heath Parish Council has also decided to assent to the proposed order in so far as relates to the district, provided that the energy shall be supplied on not less favourable terms than those on which it is supplied to consumers in Warrington.

Whitefield.—Sewage Plant.—Application is to be made to the L G.B. for sanction to the installation of an electric plant at the sewage works instead of the gas plant previously approved of, and to the borrowing of a further loan of £123 to cover the increased cost.

Windsor.—Electric Pumping.—An electric motor pump is to be installed at the waterworks for use while the turbines are out of action. This will last until the river drops to its normal height.

Wokingham.—The R.D.C. has decided not to oppose the application of the Reading Electric Supply Co. for a prov. order to supply current to parishes within the Council's area.

Wolverhampton.—Sewage Works Supply.—The Electricity Committee has decided to give a supply of current to the sewage works for power and lighting purposes.

Worcester.—Sewage Pumping.—The City Council has had the question of sewage pumping under discussion, after considering reports by the city electrical engineer and city engineer bearing on the relative costs of electricity and suction gas. In the opinion of the Committee, the annual cost of pumping by suction gas and electricity was £2,000 and by all-electric drive £2,330, and it was decided to recommend the Council to adopt the latter, but to retain the suction gas plant for pumping storm water. As the result of long discussion, however, an amendment was adopted to retain the suction gas and electric plants at the works and obtain careful costs of their working, when a further report will be presented.

The T.C. is to apply to the L.G.B. for a loan of £800 for electric services during the next three years.

York.—L.G.B. Inquiry. — The Corporation, having applied to the L.G.B. for sanction to borrow £19,000 odd for the purposes of the electricity undertaking, the usual inquiry has been held. During the hearing, the inspector (Mr. Hooper) criticised the financial policy of the undertaking when he was informed that the reserve fund practically only amounted to £55.

TRAMWAY and RAILWAY NOTES.

Accrington. — Parcels Service. — The tramway department, in conjunction with Messrs. Lober's motor-'bus service, is now carrying parcels between Accrington and Burnley.

Bournemouth.—The B. of T. has sanctioned the borrowing by the Corporation of £3,903 for the reconstruction of a portion of the tramway track in Holdenhurst Road.

Bradford.—The Tramways Committee has considered a report by the general manager in regard to a mishap to a car on Church Bank; the Committee highly commended the conductor, awarding him £5 for meritorious conduct.

Six Months' Working.—The report of the working of the city tramways for the six months ended September 30th, 1914, shows that the income was £161,818, an increase of £8,559; the profits increased from £20,797 to £23,730; and the mileage run indicated an advance of 141,000 miles. On the other side of the account the maintenance of cars showed an increase of £3,300; wages of drivers and conductors £2,815 more than the corresponding six months of 1913; and there was also an increase of £1,695 for electric power. There was a saving of £3,400 on repairs to the permanent way, and a decrease of £985 in the amount of the rates on the undertaking. As a whole, the tramways had suffered a loss of £337 during the half-year, but there is compensation in the fact that the whole expenditure—including interest and sinking fund charges—has only been 8d. per mile, one penny less than the corresponding period of 1913.

Cardiff.—The Tramways Committee recommends the doubling of the tramway track from the corner of City Road to Milton Street, at a cost of £7,000.

Continental Notes.—Italy.—The electrification of the Italian State Railways is progressing steadily, if slowly. It is controlled mainly by the available funds in the hands of the Railway Administrator in each financial year. The progress of the works is shown by the yearly expenditure since 1907. In the the three years from 1907 to 1910 the expenditure was 3,084,000 lire. In the working year 1910-11, 3.786,000 lire; 1911-12, 4,800,000 lire; and in 1912-13, about 7,000,000 lire. There was also allotted in 1912-13 for electric traction permanent plants about 13,000,000 lire, besides a sum of about one million lire for other works. This contrasts with 4.225,000 lire allotted in 1911-12. On June 30th, 1913, the extent of the transmission lines amounted to nearly 800 km. The sub-stations numbered 30, four of which belonged to the old Varesine section. The total power amounted to 50,000 kw. Electric traction has worked regularly on the Turin-Modane line, on the old lines of the Giovi, on the Milan-Varese section, and on the Valtellina lines, and a regular electric service of passenger and goods trains has been started on the Savona-S. Giuseppe-Ceva section. There now remains the electrification of the branches of the Giovi, the Lecco-Monza and the Turin-Pinerolo lines.—*Rivista tecnica d' Elettricita.*

A public meeting was recently held at Cantello, near Milan, with the object of forming a society for the construction of an electric tramway to run from Varese to Folla di Malnate, Cantello and Ligurno, and eventually to the Swiss frontier. The scheme has arisen out of a desire to provide employment for men out of work.

The Italian State Railways power station at Rivarolo was recently completely destroyed by fire, the cause being unknown.

France.—A Reuter's Paris message mentioned a tramway collision last week on the Vincennes-St. Augustine route, by which one person was killed and 40 injured—13 seriously and three mortally.

Edinburgh. — Tramway Purchase. — The Tramway Committee has agreed to seek expert advice before finally deciding to ratify the agreement between the Committee and the Tramway Co. relating to the acquisition by the Corporation of the company's rolling stock at the time of the expiry of the lease.

Halifax. — Tramway Extension Bill. — The promotion in Parliament of a Bill for tramway purposes and works, involving an expenditure of £120,000, has been agreed to at a special meeting of the T.C.

Hollingworth.—A Sub-Committee has been deputed to confer with the Mottram and Saddleworth D.C.'s on the question of the Stalybridge Joint Board's Tramways and Electricity Bill.

Hull.—Tramway Extension.—The T.C. has decided to apply for a prov. order for the construction of additional tramways in the city.

London.—Tube Extensions.—The Hammersmith B.C. is to discuss the District Railway Bill to be promoted in the next session of Parliament. This seeks power to construct an additional single line, to relieve west-bound traffic, under the Broadway, and to make other arrangements to permit of the Piccadilly Tube trains using the existing District Railway tunnel.

Maltby.—The P.C. has unanimously agreed to support the Rotherham Corporation's proposal to substitute tramways for the present railless trolley vehicle system between Rotherham and Maltby.

Morley.—Proposed Loan.—The Leeds T.C. has applied for a loan of £31,500 for the erection of a tramway depót, sub-station, &c., at Morley.

Nottingham.—New Route Opened.—The extension of the Corporation electric tramways from Sherwood to the neighbouring urban district of Arnold was opened on January 1st. A 10-minute service is provided on the new route.

Newcastle-upon-Tyne.—Owing to the number of complaints as to the inefficiency of the local tramway service, the chairman of the Corporation Committee made a statement, pointing out that 295 men had joined the Army, of whom 230 were either motormen or conductors, men whose places it was difficult to fill. Some 150 other men had been absorbed in local works, mainly in the armament and warship building works in the neighbourhood. Some of this loss they had been unable to replace, and now they had only 653 on the books as against 723 at the outbreak of war. Another factor which tended to handicap them was an increase in the traffic. The system had had to cope with nearly 200,000 more persons than over the Christmas of a year ago, the mileage was increased by 6,000 miles, and there were only two more cars running than a year ago. A similar state of things was found in the New Year week. Much of the delay in sections of the service is attributed to the movements of troops in the city and neighbourhood.

Sheffield.—The Tramways Committee has adopted a report of a Sub-Committee recommending the conversion of 12 single-deck cars into double-deckers.

St. Helens.—An application has been received from the Lancashire Light Railways Co. for terms upon which the Corporation will supply energy to the light railway between Prescot and Knotty Ash.

Wallasey.—It is proposed to double the tramway track in Seabank Road and Seaview Road.

Yeadon.—Gas Leakage.—At the last meeting of the Council a complaint was made by the Leeds electrical engineer in regard to an escape of gas in Kirk Lane. It appeared that gas got into the tramway boxes, which contained fully 50 per cent. of gas, and this not only constituted a danger, but also hindered the completion of the tramway extensions. The attention of the Gas Co. had been drawn to the matter on two or three occasions, but nothing had been done. The Council decided that the Gas Co. should be asked to attend to the matter.

TELEGRAPH and TELEPHONE NOTES.

Australia.—A reduction has been made by the Federal Executive in the charge for wireless messages to and from vessels licensed in Australia and New Zealand, from 11d. to 6d. a word.—*Aust. M. S.*

A wireless station has been erected at Rabaul, and is working satisfactorily, communications being transmitted through Port Moresby and Thursday Island to Australia. The installation, which comprises Telefunken and Marconi instruments, was mostly the property of the German Government, being used at a high-power station at Bitapaka, which was captured after a sharp encounter. The whole of the installation and the operating has been done by members of the Expeditionary Force, and is under the charge of the senior operator, Corporal G. H. Smythe, Signaller, assisted by four Marconi operators. Power is supplied by a captured German dynamo and converter driven by a Bolinger oil engine, under Electrician Corporal Tenbosch, assisted by two mechanics.—*Sydney Morning Herald.*

Canada.—On January 1st an amalgamation of the Great North-Western and Canadian Northern Telegraph Companies took place, and the two systems will in future be operated as one under the style of the Great North-Western Telegraph Co.

It is understood that within the next few months the lines and offices of the Western Union Telegraph Co. in the Maritime Provinces will be operated by the Great North-Western Co., which will then have the largest telegraph system in Canada, covering the country from the Atlantic to the Pacific.

It had been stated in Canada that the Grand Trunk Pacific Railway's telegraph system was also to be included in the merger, but this is denied by the Grand Trunk Pacific Co., which announces that its system is entirely distinct from the new combination, and is fully equipped for carrying on commercial telegraph business from the head of the lakes to the Pacific Coast.—*Standard.*

China.—Tsingtao, which was recently captured from Germany by the Japanese, was connected with Yap Island in the South Seas by a submarine cable *viâ* Shanghai, the station being located in the German Post Office in Shanghai, which is a neutral city; the shore ends of the cable at Shanghai are also in neutral territory. The line was taken over by the Japanese on the fall of the fortress, and it is announced that it will have to be cut on the high seas in order that it may be connected with the Japanese Post Office in Shanghai.

Fire Alarms at Luton.—The Fire Brigade Sub-Committee has reported in favour of the installation of the "Knight" fire-alarm system in the town, at a cost of £450. The matter is under consideration.

Field Telegraphs in East Africa.—The unexpected difficulties which may be met with in novel circumstances are well illustrated by the following extract from a letter published in the *Times:*—"The funny side of war is very much before us out here. The telegraph section, for instance, with great speed and efficiency fixed up the field telegraph, 48 miles of it, on bamboo poles. Next day, walking along the line, I never saw such a mess. Wherever a giraffe had come across it in the night he seemed to have wound it round his neck and then started off at top speed."

Illicit Wireless Apparatus.—Henry Summers, smack owner, charged at Ramsgate with having in his possession, without the permission of the Postmaster-General, certain apparatus intended to be used for sending or receiving wireless messages, which he said he bought from the Trinity Brethren in 1913 for 9 guineas, and had tried to sell, was fined £10, including costs.

On January 11th a district court-martial was held at Manchester on Frederick Goddard, of Ardwick, charged with having at his home certain wireless apparatus. Evidence was given to the effect that his wireless installation was dismantled at the beginning of the war. He had a licence to use a wireless telegraph for experimental purposes. The proceedings were adjourned to Tuesday, when the accused was acquitted.

Russia.—An agreement has been made between the Russian and Mongolian Governments which grants the Russian Central Administration of Posts and Telegraphs a concession for the construction of a telegraph line from Monda, in the Government of Irkutsk, to the Mongolian town of Uliasutai.—*Board of Trade Journal.*

San Marino.—This little Republic on the Adriatic is accused by Germany of allowing its wireless station to be used for transmitting news from French warships to Paris. The Government of San Marino has refused to allow a German Commission to visit the plant, but would consent to an Italian Commission.

The Telephone Service.—No fewer than 450 telephone exchanges have been opened in small villages during the last three years. The average number of subscribers on these rural exchanges is 10. In addition, 1,200 call offices have been opened at places too small to support an exchange.—*Standard.*

Wireless in Warfare.—The *Wireless World* for January states that in 1913, during the Upper Rhine reliability trials, the old Zeppelin "Viktoria Luise," which took part in the trials, remained throughout their duration in constant wireless communication with the base at Frankfort over distances up to 120 miles, and with other stations up to 200 miles, so that a regular wireless service for her passengers was maintained. The wireless equipment of the newer naval and military craft is far more powerful. The aerial consists of a 3-mm. phosphor-bronze wire, unwound to the required length (the full length being 750 ft.) from a spool, and floating freely in the air when the airship is aloft. The apparatus itself is extremely compact, and derives the necessary power from a small dynamo driven off the engines. It weighs, complete, 150 lb., or, including the dynamo, 270 lb.; has a minimum range of 120 miles, and can encompass wave-lengths varying between 300 and 1,200 metres. It is claimed that the danger from sparks during the process of transmission has been wholly eliminated. Every large aerodrome in Germany, both military and civilian, has its wireless station, some of which, such as those at Johannisthal, Cologne, Friedrichshafen, Frankfort, and Mannheim, are very powerful. In addition, the construction was begun some time ago of a series of wireless stations forming a ring right round the German frontiers. Their purpose is twofold: first, to enable German airships to remain in constant wireless touch with a German base during their expeditions; and, secondly, to provide them with what may be described as a wireless compass, enabling them to fix their position when out of sight of land with quite a fair degree of accuracy as a result of signals from these wireless stations.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — Adelaide. — February 10th. Testing instruments, for Postmaster-General. See "Official Notices" January 1st.

Brisbane.—March 10th. Motor-generator, power board, &c., fo Postmaster-General. See "Official Notices" to-day.

Brisbane.—(Extension of time to March 16th.) Commo battery multiple switchboard and automatic or semi-automati switchboard, &c., for the Deputy P.M.G.—*Board of Trade Journal*

Perth.—February 10th. Telephone switchboards and parts, fo Postmaster-General. See "Official Notices" January 8th.

Melbourne, Brunswick and Coburg Tramways Trust.—February 24th. Special work, bonds, steel and wood poles, overhea materials, H.T. cable, trucks, and sub-station electrical equipment March 10th. Car equipments (motors, &c.), car bodies, whee guards. Specifications for each item, £2 2s. (returnable), from the office of the Engineer (Mr. Struan Robertson), Sydney Road, Coburg. Copies can be seen at the Board of Trade Commercial Intelligence Department in London.

Beckenham.—January 25th. U.D.C. One 120-KW. D.C. generator and switchgear to couple to 120-KW. steam alternator. See "Official Notices" January 8th.

Bolton.—February 11th. Corporation. Low-tension sub-station switchgear, for the Electricity Department. See "Official Notices" January 8th.

Bury.—January 30th. Extension to reinforced concrete retaining wall at the electricity generating station, Chamber Hall. Specifications, &c., from Mr. J. A. Settle, Borough Engineer.

Cheltenham.—January 30th. Corporation. Twelve months' supply of electric light fittings, &c. Forms of tender from Mr. J. S. Pickering, Borough Engineer.

Croydon.—January 25th. General stores, for the Corporation Tramways Department, for a year. The Manager, Thornton Heath.

Darlington.—February 2nd. Corporation. Alternative tenders for 2,000-KW. and 3,000-KW. turbo-alternators; separate tenders for condensing plant. See "Official Notices" to-day.

Ipswich.—January 22nd. Corporation Electric Supply Department. Coal-handling plant. Specification, &c., 21s. (returnable). Mr. F. Ayton, Engineer and Manager.

Larne.—January 29th. For lighting public streets and roads by electricity for three years from August 1st, by the U.D.C. Particulars from Mr. W. G. Younge, Clerk to the Council.

Leeds.—January 22nd. Overhead electrically-driven travelling crane, and coal and ash-conveying plant, for Electric Lighting Department. See "Official Notices" December 11th.

London.—L.C.C.—January 26th. Platelaying, &c., for electric tramway, Grove Road and Burdett Road, &c. Specifications, &c., from Mr. G. W. Humphreys, County Hall, Spring Gardens, S.W.

January 25th. Lighting installation (200 wiring points, 260 lighting points) at Exmouth Street Elementary School, Hampstead Road, N.W. See "Official Notices" to-day.

BATTERSEA.—The B.C. is recommended to invite tenders for three, six, nine and twelve months' supply of oils, engine-room stores, electricity meters, service joint-boxes, electric lamps, &c.

Manchester.—January 19th. Tramways Committee. (*a*) Permanent way special track work, and (*b*) permanent way points, tongues, and hardened steel centres. Specifications, &c. (£1 1s. returnable), from Mr. J. M. McElroy, general manager.

New Zealand.—WELLINGTON.—February 28th. Public Works Department. 18 step-down transformers, for the Lake Coleridge power scheme. Specification at the Public Offices, Wellington.

Oldham.—January 18th. For electric lighting the Council School at Higginshaw, for the Oldham Education Committee. Specifications from Messrs. Winder & Taylor, architects, Union Street.

Plymouth.—January 21st. Corporation. Twelve months' supply of carbons, A.C. meters, transformers, cables, oils, waste, &c. See "Official Notices" January 8th.

Redditch.—U.D.C. Two turbo-alternators, each 1,000 KW., with condensers, cooling tower, &c.; two synchronous motor-alternators of 300 KW. and 150 KW. respectively. See "Official Notices" January 8th.

Rochdale.—January 27th. Tramways Committee. Erection and completion of repair shops: (*a*) reinforced concrete foundations and car platform, (*b*) steelwork (steel frame), and (*c*) builders' work. Particulars from Mr. P. W. Hathaway, Town Hall.

Spain.—February 7th. The municipal authorities of Berlange de Duero (province of Soria) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

Tenders have just been invited by the municipal authorities of Sarria (province of Lugo) for the concession for the electric lighting of the town during a period of 10 years.

Tunbridge Wells.—January 26th. Cooling tower and pipework, two water-tube boilers, economisers, mechanical stokers, pipework, and feed heater, for Borough Electricity Works. See "Official Notices" January 1st.

Woodstock.—February 4th. Generating plant, switchboard, battery, wiring, lamps and fittings (120 points), for the Union Workhouse Guardians. See "Official Notices" to-day.

CLOSED.

Australia.—In connection with the parcels post office building adjoining the Sydney railway station, the Minister for Home Affairs has accepted the following tenders:—Four goods lifts, electrically driven, Messrs. Edmiston & O'Neill, £6,700; two service lifts, electrically driven, Messrs. Edmiston & O'Neill, £600. He has also accepted the tender of Messrs. Gibson, Battle & Co. for an electrically-driven inclined elevator, including foundations. The whole of the work is to be of Australian manufacture, with the exception of some small items, such as ropes, which are not made in Australia; they will be of British manufacture.—*Melbourne Age.*

MELBOURNE.—An Australian newspaper states that large orders for wire have just been placed by the Postmaster-General's Department, the department having accepted the offer of the British Insulated and Helsby Cables, Ltd., to supply 126 tons of wire, of varying weights, for £10,625. All the wire is to be of English manufacture.

The following contracts have been placed:—

P.M.G.'s Department, Victoria.—

80 cable terminals, 52 pairs, £466 13s. 4d.—Mr. F. B. Cook.

P.M.G.'s Department, Tasmania.—

300 telephones, common battery wall pattern, £176 5s.—British General Electric Co., Ltd.

100 telephones, common battery table pattern, £125 8s. 4d.; 75 ditto, with generator, £198 15s.; 60 ditto, table pattern, with generator, £107 10s.; 100 ditto, with switch, £418 15s.; 25 ditto, table pattern, with switch, £97 10s.—J. Bartram & Son Pty.

8 tons bronze wire, £261; 10,000 copper tapes, £9 3s. 4d.; 10,000 binders, £12 18s. 4d.—British Insulated & Helsby Cables, Ltd.

Sydney Municipal Council has received the following tenders for

2,000-K.V.A. 33,000/5,000-VOLT TRANSFORMERS.

Siemens Bros.		£5,775
British Westinghouse Co.	(recommended)	**6,064**
Australian General Electric Co.		10,386

1,000-K.V.A. AND 500-K.V.A. TRANSFORMERS.

Noyes Bros.		£2,782
British Westinghouse Co.	(recommended)	**2,869**
Siemens Bros.		[illegible]
Australian General Electric Co.		5,348

500-K.V.A. 5,000/415 TRANSFORMER.

Australian General Electric Co.	(recommended)	**£1,644**
Siemens Bros.		1,852
Standard Waygood Hercules, Ltd.		1,900

MOTOR-DRIVEN AIR COMPRESSOR.

N. Guthridge, Ltd.	(recommended)	**£234**
Standard Waygood Hercules, Ltd.		[illegible]
Australian General Electric Co.		236

VACUUM CLEANERS.

N. Guthridge & Co., Ltd.		£126
H. P. Gregory & Co.	(recommended)	**150**
Lamson Store Service Co., Ltd.		155
J. Hardie & Co.		160
Noyes Bros.		170
E. V. Morrison & Co.		188
G. Vincent		[illegible]
Elliott, Maclean & Co.		497
" "	(alternative)	517

33,000-VOLT CABLE.

Callenders		£16,100
Western Electric Co.	(recommended)	**17,591**
Henley Telegraph Works, Ltd.		[illegible]
Australian General Electric Co.	(alternative)	[illegible]
Siemens Bros. & Co.		[illegible]
British Insulated & Helsby Cables, Ltd.		20,125
" " " "		[illegible]
Australian General Electric Co.		[illegible]
Warburton, Franki, Ltd.		[illegible]
Lawrence, Hanson Electric Co., Ltd.		[illegible]

Melbourne City Council.—

Hoists, electric, motors, at city abattoirs, £[illegible]—Edmiston & O'Neill.

Bacup.—The T.C. has decided to order two transformers from Messrs. Ferranti, Ltd., and 7/18 S.W.G. cable from the Macintosh Cable Co., Ltd. The tender of the Post Office has been accepted for connecting the out-stations and the central police station by telephones.

Bradford.—The Tramways Committee has accepted the tender of Messrs. Wm. Hird, Sons & Co., Ltd., of Wyke, Bradford, for the supply of 4,000 yards of grey serge, at the price of 6s. per yard, for the purposes of uniform clothing, for the Tramways Department. It has also resolved to accept the offer of the Bradford Technical College to supply five pieces of similar cloth at the same price.

The Technical Education Sub-Committee of the Corporation has accepted the following tenders for motors and wiring to motors in the workshop:—

Phoenix Dynamo Manufacturing Co., Ltd. [illegible]

Smith & Croft.—Wiring [illegible]

Bristol.—The Docks Committee of the T.C. has accepted the tender of Messrs. Siemens Bros. for arc lamp carbons.

Canterbury.—The T.C. has accepted the tender of Mr. S. Terry for electrical engineers' work for the ensuing half-year.

Clacton.—The tender of Messrs. Johnson & Phillips, Ltd., has been accepted by the U.D.C., at £425, for supplying and laying various lengths of cable.

Dartford.—The E.L. Committee has placed orders with Messrs. John Hudson & Co., Ltd., and Messrs. E. J. and W. Goldsmith, Ltd., to supply 300 tons of bituminous coal, at 2s. per ton above contract price to cover war risks, and for 110 tons of Derbyshire peas, at 18s. 6d. per ton, and 600 tons of New Hucknall slack, at 16s. 9d. per ton, respectively.

Gillingham (Kent).—The T.C. has accepted the offer of Messrs. Wm. Cory & Son, Ltd., for up to 150 tons of coal for the electricity works, at 2s. per ton over contract price.

London.—The Metropolitan Asylums Board has accepted the tender of Messrs. Turnham & Co., at £257, for installing electric light, internal telephone and bell system, provision of electric bells, and separating the fire alarm system at Sheffield House, Sheffield Street, W.C.

BATTERSEA.—The Electricity Committee has accepted the tender of the Empire Stone Co., at £545, for the construction of a reinforced concrete coal-bunker at the generating station. The Committee recommends that the offer of Messrs. Foster & Co. for 6,000 tons of Pooley Hall small coal be accepted.

HAMMERSMITH.—The B.C. Electricity Committee has accepted the offer of Messrs. W. Cory & Son, Ltd., for 1,000 tons of Midlands small coal, at 8s. 6d. per ton ; and that of Messrs. Cory Bros. & Co., Ltd., for 1,000 tons of Gedling small coal, at 12s. 6d. per ton.

Morley.—The Leeds Corporation Tramway Committee has accepted the tender of Mr. Paul Rhodes, of Leeds, for the erection of a tramway depôt at Morley.

Nuneaton.—The T.C. has accepted the tender of Messrs. Brown-Boveri & Co., at £65, for the supply of an automatic pressure regulator for the Electricity Works.

Salford. — The Tramways Committee recommends the acceptance of the tender of Messrs. Edward Wood & Co., Ltd., for the steel work required for the extension of the central car depôt, Pendleton, at £1,295.

Sheffield. — The Electricity Supply Committee has resolved to accept the following tenders :—

Staveley Coal & Iron Co., Ltd.	Cast-iron feed water pipes, £65.
Foster Bros.	Mild-steel steam pipes and valve, £133.
Lea Recorder Co., Ltd.	Combined recording water meter, including steel notch tank and float chamber £108
T. Smith & Sons.	Steam crane and grab, £1,018.

The City Council is recommended to accept the tender of the General Electric Co. for the supply of two 30-H.P. electric motors to the Water Department.

Ship Lighting.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., has been accepted for the supply of Wotan, tantalum, and carbon filament lamps to Messrs. G. Thompson and Co., the Aberdeen White Star Line.

Stockport.—The Health Committee has accepted the tender of Messrs. W. A. Shaw & Co. for certain alterations to the electric lighting at the hospital.

The tender of Messrs. Kelsall Bros., for Pleasley best nutty slack top hard, Mansfield, at 10s. 5d. per ton delivered, from 70 to 90 tons per week for 12 months, has been accepted by the Electricity Committee. The Committee has also offered to take a limited weekly supply of Brownless slack, Biddulph Valley, at 9s. 3d. per ton delivered, for a period of 12 months.

The T.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for a 5,000-KW. turbo-alternator.

Stretford.—The Electricity Committee has accepted the tender of Messrs. W. T. Henley's Telegraph Works Co. for 150 yards of 8-in. single cable, for £84.

Torquay.—The Electricity Committee has agreed to a request from Messrs. Whiteway & Ball that they should be paid an extra 2s. per ton on the original price for any future supplies of coal, owing to the difficulties and delays in navigation.

Weymouth.—The Electricity Committee has accepted the tender of Messrs. Browett, Lindley & Co., Ltd., for a 200-KW. gas-driven plant, at £3,000, and that of Messrs. Whipp & Bourne for the necessary switchboard, at £87. The tender of Mr. G. F. Bowering, at £398, for foundations for machinery at the electricity works has been accepted.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, January 15th. At 8 p.m. At 39, Victoria Street. Paper on "Motor-Car Accessories," by Mr. R. S. Fox.

Friday, January 22nd. At 8 p.m. At 39, Victoria Street. Paper on "Rotary Air Pumps," by Mr. A. Arnold.

North-Western Section.—Monday, January 18th. At 7.45 p.m. At Jafa Cafe, 26, Corporation Street, Manchester. Paper on "Country House Electric Lighting Installation," by Mr. C. F. Clifton.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, January 18th At 7.30 p.m. At the Mining Institute. Paper on "Automatic Protective Switchgear for Alternating-Current Systems," by Mr. E. B. Wedmore.

Royal Society of Arts.—Monday, January 18th. At 8 p.m. At John Street, Adelphi, W.C. Cantor Lecture on "Oils, their Production and Manufacture," by Dr. F. Mollwo Perkin.

Illuminating Engineering Society.—Tuesday, January 19th. At 8 p.m. At Royal Society of Arts, John Street, Adelphi. Discussion on "Some Points in connection with the Scientific Development and Practical Application of Searchlights."

Nottingham Society of Engineers.—Wednesday, January 20th. At 7.30 p.m. At Welbeck Hotel, Milton Street. Ten-minute papers by members.

Institute of Marine Engineers.—Wednesday, January 20th. At 7.30 p.m. At Tower Hill, Minories, E.C. Extraordinary General meeting.
At 8 p.m. Inaugural address by Sir A. Denny, Bart., LL.D.

Greenock Electrical Society.—Thursday, January 21st. At 7.45 p.m. At 21, West Stewart Street. Paper on "Electricity in a Shipbuilding Yard," by Mr. D. Angus.

Institution of Mechanical Engineers—Friday, January 22nd. At 8 p.m. At Storey's Gate, S.W. Paper on "Standardisation of Pipe Flanges and Flanged Fittings," by Mr. J. Dewrance.

Physical Society of London.—Friday, January 22nd. At 5 p.m. At Imperial College of Science, South Kensington. Paper on "Practical Harmonic Analysis," by Dr. A. Russell.

Royal Institution of Great Britain.—Saturday, January 23rd. At 3 p.m. At Albemarle Street, W. Lecture on "Aerial Navigation—Scientific Principles," by Dr. R. T. Glazebrook, F.R.S.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, January 23rd. At 4.30 p.m. At Royal Technical College, Glasgow. Joint Meeting with National Association of Colliery Managers. Paper on "Electricity at the Coal Face," by Mr. J. Bowman. After the meeting several Visual Signal Indicators will be exhibited.

NOTES.

Parliamentary.—SOUTH SHIELDS CORPORATION BILL.—A town's meeting of South Shields ratepayers has defeated the Corporation Bill, under which tramways estimated to cost £16,711 were proposed.

DONCASTER CORPORATION BILL.—The ratepayers of Doncaster at a town's meeting have defeated the clauses in the Corporation Bill for the sale and hire of electrical fittings. A poll was subsequently demanded, but it was stated that if the Corporation persisted in including the clauses, the Bill would be opposed in Parliament by the Chamber of Commerce.

STANDING ORDERS.—The County Council of the West Riding of Yorkshire has presented memorials against the Rotherham Corporation Bill and the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board Bill, alleging non-compliance with standing orders. In each case the allegation is that the promoters have not obtained the consent of the Council, who are the road authority for the construction of certain tramways.

Preferential Terms.—In a letter to the *Municipal Journal*, Mr. H. Faraday Proctor, hon. secretary of the I.M.E.A., deals with the question of power rate and photo printing, as follows :—In the issue of the *Municipal Journal* of December 25th, 1914 (Ref. 101), is published an inquiry from the chairman of an Electricity Committee, asking whether it is illegal to supply current at power rate for photo printing. The town clerk of the undertaking in question and the *Municipal Journal* express the opinion that such a practice is illegal, as it is lighting, and not power. I should like, most emphatically, to protest against such a ruling.

It must be remembered that electrical undertakers do not sell either light, heat or power. Their commodity is electrical energy, and when such energy is used for photo printing it is not used as an illuminant, but for its actinic properties—a purely commercial use ; and may certainly, therefore, be sold as power.

If the argument held good that electricity used for photo printing must be considered lighting and sold as such, then all luminous radiators would come under a similar ruling.

The ultimate purpose for which energy is used must be taken into consideration in determining whether such use is lighting, power or heating, and a moment's consideration will make this clear. In all electric lighting the energy is used primarily to heat the carbons or filaments in the lamps to such a temperature that they produce light, but would anyone suggest that all such energy must be sold at the heating rate? The natural corollary would be the abolition of all lighting rates.

Appointments Vacant.—Two shift engineers (£2); fitter for County Asylum, Whalley, near Blackburn ; power station superintendent (£175) for Maidenhead Electricity Works ; engineer-in-charge (£2 15s.) for Sunderland Electricity Department ; junior engineers (25s.) for Cleveland and Durham Electric Power, Ltd., Middlesbrough ; electrician-in-charge for the Callan Electric Lighting Society, Ltd., Callan ; electrician (35s.), for Croydon Mental Hospital ; meter tester (35s.), for Salford electricity works ; assistant electrical engineer (£300), for Government of Nigeria. Particulars are given ino ur advertisement pages

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following items appear on the programme of the Birmingham Local Section for the second half of the session :—

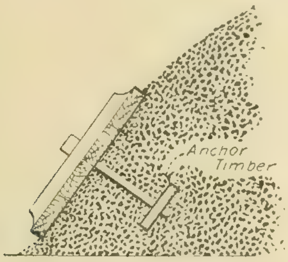
January 29th.—"Lord Kelvin's Work on Gyrostatics," by Prof. A. Gray.
February 10th.—"Polyphase Commutator Machines," by Mr. N. Shuttleworth.
March 3rd —"Electricity Applied to Mining," by Mr. C. P. Sparks.
March 17th.—"Electric Cooking. mainly from the Consumers' Point of View," by Mr. W. R. Cooper.
April 14th.—"The Bombay Hydro-Electric Scheme," by Mr. A. Dickinson.
April 28th.—"The Power Supply to the Rand Mines," by Mr. J. H. Rider.
May 12th.—Annual meeting.

Manchester Local Section.—At the meeting on Tuesday last a paper was read by Dr. S. P. Smith and Mr. R. S. H. Boulding, B.Sc., on "The Shape of the Pressure Wave in Electrical Machinery." The discussion was closed. The same paper was to be read in London last night.

Scottish Local Section.—At the meeting on Tuesday, Mr C. J. Beaver read his paper on "Cables." The meeting was held in Edinburgh, and there was a large muster of East of Scotland delegates.

Rugby Engineering Society.—On Tuesday last, a paper on "Modern Electric Lighting" was read by Mr. H. C. Wheat.

Anchor Boards for Coal Pile.—The accompanying sketch shows a method of preventing coal piles from spreading at the base, by enclosing the lower parts of the pile in courses of timbers anchored from within the pile itself. As the coal is filled in over the anchor timbers the weight of the coal serves to keep the outer portions of the pile from spreading. This construction is especially convenient where it is desirable to keep clear a pathway which would otherwise be engulfed by the flow of the lumps of coal. Unless some such protection is used, the jarring and sweeping of passing teams and persons will ordinarily cause the coal to run down a grade very much less than its ordinary angle of repose.—*Electrical World.*



Anchor Construction to Prevent Coal Pile from Spreading.

The Electrically-Propelled Super-Dreadnought "California."—Particulars now to hand show what important reinforcements and modifications have been made possible in the design of the United States first-class battleship *California* by the adoption of electric propulsion. Like her sister ships the *Nevada* and *Oklahomah*, the *California* is to rely exclusively on oil fuel, but the further saving in weight of bunkers, boilers, piping and condensers and in space occupied by these has made possible important additions to the armouring and armament of the vessel, besides improving conditions within her by less heating and less crowding of equipment. The *California* is to carry 12 14-in. guns (in four triple turrets) besides four submerged 21-in. torpedo tubes and a secondary armament of 22 5-in. guns. Her armouring is said to be the heaviest yet carried by any battleship. Besides a main belt 14-in. in thickness, special horizontal and vertical internal armouring is provided to guard against fatal injury by submarine attack. The concentration of power equipment low down in the hull greatly increases the stability of the vessel (notwithstanding the reduced total weight of the equipment) and permits the secondary armament to be placed higher, the main armament to be increased materially and the armouring to be increased, particularly by the use of 16-in. armour in the conning tower and communication tube and the provision of a truncated cone of 14 in. armour round the base of the funnel. The total boiler capacity being reduced about 50 per cent. by the use of electric propulsion, all the boilers can be placed beneath a single uptake, and by armouring the base of the latter, the risk of damage in this vital spot is greatly reduced.

With a length of 625 ft., beam 97 ft. 3 in., and draught of 29 ft., the *California* displaces 32,000 tons. At 21 knots her power plant is designed to provide 32,000 shaft horse-power, probably by the use of four motors on two propeller shafts, though the final decision on this point has not yet been made public. The claims made in respect of the capital and working economies obtainable by electric marine propulsion have been justified completely by the performance of the U.S. collier *Jupiter*, the first large vessel to be propelled electrically, and one which has been tried by U.S. Navy experts against sister vessels fitted with triple-expansion engines and geared turbines respectively. The conditions of these tests and the subsequent voyage of the *Jupiter* from Mare Island Navy Yard to Hampton Roads leave no possibility of doubt concerning the superior efficiency and complete reliability of the electric system. The *Jupiter* being a vessel of 20,000 tons displacement, there is no reason to doubt that the advantages definitely established for electric propulsion in her case will be equally secured in the *California*. Supposing only four polyphase induction motors to be employed, each must be of 8,000 h.p., and motors already at work in rolling mills and other heavy industrial services show that there is no difficulty in building compact and reliable machines of such power to run at 200 r.p.m. or so, the terminal P.D. being, say, 2,500 volts. Due to the main turbo-generators continuing to run ahead at full speed (and that the speed of maximum turbine efficiency) under all circumstances while the propeller shaft is driven electrically at the low speed giving maximum propulsive efficiency, from 25 to 30 per cent. fuel economy is secured, the weight of propelling machinery is halved, and a net capital saving of 40 to 50 per cent. is effected. Saving in weight and space can be applied to armament in war vessels and to cargo capacity in merchant vessels. In all cases full power is available for manœuvring or reversal without altering the conditions of operation of the turbo-generators ; and at reduced, or "cruising" speeds, very considerable economy is effected by shutting down part of the generating plant and running the remainder still under conditions of maximum efficiency. In a rough seaway the tendency of one propeller to race while another slows down is compensated automatically, since the speed of an induction-motor is practically independent of load ; the output of the turbo-generator remains constant, but its distribution between the propeller-motors varies automatically.

It is a matter for congratulation that electrical engineering has provided the means whereby there has been effected, in a single step, far greater improvement in the overall efficiency of mechanically-propelled vessels, than had previously been effected during the past quarter of a century. Equally important is it, to shipowners, naval authorities and electrical manufacturers alike, that the magnitude of the economies due to electric ship propulsion has been established incidentally by the Navy Department of a first-class Power, to which reliability and technical efficiency are primary considerations.

The Coolidge X-Ray Tube.—We have received from the British Thomson-Houston Co., Ltd., of Mazda House, Upper Thames Street, E.C., a price list and particulars of the Coolidge X-ray tube, for which they own the British patents. The tube, which was described in our issue of October 16th last, represents an enormous advance over previously existing patterns—as great a step as from the hand-regulated arc lamp of 50 years ago to the automatic flame arc of to-day—for it does away with the variability and delicacy of handling of the old type, and raises the X-ray generator to the rank of an instrument of precision, which can be readily adjusted to any desired intensity, over a range far beyond that of its predecessors, and enables the quality of the rays to be exactly reproduced as often as desired ; the tube can be used continuously without change in "hardness," the focal spot is fixed, the same tube can be used for all kinds of work, and it has a life of at least 1,000 hours. The rapidity of work is also greatly increased, a matter of immense importance to the surgeon, and as rays can be emitted resembling the gamma rays of radium, the latter can be to a great extent replaced by the Coolidge tube. We understand that a large number of the new tubes are in use and giving excellent service in the military hospitals both at the front and in this country, a most fortunate circumstance for both surgeons and patients.

A Railway Levitated.—A writer on science in the *Evening Standard* includes in the list of scientific discoveries of 1914 the "levitated railway" of M. Bachelet. Apart from the fact that the railway was not at the time supposed to be "levitated," but only the cars, we may point out that its demonstration in New York in 1912 rather weakens its standing as "the second discovery that came during the year" 1914. We are told that "the idea of it was splendid, but, like all other ideas, it was entirely upset by the outbreak of war." But it was in May, months before the outbreak of war, that the idea was upset, and we did our share in exposing the fallacies upon which it was based ; when the prospectus was issued in the first week of June, it fell flat. To credit the war with the failure of this fantastic scheme is ridiculous ; but we believe that lapse of time has rendered the title much more appropriate now.

Relief Measures taken by Berlin Electrical Engineers.—The American *Electrical Review* states that the Electrical Engineers Society of Berlin, Germany, has made the following appropriations : For the Berlin Red Cross Society, 1,000 marks ; for the fund to assist Germans in foreign countries, 1,000 marks ; for the fund to assist families of those fallen in battle, 1,000 marks ; for families dependent upon enlisted men, 500 marks ; for the Society for Children's Kitchens, 100 marks ; for the National Service to Women, 200 marks. The Society is further subscribing 500 marks monthly to a fund to be loaned without interest to electrical engineers in temporary need. An employment bureau has been organised by the Society in conjunction with the Verband Deutscher Electroteckniker and the Verein Deutscher Ingenieure to enable engineers out of employment to find positions vacated by those who have entered the military and naval service.

West Sussex.—The Light Railway Commissioners have granted an order for the construction of a light railway from Hunston to West Itchenor, West Wittering and East Wittering, and for the reconstruction and working as a light railway of the Hundred of Manhood and Selsey Tramway.

Australian Action Settled.—Reuter dispatches from Melbourne state that the Vacuum Oil Co. issued a writ against the *Melbourne Age*, claiming £23,000 damages for an alleged libel contained in an article entitled "Trading with the Enemy," and that the paper has withdrawn its statements and apologised.

Foreign Trade.—THE DECEMBER FIGURES.—The following are the electrical and machinery figures given in the official returns for December :—

IMPORTS.	*Month of December.*	*Inc. or dec.*	*Twelve months, 1914.*	*Inc. or dec.*
	£	£	£	£
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	89,916	— 65,631	1,241,933	—345,361
Machinery	544,236	— 78,648	6,704,389	—578,582
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	184,363	— 162,101	3,017,693	—2,368,580
Machinery	1,456,281	—1,501,175	31,335,218	—5,677,417

Auxiliary Steel Trolley Wire. — According to the *Electric Railway Journal*, excessive wear on the No. 0000 copper trolley wire on the 6,600-volt single-phase lines of the Chicago, Lake Shore, and South Bend Railway made it necessary to install a No. 0000 steel auxiliary contact wire last year, which is suspended 1¾ in. below the copper line on 2-in. duplex clips. About 103 miles of steel wire is in use exclusively on mast arm construction, although it is to be tried on span-wire suspension. The change transferred the wear to the galvanised iron sliding pantograph shoes, which gave only 2,500 miles per shoe between renewals. To overcome this trouble two pieces of half-oval mild steel, ⅜ in. × 1½ in. section, were substituted for the 12-gauge galvanised iron sliding pantograph shoes, raising the useful life of the shoe to 9,000 miles. The average cost of the new shoes is 15 cents for material and 30 cents for labour.

Fatality.—Harry Dalton (51), a tramguard in the employ of the Manchester Corporation tramways department, died on Saturday in the Stockport Infirmary from injuries received on the previous day through being crushed between the fenders of two tramcars. He was attending to his trolley at the time, and was trapped between the two cars, his thigh being fractured.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials. — At last week's meeting of the Swansea Electric Lighting and Tramways Committee, MR. W. J. BURR, the new borough electrical engineer, reported that he had been very loyally received by the staff at the station. The Committee expressed appreciation of the services of the staff, and especially of Mr. Rees, who had acted as the borough electrical engineer for some months during a period of extreme difficulty.

MR. W. N. PRITCHARD is no longer assistant engineer at Market Drayton electricity works, having taken up a similar position at the Newport (I. of W.) electricity works.

MR. A. C. NORTH, switchboard attendant at Middleton electricity works, has resigned upon receiving another post, and MR. W. BOWER has been appointed in his place.

We regret to learn from MR. A. J. BECKETT, of Bridlington, that our last week's reference to him was not quite correct. He was offered a commission by the colonel commanding, and had accepted it, but his papers had not been passed. The latter part of the paragraph is accurate in the event of Mr. Beckett receiving a commission.

MR. S. WHITEHOUSE, sub-station superintendent at the Walsall electricity works, has resigned his appointment. MR. J. D. SPARK, of Swansea, has been appointed mains engineer at Walsall, and MR. P. HUGHES has been appointed meter inspector.

MR. PENFOLD, second chief engineer at the Dover Corporation electricity works, has enlisted in the London Engineers, and the T.C. has appointed MR. WILSON to fill his place.

MR. HITCHCOCK, shift engineer at the Tonbridge electricity works, having joined the East London Engineers, the U.D.C. has appointed as his successor MR. O. CANTLE, of the staff of the Kent E P. Co., who was formerly at the Tonbridge works.

MR. JOSEPHS, shift engineer at the Gillingham (Kent) electricity works, having left to join the Army, MR. ALFRED E. HARDY, of Larbert, N.B., shift engineer with the Scottish Central E.P. Co., has been appointed to succeed him.

MR. T. ARNOLD TAYLOR has resigned the post of mains superintendent, which he has held since February last, with the Corporation of Sunderland, and has accepted the post of assistant engineer with the Burmah Electric Tramways and Lighting Co.

Tramway Officials.—The Reading T.C. has increased the salary of MR. J. MCLENNAN CALDER, chief assistant tramway engineer, to £220 a year, rising by two further annual increments of £15 to £250.

MR. JOSHUA BRIERLEY, who has held the position of traffic superintendent on probation in the Oldham tramway department, has now been appointed permanently to the position.

General.—Messrs. Preece, Cardew & Snell inform us that they are taking into partnership MR. JOHN HALL RIDER (who will join them in April), on his retirement from the position of consulting electrical and mechanical engineer to the Central Mining and Investment Corporation, Ltd., and Rand Mines, Ltd., Johannesburg. Mr. Rider was, previously to his going to South Africa in 1910, electrical engineer to the London County Council tramways for nine years. The partners will be Mr. A. H. Preece, M.Inst.C.E., &c., Sir John Snell, M.Inst.C.E., M.I.E.E., &c., Mr. Llewellyn Preece, M.Inst.C.E., &c., Mr. J. H. Rider, M.Inst.C.E., &c., Mr. J. H. Woodward, A.M.I.C.E., &c., and Mr. S. Moore Ede, A.M.I.C.E. The designation of the firm after March will be Preece, Cardew, Snell & Rider, and the offices will be as heretofore at 8, Queen Anne's Gate, Westminster.

The *Manchester Courier* states that the directors of the British Engine, Boiler and Electrical Insurance Co., Ltd., have appointed MR. HARRY M. LONGRIDGE, B.A. (Cantab.) to be manager of the company. He has been in the service of the company for 10½ years. His grandfather, Mr. R. B. Longridge, who recently died at the advanced age of 93, was the pioneer of boiler inspection and insurance. Mr. H. M. Longridge is a son of Mr. R. Charles Longridge, the present managing director of the company, and a nephew of Mr. Michael Longridge, the chief engineer. Both of these gentleman will now partly relinquish active work.

MR. JAMES BANKS, one of the superintendents of the telegraph department in the Edinburgh Post Office, has retired under the Civil Service regulations as to the age limit, after nearly 50 years' service. Mr. Banks received from the members of the staff practical recognition of the esteem in which he was held. He is succeeded by MR. T. WARDEN, whose place is taken by MR. J. N. PRESCOTT.

Obituary.—MR. J. WRIGHT.—The death occurred on January 3rd of Mr. John Wright, sen., for many years a member of the firm of John Wright & Son, electrical engineers, Dover. Deceased, who was in his seventy-third year, was a Past Master of the Corinthian Lodge of Freemasons, and a prominent Conservative. The business will be carried on by his sons, Messrs. John and Edward Wright, the latter of whom has managed the electrical branch.

MR. MOSES STOKES, superintendent of Darwen tramways, died on Sunday night. Deceased went from Liverpool to the tramways department at Darwen 30 years ago.

NEW COMPANIES REGISTERED.

D. & M. Synd (Hollister's Patents), Ltd. (138,898).—This company was registered on January 6th, with a capital of £2,500 in £1 shares, to carry on the business of electricians, electrical and mechanical engineers, manufacturers and workers of and dealers in electricity, motive power and light, etc., and to enter into an agreement with F. L. Hollister. The subscribers are: F. L. Hollister, 8, Upper John Street, Golden Square, W., engineer, 25 shares; G. R. Taylor, 6, South Square, Gray's Inn, W.C., managing clerk, one share. Private company. The number of directors is not to be less than three or more than five; the first are not named. Qualification, £25. Solicitor: A. W. Osmond, 6, South Square, Gray's Inn, W.C.

Perfection Light Co., Ltd. (138,901).—This company was registered on January 6th, with a capital of £2,000 in 40 founders' and 1,000 pref. shares of £1 each, and 3,840 ordinary shares of 5s. each, to take over the business carried on at 5, Victoria Street, Westminster, and at 39a, Lower Kennington Lane, S.E., as the "Perfection Light Co.," to carry on the business of mechanical, gas, electrical and domestic engineers, manufacturers of and dealers in engines, machines, dynamos, lamps, wire, pipes, mantles, burners, insulating materials, accumulators, petrol and other oils, etc., and to enter into certain agreements, the parties to which are not named. The subscribers (with one share each) are: L. J. D. Gibson, Thicket Side, Maidenhead Thicket, Berks, civil engineer; F. Bradley, 60, Braxted Park, Streatham, S.W., civil engineer. Private company. The number of directors is not to be less than two or more than five; the first are L. J. D. Gibson and F. Bradley (joint managing directors). Registered office: 5, Victoria Street, S.W.

Midhurst and District Electric Supply Co., Ltd. (138,886).—This company was registered on January 5th, with a capital of £7,500 in £1 shares, to carry on the business indicated by the title, and to adopt an agreement with B. E. G. Bailey, Hon. W. H. M. Pearson, and T. Stallibrass. The subscribers are: B. E. G. Bailey, The Old House, Midhurst, medical practitioner, 50 shares; A. Farley, Beachey House, Midhurst, merchant, 50 shares; J. Gwillim, North Road, Midhurst, 50 shares; W. H. M. Pearson, M.P., Capron House, Midhurst, 50 shares; T. Stallibrass, Rumbolds Hill, Midhurst, railway agent, 50 shares; Sir Stephen G. Sale, K.C.I.E., Heather Wood, Midhurst, 2,000 shares; R. P. Brousson, 47, Parliament Street, S.W., electrical engineer, 50 shares. Minimum cash subscription, 20 per cent. of the shares offered to the public. The number of directors is not to be less than three or more than seven; the first are B. E. G. Bailey, W. H. M. Pearson, M.P., and R. P. Brousson. Qualification, 50 shares. Remuneration as fixed by the company. Solicitor: G. C. Clarence, Market Place, Midhurst, Sussex.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Abingdon Electric Supply Co., Ltd.—Particulars of £3,000 debs., created December 31st, 1914, and secured by trust deed of even date, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, and leasehold hereditaments at Abingdon. Trustees: J. H. Edwards, Haresfield, near Stonehouse, Glos., and A. A. Douglas, Brendon, Queen's Drive, Colwyn Bay, Denbigh.

Suffolk Electricity Supply Co., Ltd.—Issue on December 14th, 1914, of £750 debs., part of a series of which particulars have already been filed.

Royce, Ltd.—Capital, £170,000 in £1 shares (7,000 pref.).—Return dated July 13th, 1914. 34,955 pref. and 72,487 ord. shares taken up; £1 per share called up on 4,955 pref. and 6 ord. and 15s. per share on 30,000 pref. shares. £27,461 paid, £79,981 considered as paid, being £1 per share on 72,481 ord. and 5s. per share on 30,000 pref. shares. Mortgages and charges, nil.

Maxim Lamp Works, Ltd.—A memorandum of satisfaction in full on December 30th, 1914, of charge dated September 29th, 1910, securing £1,060 3s. 10d., has been filed.

Ely Valley Lighting Co., Ltd.—Capital, £5,000 in £1 shares. Return dated September 24th, 1914. 3,471 shares taken up; £3,468 5s. paid; leaving £2 15s. in arrears. Mortgages and charges, £880.

Wardle Engineering Co., Ltd.—Capital, £5,000 in £1 shares (2,000 pref.). Return dated July 29th, 1914. 2,885 ord. and 1,330 pref. shares taken up. £4,015 paid; £200 considered as paid. Mortgages and charges, nil.

Maud & Turner, Ltd.—Particulars of £4,000 debs., created December 30th, 1914, and secured by trust deed dated January 1st, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital and land with Perseverance Works, at Half Mile, Thorn, Halifax. Trustees: Harriet Maud and E. Booth.

General Accessories Co., Ltd. (104,464).—Capital, £3,000 in 1,580 six per cent. pref., 820 five per cent. pref., and 500 ord. shares. Return dated August 28th, 1914 (filed Nov. 12th). All shares taken up. £1,580 paid; £1,420 considered as paid. Mortgages and charges, nil.

Electro-Mechanical Brake Co., Ltd. (98,276).—Capital, £20,000 in 2,500 six per cent. cum. pref. and 17,500 ord. shares of £1 each. Return dated October 9th, 1914. 987 pref. and 16,317 ord. shares taken up; £1 per share called up on 987 pref. and 10,282 ord.; £11,269 paid; £6,035 considered as paid on 6,035 ord. Mortgages and charges, nil.

Frinton-on-Sea and District Electric Light and Power Co., Ltd. (70,689).—Capital, £10,000 in 2,700 ord. and 73,000 pref. shares of £1 each. Return dated October 8th, 1914. 1,376 ord. and 5,125 pref. shares taken up; £6,501 paid. Mortgages and charges, £6,000.

CITY NOTES.

Tata Hydro-Electric Power Supply Co., Ltd.

The *Englishman* states that Sir D. J. Tata presided at the annual meeting on December 3rd. He referred to the doubts and fears about the scheme in the form of bazar rumours, and in order to remove them read a report by Mr. Joyner, the Company's Hydraulic expert. Mr. Joyner states that the dams are twice as strong as Kharakwashla dam, ten miles from Poona, which was built forty-six years ago and which is still absolutely sound and has never shown any tendency to be otherwise. The water supply too is expected to be better than was originally anticipated for whereas the estimate was that 62 per cent. of the rainfall would be collected during the past two monsoons, it has been found that the proportion running off the catchments is 80 per cent. in addition to which the cool surface of the lakes condensing damp air has caused heavier rain to fall on them. The ducts and forebay are described as "eminently suitable for their purpose in every respect" and the ducts will carry sufficient water to give 100,000 e.h.p.

Sir Dorab, referring to the future of the company, roughly estimated that 160,000 h.p. would be required to meet the demand of Bombay, but as the full capacity of the present lakes could not possibly meet such demand it was resolved to find out a suitable site near Bombay, possessing advantages similar to those of the present scheme. Mr. Gibbs, general manager, has been successful in discovering other valleys in the Ghauts. With the sanction of Government survey parties have been at work. The whole problem is being considered by expert advisers.

Llandudno and Colwyn Bay Electric Railway, Ltd.

The directors' report for the year to November 30th, 1914, states that the profit after providing for operating and administration expenses and interest on debenture stock, amounts to £5,144, plus £919 brought forward. There has been applied in providing for sinking fund instalment, due January, 1915, £1,475, and in writing off discount on debenture stock issued during year £50, leaving £4,538. The directors recommend a dividend at the rate of 4 per cent. per annum (payable, less income tax, on January 30th, 1915), absorbing £3,976, carrying forward £562.

The traffic receipts show a decrease of £2,039, which is entirely due to the interruption of the holiday season consequent upon the outbreak of war, the receipts up to that period slightly exceeding those of the previous year. The receipts since the close of the financial year have been fully maintained.

The sinking fund in connection with the debenture stock has again been provided out of the revenue for the year, and the directors consider that this provision is sufficient to meet depreciation. The extension to Old Colwyn is now being carried out and will be completed in a few weeks. The [illegible] of the track from the end of Mostyn Avenue to St. John's Chapel, Llandudno was carried out during the year, and it is satisfactory to record that this work was carried out without seriously handicapping the working of the system.

Reduction of Capital.—Turners & Manville, Ltd. (and Reduced).—A petition for confirming the reduction of the capital from £50,000 to £39,994 has been presented, and is now pending. List of creditors of the company is to be made out as for February 17th.

Companies Struck off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Automatic Glass Blowing Patents Syndicate.
Automatic Weldless Chain Co.
Auxiliary Power Co.
Bishop's Stortford and Stansted Electric Lighting Co.
British Electric Light Wiring Co.
British "Ever-Ready" Electrical Co.
Burkel Tram Rail Syndicate.
Cauricedale Anti-Friction Metal Syndicate.
Concentric Condensers.
Cumberland Power Syndicate.
Economic Furnaces.
Metals Finance.
National Automatic Fire Alarm Co.
Penmachno, Corwen and Bettws-y-Coed Light Railway Co.
Positive Rotary Pumps.
Technical Advertising.
Traction and Power Agency.
Wolfram (Tungsten) Syndicate.

Sydney Electric Light and Power Supply Corporation.—According to an Australian paper just to hand, this company is reporting on the four months ending October 31st last, states that the new business continues satisfactory, and that during the period mentioned there has been an increase of 325 consumers. The profits for the four months amounted to £8,122, which, after paying a dividend at the rate of 7 per cent. for the period, and deducting £468 as portion of debenture flotation expenses, left a balance of £3,667 to be carried forward. Consumers have increased at the rate of nearly 40 per cent. per annum. After allowing for the interest payable on the first and second debentures, the balance of profit would be sufficient to pay roughly about 2 per cent. on the shares issued, but the directors have adopted a conservative policy, and are only paying the usual rate of 7 per cent. per annum.

Victoria Falls and Transvaal Power Co.—The *Financial Times* states that a circular has been issued to the shareholders of this company, stating that business since the last report has continued to make satisfactory progress, the war not having interfered with the undertaking in South Africa. The amount of power now being delivered shows an increase over that of June last. That is reflected in profits, which show a steady increase since the beginning of last year. In connection with the erection of new plant at Brakpan, the first extension set will be in commission within a month, and the second set will be available for service two months later. Fresh demands for power requirements are being received.

Electric and General Investment Co., Ltd.—The directors announce, says the *Financial Times*, that as they consider it advisable during the continuance of the war to conserve cash resources they do no propose to pay any interim dividend on the preference or ordinary shares.

Direct United States Cable Co., Ltd.—Interim dividend 2s. per share, less income-tax at 2s. 1d. in the £, (being at the rate of 4 per cent. per annum for the quarter ended December 31st, 1914), is payable on and after 31st inst.

Stock Exchange Notice.—The Committee has been asked to allow the following to be quoted in the Official List:—

London and Suburban Traction Co., Ltd.—£350,000 5 per cent. "A" Debenture stock.

Kaministiquia Power Co., Ltd.—Dividend 1½ per cent. on the common stock for the quarter ending January 31st.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—A dividend of 1¼ per cent. is announced.

Sao Paulo Tramway, Light and Power Co., Ltd.—A dividend of 2½ per cent. is announced.

Westinghouse Brake Co., Ltd.—A dividend at the rate of 20 per cent. per annum for the half-year ended December 31st is announced.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange fears, which [illegible] when the Treasury regulations for reopening the House became known, have already begun to fade away, now that the actual conditions of working have [illegible] to be less terrifying than they appeared in prospect. In spite of the fact that speculation is stopped and that business is confined purely to investment orders, markets find a fair amount to do; while the advantage of being able to deal [illegible], and with dry feet, is certainly one that appeals in the wet weather that is not unknown in London these days.

What the papers call the [illegible] of the Treasury dividends has brought a certain amount of money to the stock markets. The most popular security of the moment is the War Loan, and, this apart, interest continues to centre mainly upon gilt-edged securities. It is a matter of no little astonishment to find how keen is the demand still for all kinds of electrical debenture stocks. [illegible] they have their weeks of favour and disfavour, [illegible] the higher-grade issues the demand is constant and insistent. Buyers of course think that they ought to get stock a great deal cheaper than the prices at which it is offered, and disappointment still lingers that the war should have produced so few opportunities for bargain-hunting. Remains, however, the fact that most shares—and our list of electricity supply descriptions illustrates this—can be bought considerably cheaper than before the outbreak of war, when, it must be remembered, quotations had already suffered a severe shrinkage because of the abnormal financial conditions that prevailed for weeks before the storm actually burst upon Europe.

The last few days have been noticeable mainly for further advances in Home Railway stocks. With dividend declarations so near at hand, and with all dealings for cash only, the bears have had an uncomfortable time, their anxiety not being lessened by the readiness with which small investors are buying odd lots of the best-known stocks. Why the electrical railway issues should have been overlooked it is difficult to say. They are likely to have their turn before long; and a recovery in Underground Electric income bonds and shares is an indication that this group is not without friends.

London and South Western 5 per cent. preference stock, issued to pay for partial electrification of the system, is well held at 103; but Metropolitan preference continues at a small discount. Work on the London and North Western electrification scheme seems to have been largely checked, no doubt in consequence of the war. There was great activity to get the new station at Chalk Farm finished before the autumn, but present operations are being carried out on a much smaller scale, the Company's men no doubt being required for handling the troop-traffic, and being denuded, of course, by the hundreds who have joined the colours.

The St. James' Electric Supply is usually the first of the electrical companies to declare its dividend, though chased very closely by the Westminster, and followed shortly after by the Brompton and the others in the London group. The question before directors at present probably is whether they shall deplete reserves and pay the same dividends as a year ago, or whether they shall distribute smaller payments and keep up the appropriations. Last August, it may be recalled, the tendency was in the former direction; and the boards will now have to shape their policy according to their views with regard to the duration of the war. The uncertainty prevailing on the point no doubt has something to do with the continued quietude in the share market. It will be seen from the following prices how trifling the changes are:—

HOME ELECTRICITY COMPANIES.

	Mean price. July 27.	Jan. 12, 1915.	Rise or fall this week.
Brompton Ordinary	9⅛	8⅞	+ ⅛
do. 7 per cent. Pref.	8⅝	8⅜	—
Charing Cross Ordinary	5¼	4⅞	+ ⅛
do. do. do. 4½ Pref.	4¾	4¼	—
do. do. City Pref.	4⅝	4	—
do. 4 Deb.	91½	90	+ 1
Chelsea	4⅞	4¾	—
do. 4½ Deb.	96½	92	+ ½
City of London	16	14¾	—
do. do. 6 per cent. Pref.	13½	13	—
do. do. 5 Deb.	116½	114	—
do. do. 4½ Deb.	100¼	98	—
County of London	12	11⅛	—
do. do. 6 per cent. Pref.	12	11⅞	+ ⅛
do. do. 1st Deb.	102½	99	—
do. do. 2nd Deb.	100½	97	—
Kensington Ordinary	7½	7⅝	+ ⅛
London Electric	1 7/16	1½	—
do. do. 6 per cent. Pref.	5 1/16	5	—
do. do. 4 Deb.	92½	89¼	—
Metropolitan	3½	3¼	+ ⅛
do. 4½ per cent. Pref.	4 7/16	4¼	—
do. 4½ Deb.	97½	91½	—
do. 3½ Deb.	83	81½	—
St. James' and Pall Mall	9⅝	9	—
do. do. do. 7 per cent. Pref.	7	6¾	—
do. do. do. 3½ Deb.	81½	83½	+ ½
South London	3 7/16	3	—
South Metropolitan Pref.	1½	1⅛	—
Westminster Ordinary	8⅝	8⅝	— ⅛
do. 4½ Pref.	5⅛	4⅞	—

TELEGRAPHS AND TELEPHONES.

	Mean price. July 27.	Jan. 12, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108¼	102½	—
do. Def.	23	21¾	—
Chile Telephone	7⅜	7⅛	+ ⅛
Constantinople Tel.	4¼	4	—
Cuba Sub. Ord.	8½	8⅜	—
do. Pf.	16½	15½	—
Eastern Extension	12¾	12½	+ ¼
do. 4 Deb.	97½	94	—
Eastern Tel. Ord.	130½	122	+ 1
do. 3½ Pf.	77½	74½	+ 1
do. 4 Deb.	96½	95	—
Globe Tel. and T. Ord.	11¼	10	— ⅞
do. Pf.	12½	12	— ¼
Gt. Northern Tel.	32½	28	—
Indo-European	59	57	— 1
Marconi	1 15/16	1 13/32	+ 1/32
New York Tel. 4½	101	96½	+ ½
Oriental Telephone Ord.	2 5/32	2	—
do. Pf.	1 1/32	1 1/16	—
Tel. Egypt Deb.	98	97½	+ ½
United R. Plate Tel.	6⅜	6	—
do. Pf.	5¼	5	—
West India and Pan.	1¼	1⅛	—
Western Telegraph	18½	12⅞	+ ⅛
do. 4 Deb.	96½	95½	—

HOME RAILS.

	Mean price. July 27.	Jan. 12, 1915.	Rise or fall this week.
Central London, Ord. Assented	83	79	—
Metropolitan	37½	31⅛	+ ⅛
do. District	21¾	18¼	+ ¼
Underground Electric Ordinary	2½	1⅞	—
do. "A"	7/6	6/-	—
do. Income	88	80	+ 1

FOREIGN TRAMS, &c.

	Mean price. July 27.	Jan. 12, 1915.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅞	4½	—
do. 2nd Pf.	4½	4⅛	—
do. 4 Deb.	91	86	—
do. 4½ Deb.	98½	96	—
do. 5 Deb.	96	89	—
Brazil Tractions	66	68	+
Bombay Electric Pf.	11⅜	10½	—
do. 4½ Deb.	96	95	—
Mexico Trams	70	45	—
do. 5 per cent. Bonds	84	70	—
do. 6 per cent. Bonds	76	65	—
Adelaide Sup. 6 per cent. Pf.	5¼	5⅛	+ 1/16
do. 5 Deb.	104	100½xd.	—

MANUFACTURING COMPANIES.

	Mean price. July 27.	Jan. 12, 1915.	Rise or fall this week.
British Westinghouse Pref.	1¾	1⅞	—
do. 4 Deb.	74½	72	—
do. 6 p. lien	102½	98½	+ ½
Callenders	11⅞	11½	—
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	+ ½
Castner-Kellner	2½	2⅝	—
Edison & Swan, £3 pd.	3/32	12/6	— 6d.
do. do. fully paid	1¼	2½	—
do. do. 4 Deb.	59	60	—
do. do. 2 Deb.	65½	60	—
Electric Construction	7/32	11/-	+ 1/-
do. do. Pf.	1/16	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	18	—
do. 4½ Pref.	5	5	+ ¼
do. 4½ Deb.	100½	97	—
India-Rubber	9	8½	—
Telegraph Con.	38½	36	—

It will be noticed that Edison & Swan shares have given way a little after their drive up, when the price went to nearly 15s. The reaction is due to the disclaimer issued in semi-official manner as to the company being largely engaged in work for submarines. The fully-paid shares are unchanged at 2½. Electric Constructions are better at 11s., standing now higher than they did when war broke out. The manufacturing shares of the Telegraph group are very firm.

Telegraph securities themselves are remarkably quiet. There has been more demand for Eastern ordinary, while Eastern Extensions, at 12¼, are the fraction higher on the week. The Anglo-American group is steady, and the reception accorded to Sir Edward Grey's reply to the United States' protest on the subject of contraband has been sufficiently favourable to cause general satisfaction. Marconis, after being 1⅝ buyers, developed a slightly duller tone. American Marconis rose to 11s., but reacted to half-a-guinea; Canadians remain in the neighbourhood of 4s. 6d.

Brazil Tractions are better at 58, regaining their previous fall. A number of enquiries have reached the market as to whether there is any premium to be obtained on the new Calcutta Electric Supply ordinary and preference; but in view of the very slight difference which exists between the old and new, taking the two together, there is no profit at present for the applicant. The rubber market is better, thanks to Sir Edward Grey's promise to raise partially the embargo placed upon exports to the United States. The armament group has no feature to render it conspicuous.

Last Sunday, by the way, the special constables of Wimbledon, Fulham, Barnes and other places received peremptory orders, as they were finishing their dinners, to proceed at once to their points of duty; and power stations, being regarded as amongst the most vulnerable points, received rapid reinforcements from those whose afternoon nap was thus rudely disturbed. The occasion for this call was, of course, the appearance of German aircraft on the French coast; and the R.N.V.R. men, who are in charge of searchlights and guns, spent several exciting hours in watching for the enemy from the high points round London. Reservists and Special Constables were happily disappointed, but the false alarm has revived the previous anticipation of visits from alien air-craft.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Jan. 6	2,917	— 114	1	647	— 48	..	..
Blackpool-Fleetw'd	" 9	1,346	+ 5	1	456	— 35	8	..
Bristol	" 8	37,192	+4,031	1	10,190	+ 129	80·5	..
Chatham and Dist.	" 7	4,018	+ 367	1	970	+ 146	14·98	..
Dublin	" 8	23,540	+2,263	1	5,821	+ 586	54·25	..
Cork	" 7	1,852	+ 45	1	459	— 55	9·89	..
Hastings	Dec. 31	3,220	— 95	..	..	— 3,190	19·8	..
Lancashire United	Jan. 6	6,391	— 51	1	1,772	+ 101	42	..
Llandudno-Col. Bay	" 1	694	+ 51	4	694	+ 51	6·5	..
Tyneside	Dec. 30	2,087	+ 87	27	16,166	+ 2,185	11	..
Anglo-Argentine	Jan. 7	216,217	—32,894	1	52,720	— 5,347	..	..
Auckland	Dec. 18	20,414	+2,763	[illegible]	124,932	+15,027	25·42	1·06
Calcutta	Jan. 9	16,799	—1,952	..	.	+ 1,081	..	..
Kalgoorlie, W.A.	Sept.	2,864	..	29	23,980	..	..	..
Madras	Dec. 31	3,725	— 132	52	44,441	+ 1,495	..	..
Montevideo	Dec.	28,605	—4,705	9	55,686	— 8,154	..	..
Dublin-Lucan Rly.	Jan. 8	639	— 16	1	186	— 18	7	..

NOTES ON SWITCHBOARD ARRANGEMENT AND EQUIPMENT.

[COMMUNICATED.]

At one time it was customary to regard switchboards and their equipment as a nuisance—necessary but distinctly parasitic, and quite fitly to be placed in any odd corner, too small, or otherwise unsuitable, for any other equipment. Often the boards were much whited sepulchres, architecturally ornate and resplendent in marble and brass, but covering a multitude of faulty points in construction or design. Some of the defects involved only inefficiency; others actual danger to life and property. Painful experience, more frequent in its occurrence as working pressures increased, compelled attention to this matter and brought home the fact that the switchboard is the vital link connecting the generating and distributing systems, so that comparatively trivial switchboard defects may easily suspend supply over a more or less extensive area. Recently switchboards and gear have been accorded respect befitting their importance, but even in modern installations defects in design and arrangement are found which are particularly objectionable and dangerous when, as often happens in industrial service, the board is under the control of a more or less unskilled attendant.

Frequently one finds a switchboard placed in a gallery "affording a clear view over the engine room" (as the textbooks have it) when there is really no justification for this costly construction. In small stations of the one-man type the switchboard attendant (who probably enjoys the title of "engineer-in-charge," in recognition of the fact that he does everything that needs doing) is near enough to the engines to tell by sound what is happening to them, and that much more easily and certainly than he could tell by eye when in a gallery; and should he have cause to leave the board hurriedly to attend to the engines, it is a distinct advantage to have no steps to descend. In larger works, actual supervision of the engines from the switchboard is necessarily very superficial. Separate engines and switchboard staffs are required, and intercommunication by signals can be effected as easily from a floor board as from a gallery. In stations of either of the above classes a lofty gallery is an unnecessary and inconvenient expense, but the switchboard may well be mounted on a platform not more than two or three steps high; this arrangement improves the look of the station, permits the board to be conveniently railed off, and undoubtedly exercises some occult effect in emphasising the importance and sanctity of the board. In large modern stations of the high-tension type, a switch gallery is almost compulsory, owing to the depth required beneath the operating platform for cable races, transformers, and oil switches, &c.

In such stations remote control of engine or turbine valves is usually provided on the switchboard; the switchboard attendants work only on the board itself and find full employment there, and by the switchboard gallery overhanging the turbine aisles, space can be frequently saved as compared with the space required for ground level boards. Some of the low-tension boards controlling local and auxiliary circuits can still be placed advantageously on the walls of the engine room at ground level. The prevailing tendency is to separate generator, feeder, and section panels (to limit the scope of damage), while providing central remote control for all.

In the latest and largest power schemes there is an increasing tendency to locate the main switchgear in a building distinct from the power house itself, even going the length of providing a separate switch house for each generating unit in a large overland scheme. By such isolation the risk of wholesale interruption of supply due to cable and switch fire is much reduced, and the task of isolating and extinguishing a fire is greatly simplified. All pretence at direct engine room supervision from the switchboard is abandoned, and a complete system of signal telegraphs and remote control apparatus is arranged.

Simplicity in any switch installation is an invaluable aid to security, for the risk of trouble increases far more rapidly than the number of pieces of apparatus and component parts on the board. High-tension boards and switchgear can and must be interlocked very completely, but there is a tendency to overdo the automatic features and "foolproofing" of industrial switchgear. In some directions foolproofing engenders or encourages carelessness, and even deliberate misuse of apparatus in order to see the automatic features work. Broadly speaking, safety and reliability are best assured by a minimum number of automatic features, all the expenditure permissible being devoted to making these and the fundamental components of the switchgear of the best material and design. The use, on metal parts behind boards, of insulation which might be inadequate under any circumstances, is inviting trouble; the metal concerned had far better be left bare and protected by a mechanical screen, or left obviously dangerous, or earthed, according to circumstances. Bare conductors behind the board reduce the risk of fire to a minimum. Asbestos is a flame-proof covering, but one which is apt to form a good "wick" for burning oil. Bare conductors must be so supported that they cannot be deflected dangerously by the enormous mechanical forces set up by short-circuit in a modern station. Portable electrostatic live wire indicators of the electroscope type should be used regularly by men handling high-tension switchgear and leads; naturally, the instrument should be of first-class design and construction, or it will introduce more risks than it will remove. Doors in the side or back of the enclosure behind the board should be on permanent hinges or slideways wherever possible, and should be interlocked with the main switches in the section to which they give access. If the doors be of the hang-on panel type, they should be entirely of insulating material with completely insulated reinforcement, if any, otherwise they are likely to cause disaster by coming in contact with live parts.

Low-tension, no less than high-tension, switches should be mounted with all live parts behind the board, and only the insulated handles in front; safety and good appearance are thus alike secured. In the past, on many boards, particularly of Continental origin, live parts on the front of the board have been covered by shields of fibre or papier mâché composition, easily damaged mechanically, and subject to rapid deterioration by damp. Such construction is unsightly, unsafe, and altogether false economy. In multipolar switchgear, with mechanically coupled phases or poles, the coupling-piece should be exclusively of insulating material; if it has a metal core, damage to the insulation will probably cause a dead short.

The design of oil-immersed switchgear can hardly be said to have kept pace with the revolutionary increase in power of generating sets and pressures of generation and distribution; the distance between live parts is often insufficient, and the total volume of oil in the box inadequate to prevent overheating. Switch parts should be as light as is consistent with strength, so that acceleration is a maximum for a given operating force, and there is advantage in using a mechanism which gets into motion before the actual break occurs. The containing case should be very strong and fitted with a relief valve, and the cell within which the switch is placed should be of fireproof construction and provided with a drain carrying away oil in case of fracture of the switch-box. Generator switches should usually be non-automatic, but have overload alarms operated by a current transformer; also alarms operating in case of abnormal oil heating. On important lines it is not extravagant to provide two switches in series, particularly if fitted with automatic gear, or if used very often or very seldom. Each switch is fitted with a bridging isolating switch, the latter being closed across the main switch which is held in reserve at the moment. Wherever oil switch or other oil fires are liable to occur, plenty of sand should be kept handy, and smoke helmets should be provided, for without the latter it is often impossible to reach the seat of conflagration.

The large generating sets now employed, and the low reactance of generators and transformers commonly adopted for the sake of good regulation, result in enormous short-circuit energy. It is doubtful whether any practicable oil switch can deal unaided with the conditions which may arise in a large modern station, and the alternative to sectionalising, so as to limit the short-circuit energy available behind any one switch, is to use two switches in series, or one special switch, so that supplementary reactance is inserted automatically before the main switch opens. Earthing the neutral of three-phase systems is desirable so long as steps are taken to limit circulating currents during normal operation and to provide low-resistance earthing when really required. The use of switching-in or charging resistances is now common in all high-tension installations, and is particularly desirable when connecting circuits of high inductance or capacity. Without this precaution dangerous resonant cable surges may occur, and special insulation of motor and transformer end coils becomes necessary. The practice of running up a machine with its cables connected is of limited applicability, is crude, and by no means free from risks. Periodic testing of network insulation is a necessary and universal practice, but any method or instrument which gives graduated warning of the imminence and aggravation of faults is specially valuable. The telephone of a phasaphone, for instance, enables one to listen to the charge and discharge of a condenser connected between line and earth through a suitable resistance; irregular or incipient defects cause variations in the telephone note. Any measures leading to the prevention of faults are particularly valuable, since they not only prevent the first interruption of service, but save a further whole crop of trouble. Most central station statistics show that breakdowns occur in groups. The first serious breakdown causes surges which strain or even puncture insulation in other parts of the system; static discharges occur when working is recommenced, and a power discharge soon follows. Once started, there is often quite a long train of serious breakdowns at short intervals.

Instruments of the flange type with body sunk in the board are neat in appearance, easily cleaned and easily read—all advantages of special importance on large boards, and more than compensating for the extra cost involved. Classification of instruments by case diameter is obviously illogical, since the scale is quite likely to be smaller and less clear though the case diameter be larger. It is much safer and more definite to specify either the scale length or, what amounts to the same thing, the pointer length and maximum angular deflection. Such a basis is equally applicable to face and sector instruments of all types. Any instrument to be mounted above eye level should have at least 6½-in. scale length (or, say, 90° deflection of a 4½-in pointer); the advantages of modern long-scale instruments are well known. The merits of induction type instruments for alternating-current working include long-scale and all-glass front showing full pointer length. These instruments are simple and strong, and can be repaired by an ordinary meter adjuster. Their frequency error is high, but this is of no importance in a turbine station; the temperature error, which would be a more serious matter, is capable of close compensation.

The elementary precaution of placing all series and regulating resistances so that convected heat does not reach neighbouring instruments is often neglected, naturally to the prejudice of instrument accuracy. Errors due to this cause cannot always be detected even by *in situ* tests, for the offending resistances may be cool at the time of testing. Irregular operation of fuses is often traceable to their being mounted with similar disregard for the neighbourhood of regulating resistances; if the fuse is proportioned to carry a certain current when the resistance is hot, the circuit is inadequately protected when the resistance is cold. Induction from heavy current cables six or seven inches away often causes quite serious instrument error.

Instrument change-over switches placing instruments in various circuits or across various shunts are often built so lightly that they give trouble by imperfect contact or, what is more serious, cause short circuit by mechanical fracture. The back contacts of these and other switches should be fully accessible and not covered in by bus-bars or other apparatus. For calibrating purposes it is often desirable to connect standard instruments temporarily in circuit without interrupting operation, and to permit this with minimum trouble and risk, special terminals should be provided on isolating switch or fuse blocks in the first place so that, the current winding being connected, it remains only to open the bridging switch or fuse.

The frequency in modern turbine stations is practically constant, but not infrequently is lower than standard, owing to weakening of the control in the tachometer or other instrument used. A frequency meter switched in circuit only at intervals to check the regularly employed tachometer is a useful precaution. There is rarely need for a registering frequency meter, but the use of recording volt and wattmeters is in the interests of efficient working and supervision. It is a small matter to planimeter wattmeter records to save the use of watt-hour meters if both are not desirable for any reason; and the wattmeter record is very useful in distributing generator and feeder connections and settling tariff problems. Volt and wattmeter records are useful, too, in detecting and discriminating faulty conditions; for example, branches touching overhead lines cause smaller fluctuations than fallen wires or insulator defects, and imperfect contacts such as often occur in open-air high-tension isolating switches, cause violent fluctuations on voltmeter records but little on wattmeter records.

The design of good instrument transformers is now generally understood but not always practised. For trip coils and relays, accuracy of transformer ratio and phase are of minor importance, but for use with measuring instruments very light portable transformers are generally unsuitable. In large systems, transformers with small primary capacity may be destroyed by the mechanical forces set up during short circuit; specially heavy design is essential, and the secondary load should be as light and constant as possible, to secure highest accuracy. Often an installation can be cheapened and simplified by using one transformer for several instruments; the transformer should be designed liberally, so that an extra instrument can be connected to it at any time (the possibility of so doing will often be of great practical value). A single current transformer may supply a number of watt-hour meters, but should not be connected to other apparatus as well. Not infrequently it is neglected to earth the secondary measuring circuit, or otherwise make it impossible for the low-tension circuit to become "live" with high-tension current. A danger equally fatal and more serious in that it exists under ordinary working conditions if not safeguarded, is that of generators and leads being kept alive after the main switch is opened, by induction through synchronising transformers. The obvious remedy is to place an isolating switch ahead of all potential transformers, interlocking this switch with the main circuit switches. Besides fusing the primary side of voltage transformers, low-tension fuses should be placed in the secondary circuit to protect against incorrect connection, incorrect earthing, or short circuit, in leads or instrument. All instruments connected directly to bus-bars or mains should be fused, for the same reason.

AUTOMATIC PROTECTIVE SWITCHGEAR FOR AUTOMATIC CURRENT SYSTEMS.

By E. B. WEDMORE, M.I.E.E.

(*For abstract of paper read before the* Institution of Electrical Engineers, *see* Elec. Rev., *p.* 37.)

Discussion in London.

Mr. C. H. **Merz** said that all these devices had been developed as the result of experience, which had shown the need of them. On the North-east Coast they were deeply interested in the matter as a commercial question. They had many long transmissions, and the system had naturally developed into a series of interconnected ring mains, supplied from substations with attendants; in order to maintain continuity of supply in the event of a fault occurring, they had to have automatic apparatus that would cut out the faulty cable, no matter which way the current flowed. The result was the development of systems of protection. The conditions were different in the United States, where the distribution was largely by direct current through rotary-converter sub-stations; radial feeders were laid with each sub-station, and attendants were employed, so that ordinary overload devices were sufficient. In this country the tendency was to supply important consumers with three-phase current through static transformer sub-stations, hence the necessity for selective devices. The real question was not the cost of a particular piece of apparatus, but whether it was possible to improve the lay-out by using it and thus save perhaps 100 times its cost.

Mr. H. W. **Clothier** said that the paper contained the condensed results of twenty years' work. It was difficult to induce the users of cables to think out the problems involved and to become themselves "selective." It was important to consider the case of T mains, as at J in fig. 1.

Core-balancing on switchgear had been adopted extensively four years ago, and at least 100 circuits, to his knowledge, were protected with it to-day. Messrs. Merz and Price themselves did not fully realise the value of the system at first. He did not like the balanced relay system as applied to the case of parallel feeders; with regard to interlocked reverse-relays, he agreed with the author, and was surprised that they were still specified. Systems of protection of parallel feeders had a tendency to open the wrong switch in the event of a fault on open circuit, and they were useless where there were T mains; the situation might be saved by the split-conductor system. He agreed with the author's conclusions regarding the split-conductor system for feeders; it was new to the public, but over 100 miles of cables and overhead mains were protected by it. On a system of some 50 miles of cable, it operated 40 times in the year, and only once had it failed; on that occasion the system was not to blame, the failure being due to a fault in the mechanical construction.

Mr. A. M. **Taylor** regarded the subject from the point of view of the switch-gear engineer in a municipal undertaking. Referring to the author's conclusions, under (*a*), the remedy which the author gave for the protection of all closed feeder circuits was a split-conductor system, but unfortunately in municipal work that was of no assistance in regard to existing feeders. They had to deal with feeders running from a generating station to numerous sub-stations, in many of which were rotary converters. These feeders were mostly run in triplets, but occasionally in pairs, and sometimes in sets of four, throughout the city, and the author's suggestions in regard to closed feeder circuits, which these were in some cases, did not help them because they could not rip up these feeders and put down split-conductor arrangements. Neither could they throw two existing feeders together under one switch and call them a split-conductor arrangement, because that would have the disadvantage that both feeders would be thrown out of gear for a fault on either of them, and they would be worse off than at present. With reference to the author's arrangement of overload relays, in which the relays operated with the load current plus the fault current, or rather a sub-multiple of it, the author did not mention, except incidentally, the fact that it was not necessary in the case of every fault, say for instance one three-quarters of the way along one of the feeders to the sub-station, that the current to the fault should return *from* the sub-station. In fact it was purely a question of the relation between the load current and the fault current and the potential of the feeder at the point where the earth occurred that determined whether the current should flow back from the sub-station bus-bars to the fault or whether the faulty feeder should carry the load current past the fault on to the sub-station. The author had impressed upon them the desirability of cutting down the amount of fault current by the insertion of a high earthing resistance in order to reduce the shock to the system. To whatever extent they reduced the fault current, to that same extent they made the apparatus unreliable and introduced the possibility of the wrong feeder being pulled out. In fact the system would be the more reliable the bigger the fault current which was allowed to flow. On the other hand, one great virtue of the author's overload interlocked arrangement was the fact that if a short circuit developed between phases on any feeder (or apparatus connected with any feeder) the faulty feeder was instantaneously cut off without waiting for any overload relay to operate. In a case where four parallel trunks ran between two generating stations, that was practically an interconnector consisting of four parallel trunks, he did not see why an arrangement consisting of a core-balancing transformer at each end of the four trunks operating in each case on an independent relay, supplemented by overload relays on each phase of each feeder in the ordinary way as a stand-by, should not be a quite satisfactory solution; it would be very simple because the feeders were already equipped with overload relays and the core-balancing transformers could be added round the feeders without introducing any further element of weakness. It appeared to him that where there were four feeders in parallel, no matter on what part of any of these feeders the fault might occur, there must always be three times the fault current through the sub-station relay on the faulty feeder that there was through the relays on any of the other three, which should sufficiently discriminate between them, the sub-station end of the faulty feeder only being pulled out. Directly this was done the generating station end would follow. Since the arrangement was absolutely reversible it did not matter which was the generating end and which was the sub-station end, the generating end at any instant being always understood to be the one from which energy was most likely to flow to the fault.

Mr. **Waters** described a new balancing relay system which permitted T connections to be made off one of two cables; he also described an automatic reverse-current device, with the aid of diagrams.

Mr. A. G. **Collis** said that the author used the term "instantaneous," but actually a relay took 0.4 second to operate, and the switch 0.6 second to open, making a total of one second; hence the circuit was not interrupted until an appreciable rise in the current took place. The author's reverse-current was 180 degrees out of phase; what would be the effect of a current 90 degrees out of phase? It was stated that fuses had no discriminating value, yet they were shown in one of the figures.

Mr. H. **Brazil** inquired as to the cost of the split-conductor cable, and the method of jointing such cables, and referred to the thickness of insulation between the two cores, which might be subjected to a pressure of 6,000-volts in the case of a fault on an 11,000-volt cable. He said it would be difficult to find a fault thus caused between the cores. Referring to overload devices on earthed feeders, which would require an earthing resistance to carry, say, 800 amperes, if a resistance with a negative characteristic were used it could be set at 300 amperes; if the cut-out did not act at once, the current would increase until it attained a sufficient value.

Mr. **Murphy** said that reverse-relays had been greatly improved and could be relied upon nowadays; the relay was pretty sure to act before the voltage dropped to zero. The use of reactances in the line gave reverse-relays a better chance to act satisfactorily. The circulating-current system was more complicated than the reverse-current relay, and introduced the risk of shut-down due to breakage of the instrument connections, a matter which was as serious as failure to operate. He described a device for protecting parallel feeders or ring mains in existing networks by using the combined effects of excess current and drop of voltage.

The **Author**, replying to the discussion, said that many engineers in the United States were beginning to pay attention to the design of relay systems. The balanced relay was not included in his summary of ideal systems, but had its uses. Where the Merz-Price system could not be employed, the systems described in the paper for protecting parallel feeders afforded the best protection. The system described by Mr. Waters only dealt with faults to earth. In reply to a question put by Mr. Collis, the core-balancing system cleared cable faults with the minimum risk of the arc coming outside the cable. The insulation between conductors was only "light" compared with the full insulation; Mr. Brazil was correct regarding the full star voltage occurring between the cores for a moment. His suggestion of an earthing resistance with a negative coefficient was interesting, but a few seconds was too long to wait. Mr. Murphy's device would require adjustment on site, and re-adjustment after any change in the circuits.

Discussion at Birmingham.

The discussion was opened by Mr. A. M. **Taylor**, who dwelt upon the advantages of the split-conductor system as compared with core-balancing systems. In continuing the discussion, Dr. **Garrard** pointed out that the Merz-Price system did not protect against bad synchronising but only safeguarded a system against faults to earth. The balanced relay was superior in this particular.

Mr. S. T. **Allen** said that the system under his management was not fitted with any other protective device except the usual inverse time characteristic overload devices. The system contained about twelve miles of E.H.T. feeders, and had operated without any failure or trouble for some years.

Mr. **Clough** said that he did not think it desirable to have overload devices on generators.

Mr. **Orsettich** objected to the tendency to elaborate protective devices. It was better to work in the direction of so simplifying the systems and machinery that they were robust enough to withstand the consequences of minor faults.

Mr. **Hollis** did not agree with the abuse showered on pilot cables, but thought they were quite satisfactory for many purposes.

Mr. **Groves** advocated that more attention should be given to the protection of bus-bars. The devices described in the paper looked after the cables, but left out the bus-bars.

In a written communication Mr. **Witcher** thought it desirable to emphasize the distinction between systems which operated on faults to earth and those which operated on faults between phases. He also expressed regret that the author of the paper had not developed the discussion of the split-conductor principle more along the lines of unequal splits.

Discussion at Manchester.

Mr. [illegible] agreed with the author's conclusions, with the exception of (*b*), which was open to argument because, as stated by the author, the core-balancing system appeared to depend on the possibility that the fault would be a fault to earth and not between phases. The recommendations of the author were based on technical grounds, and no comparison of cost was given; this was an element which could not be disregarded. The split-conductor system had some undoubted advantages over the Merz-Price system when dealing with overhead line protection. It was free from the difficulties inseparable from slinging up an insulated cable all along the route, also it was free from having the equivalent of an earthed conductor below the line which could be fouled in the event of a line breakdown. Moreover the split-conductor system had the advantage that on breaking a conductor, the relays would operate and render the overhead wires "dead" long before they could come within reach of the ground.

Mr. S. **Ferguson** said that there were certain systems where overload devices were used together with a 3-pole high-resistance earth, and if a fault occurred to earth the overload device was useless; for this reason the two things should be considered jointly. The time limit on leakage devices would appear to destroy some very important advantages of the balanced system, as it had always been said that one important feature of the system was its instantaneous action. Further, the balanced system of protection dealt with a current much less than on overload protection, and if a time limit were introduced, the fault current would be reduced. A remarkable thing about the author's conclusions was that overload did not figure at all, whereas for many years everybody had pinned their faith to overload devices. The system seemed good, but it depended upon the two conductors carrying equal current; if a fault occurred in a sub-station, the inequality was very small. Regarding the protection of open-ended feeder circuits, the balanced system was almost useless if the neutral was not earthed, except in very large systems such as Manchester with a considerable capacity current. Overload protection seemed absolutely necessary in addition to core-balancing. A useful combination which had proved satisfactory was to provide overload protection on two phases to protect against shorts, the remaining phase taking care of the out-of-balance current. The Merz-Price system was unquestionably the best for generators and transformers, although trouble might occur in lock-up sub-stations due to the relays operating on resuming supply after a shut-down.

Mr. A. E. McKenzie said that in Manchester ten sets of balanced protection gear had been installed without an earthed neutral, and as stated by Mr. Ferguson, the capacity current was quite sufficient to ensure the necessary operation. Unfortunately most stations had their high-tension feeders already laid with no provision for pilot wires for operating Merz-Price gear; in such cases the author's recommendations were to be thoroughly endorsed. He agreed with Mr. Ferguson in condemning time-limit devices on balanced protection, and cited a case where tremendous damage occurred on a feeder protected by overload protective gear with a one-second time limit. Balanced protective devices in series were unnecessary, as the number of faults on a properly-laid cable system did not warrant the expenditure. The Manchester Corporation system had over 150 miles of extra-high-tension cable, and the number of faults per annum was about six. The turbo-alternators and large generators at Stuart Street, Manchester, were protected by Merz-Price gear, fuses being placed in the secondary circuit so that these devices would blow only if a machine was kept on sustained short-circuit or if a fault developed on the machine windings causing current in excess of the normal short-circuit of the machine to be sent in from the other generators. It was therefore quite possible to protect machines against faults on windings or on the main switchboard. Regarding the interlocking of parallel feeders, he had not yet found a satisfactory reverse relay, and consequently where a number of feeders fed a sub-station, it had always been considered advisable to separate the high-tension bus-bars and run as many different sections as possible. The interlocking devices described in the paper were worthy of a trial. In the speaker's experience it had always been found advisable to have a small switch in the secondary circuit of the balanced protective gear, which could be opened temporarily whilst parallelling two feeders going to the same sub-station. No matter how quickly or accurately the switching was done, one phase made contact before the other, and the capacity current caused the relays to operate. His ideal protective gear for generators was Merz-Price balanced protection, with fuses in the secondary, and a device to cut off automatically the field immediately the main switch was opened. Referring to alternator protection, whilst the author's idea of a transformer in one phase was theoretically all right, it seemed more simple to place it on the neutral end of the winding which would probably be outside the casing. This arrangement had been decided upon for the protection of generators in the new Barton Station, Manchester, and consequently there would be no switch-gear between transformers and machines. The machine would generate at 6,500-volts and the transformers step up to 33,000 volts which would go directly through the switch to the main busbars. Merz-Price gear would be installed between the neutral of the outgoing switch and the extra-high-tension transformer. In the event of a fault occurring on either transformer or generator winding, the protective gear would open the main switch and cut the field off the generator. Transformers would be in duplicate so that in case of breakdown, a generating unit would not necessarily go out of commission. The split-conductor system seemed ideal for overhead construction. The speaker thoroughly endorsed the author's recommendations in paragraph (*b*) of his conclusions.

Mr. K. M. Faye Hansen said the core-balancing principle was excellent, but should be used in conjunction with an overload device. The biased protective relay was a thoroughly sound practical idea. The author's arrangement of protecting transformers and alternators in series by having two parallel circuits was interesting, and took care of the case where breakdown occurred between different parts of the same machine, which the ordinary Merz-Price arrangement would not protect against. Merz-Price gear should not be used alone for the protection of alternators. Regarding the split-conductor system, since the introduction of concentric cable, the risk of both conductors breaking down to earth was minimised, and the system should have a wide field.

Prof. E. Marchant said a very sound maxim was laid down some years ago by Mr. Merz to the effect that no protective device was worth putting in if it led to an increase of risk to the plant which it was designed to protect. The split-conductor system did not lend itself to any criticism from this point of view. If the insulation between the inner and outer conductors was very slight, and a breakdown to earth took place on the outer, it seemed probable that the inner conductor would earth and the split-conductor system would fail to protect. The same applied when two overhead lines were earthed simultaneously.

Mr. S. L. Pearce said that Manchester had an extensive experience of protective systems which could be summarised under four headings. First, any consumer's fault, however severe, should be cleared without upsetting the system. The same remark applied to the regular public supply sub-stations. Thirdly, the feeder at the main generating station should not be brought out except in the event of a fault to earth on any one of the three phases. Lastly, the main generators ought not to be brought off the main bus-bars through any fault on a feeder or on consuming devices, but only in the event of a fault on their own windings. Coupled with this last point was the precaution rightly emphasized by Mr. McKenzie. It was no use taking care to have the generator switched off the main bus-bars if the field was not cut off as quickly as possible. This applied particularly to the present type of machine with forced ventilation. Unless the field was cut off almost instantaneously, the destruction of the generator, whether on the bars or not, was bound to follow. Regarding the Merz-Price and the Merz-Hunter split-conductor systems, the speaker had no experience of the latter, but believed the initial difficulties had been overcome, and it should be the cheaper proposition of the two. The only question was that of jointing, and cable-makers would say that it was not applicable to all voltages and every size of cable decided upon. The only alternative was the Merz-Price. Having regard to the magnitude of the stake, he did not think the relative cost of protective systems ought to be considered. Regarding the protection of duplicate feeders, a new system known as the Ferranti-Waters system seemed to be making headway and was possibly a coming rival to the split-conductor system or the Merz-Price system.

The Author in reply said that contrary to the impression of certain speakers, he had stated that he recommended core-balancing devices with overload devices. Regarding instantaneous operation, it was quite practicable to make core-balancing apparatus work in 1/20th second including the time taken by the relay. The cost of the split-conductor system was at present comparable with the Merz-Price, and was bound to come down. Inherently the system was cheaper than the Merz-Price apparatus. Only in the case of the core-balancing leakage device had a time-limit been recommended. The leakage current on a system with the middle point earthed through resistance would represent only a temporary overload on the machine, and did not subject the system to severe shocks. If it was desired to discriminate between individual feeders and consumers' premises, the time-limit core-balancing device on the feeder in conjunction with instantaneous core-balancing devices on the consumers' premises would give the desired result. The split-contact switch was an innovation on purely commercial lines, the net cost of the switch, plus the relatively small transformers required, being much less than in the case of the solid control switch with relatively large transformers. The split-contact switch was not a necessity, but used a much simpler transformer with bar primary. The split-conductor system represented a considerable advance on the results obtainable with the Merz-Price system. It was generally recognised that with the latter on a large system, it was impossible to use settings below normal load current. The methods of attaining the balance in the split-conductor system were so fine that it would trip out on a few amperes and yet be balanced against dead short circuits on a very large system. There were many miles of overhead wire and cable operating on the split conductor system, and for forty faults successfully cleared there was only one failure, which was due to a bad joint and not to any deficiency in design. The automatic field switch referred to by Mr. McKenzie should be made dependent upon the combined action of the device which tripped the switch itself, that is to say, the field switch should not come out immediately the relay operated. On the other hand it should not come out immediately the switch opened, as in that case a machine could not be got off without shutting down. The operating current for core-balancing relays was about 10-amperes, and where a much smaller setting was required the current transformer was of very moderate dimensions. It was quite safe to employ very much less insulation between the two halves of the core than the general insulation of the conductor. At least one case had occurred where both cores were damaged by a pick and the operation of the protective device had not been hindered. The Ferranti-Waters system had introduced some novel and interesting features in relay design. The system actually appeared in the paper under the head of interlocked relays, overload and reverse-current relays and leakage relays. In the author's opinion, interlocked systems were the best methods of dealing with existing cables. In such cases conductors could not be split and frequently Merz-Price pilot wires could not be inserted.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Ironclad House-Service Set.

It has been the practice in the past in connecting up house service cables to the fuses, to provide a separate sealing trough and pair of ironclad fuses. The General Electric Co., Ltd., of Witton, Birmingham, have now introduced a self-contained ironclad cut-out set, consisting of a pair of 10-ampere porcelain clad Home Office type cut-outs mounted in a cast-iron case which forms part of the main casting of the sealing trough, this latter being split. Care has been taken to provide every facility for wiring up and fixing; no parts have to be removed for screwing to the board on which it is mounted, and the cable is taken straight from the sealing trough into the bottom terminals of the porcelain clad fuses. With the cover open it is impossible accidentally to touch any live part. Weighing 5 lb., and having overall dimensions of 9½ in. long × 5½ in. wide × 3¼ in. deep, the set is far more compact than the usual arrangement, and should find considerable use among supply authorities, especially as it is less costly than the older arrangement. It is available in both side and bottom entry patterns.

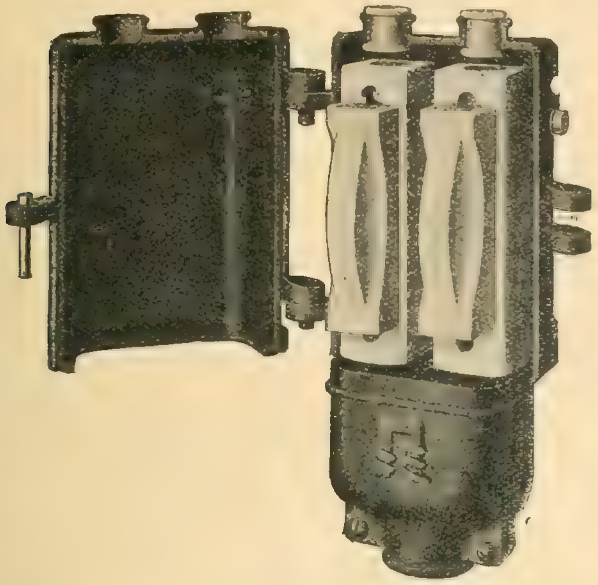


Fig. 1.—G.E.C. 10-Ampere Double Pole House-Service Cut-out Set, Open.

Indirect Lighting.

The British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C., have sent us their new "Eye-Rest" list No. 10 550, from which we note that the system has made such progress, that 40 pages are now required to hold particulars of the many new patterns and adaptations of this system of indirect lighting; whereas the list issued in 1912 described two types of fittings only, the new list contains particulars of about 50 different types. The system depends for its efficiency on X-ray reflectors, which are claimed to be the most efficient reflectors made; the coming of the Mazda "Half-Watt" lamp has naturally had a big effect on the use of "Eye Rest" lighting, and the new list illustrates and prices a complete range of fittings to accommodate these new lamps. A number of reproductions of "Eye-Rest" installations are shown, taken by the unaided light of the Mazda lamps. To meet the objection held by some people, that the light source cannot be seen, new types have been introduced with the lower half of the bowl made luminous by means of an auxiliary lamp of low candle-power; this translucent part of the bowl can be supplied in a number of pleasing colours. There is also a dining-room pendant type which is supplied to meet the need for the conventional silk shade fitting, with a small lamp and reflector to illuminate the table and silk shade.

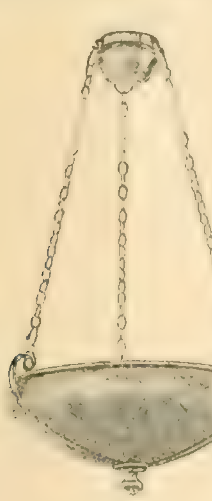


Fig. 2.—"Eye-Rest" Four-Light Fitting.

A special hospital fitting has been designed, with a glass cover, to keep out dust and reduce cleaning to a minimum. Another adaptation of the "Eye-Rest" system is its application in flambeau form, with from two to six flambeaux; an ingenious connection box for wiring forms part of the decoration.

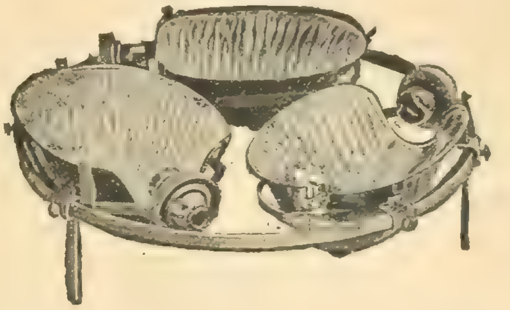


Fig. 3.—Arrangement of Three X-Ray Reflectors.

The system has been applied to portable standards, for floor or table use. There is also illustrated a very clever pull switch for fixing to "Eye-Rest" bowls containing a number of lamps, operated by a ball chain hanging from the centre. In some cases the fitting has to be lowered for cleaning, and a two-contact gear with a pulley is shown for this purpose. Illumination data with regard to "Eye-Rest" lighting are given, and there are tables showing the watts per sq. ft. for different classes of installations, and the length of drop required for various sizes of rooms, according to which particular type of X-ray reflector is used.

We illustrate, in fig. 2, a four-light fitting, and in fig. 3 the internal arrangement of the reflectors of a three-light fitting.

The County Lantern.

We have received from the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., particulars of the County half-watt street lighting lantern. This is provided with a Holophane globe and the distribution curve, fig. 4, taken with a 200-watt Osram half-watt lamp, gives a remarkably wide angle of illumination.

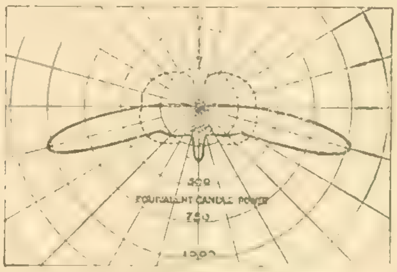


Fig. 4.—Distribution Curve, County Lantern.

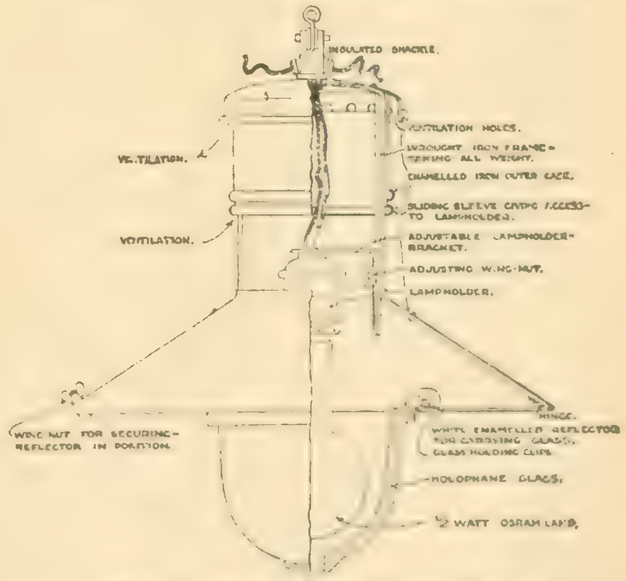

INSULATED SHACKLE.
VENTILATION HOLES.
VENTILATION.
WROUGHT IRON FRAME TAKING ALL WEIGHT.
ENAMELLED IRON OUTER CASE.
SLIDING SLEEVE GIVING ACCESS TO LAMPHOLDER.
VENTILATION.
ADJUSTABLE LAMPHOLDER BRACKET.
ADJUSTING WING-NUT.
LAMPHOLDER.
HINGE.
WING NUT FOR SECURING REFLECTOR IN POSITION.
WHITE ENAMELLED REFLECTOR FOR CARRYING GLASS.
GLASS HOLDING CLIPS.
HOLOPHANE GLASS.
½ WATT OSRAM LAMP.

Fig. 5.—Sectional View, County Lantern.

Two interesting features are a sliding sleeve, giving free access to the lampholder, and an adjustable bracket to which the holder is attached, enabling perfect accuracy of focusing to be obtained these points are clearly shown in fig. 5.

The lantern is finished in either vitreous enamelled or stove Japanned iron.

We may remind our readers that the company has an illuminating engineering department, specially to advise on the carrying out of illumination schemes of all kinds.

LEGAL.

WORKMEN'S COMPENSATION.

ON January 6th, in the West London County Court, application was made to his Honour, Sir W. Lucius Selfe, sitting with the Medical Referee, for an award under the Workmen's Compensation Act in favour of W. H. Daniell, living with his parents at 21, Glenrose Street, Fulham, an apprentice with Messrs. Marryatt and Macnaught, Ltd., electrical engineers, Askew Works, Shepherd's Bush, who were respondents. On behalf of the latter, Mr. W. Shakespeare, barrister, submitted that the injury on which the applicant relied did not arise out of his employment.

The facts stated were that on the 18th May last, Daniells went into the employ of the company at 4s. 6d. a week. He worked on till June 6th, when one of the other apprentices was showing him what a lathe was used for. To illustrate this he fastened a spanner in the chuck and then turned the belt on to the driving pulley. This was running at 1,400 revolutions per minute, and the result was that the spanner flew out and struck Daniells in the left eye, which was completely destroyed. Applicant gave evidence to this effect, and in cross-examination stated that he was not aware of the rule in the works that he should not speak to others while at work, and that when he wanted to know anything he should ask the manager or the foreman. Brooks, an apprentice working on a lathe next to Daniells, said that he frequently showed applicant the working of the lathe. To show him that only round articles could be turned in the lathe, he put in a spanner and fixed it in the clutch. Then he switched on the belt, which he thought was on the slow pulley, but it was in fact at top speed—1,400 revolutions a minute. The spanner flew out and caught Daniells in the left eye. His Honour held that the boy had been hurt while in the course of his employment, and seeing that the medical referee stated that he was again fit for work, awarded him 4s. 4d. per week from June 6th till date, with costs.

PLUTTE, SCHEELE & CO., LTD., v. HUDSON, SHEED & TOWELL, LTD.

IN the City of London Court, on Friday, Messrs Plutte, Scheele and Co., Ltd., electrical accessories manufacturers, 18-19, Queenhithe, sought to recover £4 12s. 4d. for electrical accessories supplied to Messrs. Hudson, Sheed & Towell, Ltd., art metal workers, 9, Newman Street, Oxford Street.

MR PEARCE, plaintiffs' solicitor, said that the defendants admitted owing the debt; but they would not pay it on the ground that plaintiffs were alien enemies. Plaintiff company was registered in England and carried on business in London. That was sufficient to enable the plaintiffs to recover.

Defendants' representative told the Court that the plaintiffs were alien enemies, and for that reason they did not want to pay the money to anyone who was fighting the country.

JUDGE RENTOUL: That is most patriotic.

MR. PEARCE observed that the money would be paid to Englishmen. The majority of the shareholders were naturalised Englishmen.

MR. JONES, plaintiffs' sales manager, said there were four or five shareholders. The plaintiffs were before the Court in August, when the Court ordered money to be released in their favour in other litigation.

Defendants' representative added that the goods were supplied in June and July. At Somerset House they found that Alexander Plutte and his wife held £4,765 shares and F. Plutte held £845. Both the Pluttes had gone to Germany to fight England.

MR. JONES said that E. Plutte had left the country, but F. Plutte, the founder of the company, was a naturalised British subject and was in London.

JUDGE RENTOUL: Naturalised!

MR. PEARCE said that the plaintiffs would undertake not to part with the money to Germans.

Defendants' representative said that the two Germans who had fled the country were both directors of the company as well as shareholders.

JUDGE RENTOUL: They will do no harm now that they are away.

Defendants' representative: But they remain shareholders.

JUDGE RENTOUL: His Majesty has a first cousin, and we do not know how things are mixed up. There must be judgment for the plaintiffs with costs.

A MOTOR-CYCLIST'S CLAIM.

INTIMATION has been made in the Court of Session of the settlement of the action by a Glasgow manufacturer, against the British Thomson-Houston Co., Ltd, Glasgow, and the District Committee of the Middle Ward of Lanarkshire, for £500. Pursuer, while riding a motor-cycle, ran into a heap of road metal and tarmacadam and sustained serious injuries. The British Thomson-Houston Co., Ltd., were laying a tramway in the neighbourhood. Pursuer has accepted a tender of £300 and expenses.

DOUGLAS v. PELICAN.

IN the Shoreditch County Court, last week, before his Honour Judge Cluer, Benjamin Douglas, of Hackney, an electrician and decorator, sued Harry Pelican, of Stratford, to recover £6 for work done and wages. Plaintiff's case was that he had electrical work, &c., to do, to the amount of £13, and had received £9. He claimed the balance of £4 and £2 for a week's work at Stratford. When he asked for his money, he got a complaint that the work at Stratford was not carried out properly, but that was untrue. He was laid up for a week after working at Stratford, and when he returned he was refused employment. It was the electric light wiring that he was told was complained of. It was untrue, he said, that a Borough Council inspector came to the place and condemned the work, because it was not covered with insulated tubing in accordance with the Board of Trade regulations. Plaintiff said he had asked the defendant for more tubing, but was refused it on the ground that he had sufficient. It was true that an account was opened in his name with a firm for the supply of tubing by the defendant, but he denied that he could have ordered what he liked. Plaintiff positively denied that he saw the officer of the West Ham Council more than once, and then no complaint was made as to the work. Since that time he had done other work which had been passed by the Council officer. The officer never said anything about it being dangerous to life and limb, or that it would have to be covered with Simplex tubing. The defence was that the work had not been carried out properly, and would cost a lot to put right. Judge Cluer upheld that view, and gave a verdict for the defendant with costs.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27 "Electrolysis." F. W. GAUNTLETT. January 1st.

55. "Apparatus for supplying alternating current from a direct-current electric battery." E. C. IRVING & S. L. GLENN. January 1st.

58. "Means for the electrical transmission and distant control of movements, specially applicable to systems for signalling orders and the like." E. A. GRAHAM & W. J. RICKETS. January 1st. (Addition to 6,214/14.) (Complete.)

81. "Electric couplings." J. S. HECHT. January 2nd.

82. "Electric-current modulators, more particularly for microphones, electric vibrators, and the like. F. MORANO. January 2nd. (Complete.)

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23,897. HOT PLATES AND THE LIKE ELECTRICAL HEATING DEVICES. G. Cooper. October 22nd.

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THE
ELECTRICAL REVIEW.

Vol. LXXVI. JANUARY 22, 1915. No. 1,939.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: January 22, 1915. [No. 1,939.

Page
Cab-Signalling at the "Mechanicals" ... 97
Lead ... 98
Preferential Terms... 99
Russia and German Firms ... 99
Syndication Methods in Germany ... 99
Labour Problems: Past, Present and Future ... 100
Russian Electrical Affairs: German Influence in the Past ... 101
Electric Lighting Authorities and the Law of Rating ... 102
The N.S.W. Government Power Station (*illus.*) ... 103
Correspondence—
  A.C. *v.* D.C. for Lighting ... 105
  Garage Heating ... 105
  Wireless and Warfare ... 105
  Wonderful Accumulator Cells ... 105
  Salaries of Junior Engineers ... 105
  Preferential Terms for Arc Lights for Photo Printing ... 106
  Advertising and Character ... 106
  Jower's Protective Leakage Device ... 106
  Stray Magnetism from Tramway Feeders... 107
War Items ... 107
New Electrical Devices, Fittings and Plant (*illus.*) ... 108
The Magnetisation of Iron, by J. S. Nicholson (*illus.*) ... 119
Business Notes ... 111
Notes ... 116
City Notes ... 119
Stocks and Shares ... 119
Market Quotations ... 120
The National Electrical Code and British Wiring Rules Compared, by F. Broadbent ... 121
The Case for the Electrification of Flour Mills, by E. P. Hollis 123
Cab Signals on British Railways, by V. L. Raven (*illus.*) ... 125
Legal ... 127
The Hardening of Metals... 128
New Patents Applied For, 1915 ... 128
Abstracts of Published Specifications ... 128
Contractors' Column ... Advertisement page xviii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

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TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

1915 EDITION
IN PREPARATION.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

CAB-SIGNALLING AT THE "MECHANICALS."

THE strongest impression brought away by one visitor to the discussion on "Cab-Signalling" at the Institution of Mechanical Engineers on the 18th of last month, was regret at what seemed to be the missing of a great opportunity in what is, undoubtedly, a crisis in the agitation for the provision of this method of signalling as an additional safeguard to railway operation; and candour forces the confession that this regret is justified by a perusal of the discussion as it appears in the pages of the *Journal.*

It is well known that the Board of Trade Inspectors recently recommended the Board of Trade to call upon the railway companies to carry out experiments with different systems of cab-signalling and automatic control, with a view to the selection of some such method suitable for universal adoption, and they added that they held "that some system of this description should be generally adopted in the future." It is also an open secret that a Committee is now considering the question of cab-signalling, together with other matters relating to railway operation.

This being the case, it might have been thought that the opportunity provided by the Institution of Mechanical Engineers would have been seized upon to thrash out the requirements of such systems. Five papers were presented, which were divided by one of the speakers into three divisions—two dealing with the subject theoretically, two dealing with practical systems, and one outside the scope of cab-signalling proper. Leaving the last paper out of account, the two theoretical papers may be dismissed by saying that they put forward nothing that was new or useful, and that they smelled more of the lamp than the footplate.

The papers described as practical dealt with two well-known systems—practically the only two designs which have any chance of adoption in this country—the differences between which are such as to indicate clearly two distinct schools. Moreover, this was the first occasion on which they had been put forward for consideration together. In the one system the designers seem to say: We will advise the driver of the position of the distant signal as he approaches it, and, further, if the signal is "on" we will apply the brake, to a certain extent, for him; we will not give him any further information whilst he is passing forward under the control of signals, and we will leave him in complete control of the indications he receives and of the brake after its automatic application. In the other system the designer seems to say: I will provide an automatic indication at some point before the driver reaches the distant signal, so that the driver may have his attention drawn to the fact that he is passing into a signal-controlled area, and give him an opportunity to look specially for the line signal if the conditions are such as to obscure it; at the distant I will further advise him of the positions (collectively) of the "stop" signals, and if they are "off," and their position is at a diverging junction, I will advise him which road, at the junction, is prepared. I will further arrange to keep control of the train throughout the signal-controlled area, so that he shall not be compelled to rely only upon his vision for further necessary indications after passing the distant. The apparatus shall be capable of giving a "line clear" indication between the distant and the home (combined with route indications), and emergency "danger" indications at that point and at all the "stop" signals. The apparatus shall show a danger indication when the engine is standing at a "stop" signal at danger and will be capable of receiving an "off" or a "calling-on" signal, as the case may be, at the home signal, and the latter indication shall continue to show its cautionary character after passing the home and up to the advance. Both the "off" and "calling-on" indications at the home will be combined with the appropriate route indications at a diverging junction. Lastly, I will give an "off" indication at the advance, and this indication shall be independent of any indications given behind the home signal. In the indications thus provided for there is not more than is now provided by accurate interpretation of the line signals.

Such, roughly, is a comparison of the results apparently aimed at under the two schools of thought, and which might have been expected to furnish the basis of a useful and instructive discussion which would have given a much needed lead to the Committee considering the subject with a view to legislation, or the issue of directive orders to the railway companies. Notwithstanding the memorandum to which reference has already been made, it is not likely that the Board of Trade will endorse the "selecting of some such method suitable for universal adoption." It is not likely that a selection of *any* system will be made. That would be for the Government to depart from all tradition, and English Governments are largely guided by precedent. To select a system for "universal adoption" is to discount all future invention, and the Government has wisely, in the past, left railways free to use whatever apparatus they please provided that they achieve the results demanded. This is shown conclusively by the many types of block telegraph apparatus in use. But a Government can say what results *must* be obtained; *how* the results are obtained is not material except to those who have to produce them. It was the opportunity to give the Government the considered reasonings of those who favoured one set of results or the other which was missed during the discussion.

Instead of a useful discussion on lines such as are here suggested, one found that individualism and the desire to *score* were rampant, and for the most part, the remarks made seemed to have no reference whatever to the effects desired for the guidance of the man on the footplate. Instead, there was a good deal of "fencing," a good deal of hesitation and a good deal of what is too difficult to describe in writing. One gentleman, whilst avowing himself an advocate of cab-signalling, was chiefly concerned to find objections to it. Another gentleman had been until recently of the opinion that only one system—the Great Western—was worth looking at, but whilst he now seemed deeply impressed with an inductive signalling method, his remarks did not disclose any whole-hearted belief in its entire effectiveness, and he went on to suggest that the present outdoor visual signals, "the very first thing devised," were really the best. Another thought the driver might be tempted improperly to use a switch, and on that point the author of one of the papers agreed with him, forgetting, apparently, that the same thing could be done with the apparatus he had described. The question was asked whether cab-signalling enabled trains to run to time in foggy weather (in a discussion dealing with safety of running). One of the authors described the "astonishment" at Paddington when several trains arrived to time during a fog, after the apparatus had been installed (the installation covered a distance of about 30 miles.) Another gentleman was anxious to tell the meeting that the railway with which he was connected was experimenting with audible cab-signals, and had actually been able to—dispense with a battery on the engine.

And so the discussion went on. Visual signals were inadmissible, because they took the attention of the driver off the line, which might be encumbered with platelayers' trolleys, cattle and other wild fowl which are so plainly visible to a driver at night time: cab-signalling would not prevent mistakes by signalmen: with the —— system the driver was not told that the signal was at danger when it was at "all right." Consider the criticism and answer in connection with the Great Western Co.'s system:—". . . . he noticed from the description of the apparatus that the *signal* was held up at '*line clear*' by the local battery situated on the engine. When the engine passed over the ramp, the circuit was broken and the *signal dropped* to danger. If the ramp were energised it picked up another current and received the 'line clear' signal *again*. It would be seen that the armature must be rather light, otherwise a very big battery was required or the armature would drop off through the shaking of the *train*. He concluded that the construction was of a rather *light character*. If that was so, the parts might stick either through corrosion or the presence of oil, or something similar. In that case, the switch would not give the danger signal. Another point was that, although brass pegs were probably provided to hold the armature off, there was such a thing as residual magnetism, and that might hold it up." (The italics are ours.) This is a criticism made after eight or nine years' use. The answer to this criticism is short. ". . . had referred to the power of the accumulator on the engine to *lift* the *heavy* armature. It was a 4-volt accumulator, and it would be seen from Plate 1 that the armature was, at any rate, robust enough to do its work." And, after all, the armature is replaced by hand.

Much more of the same character might be brought forward to show in what way so important a privilege as that given by the Institution of Mechanical Engineers for the discussion of a "live" subject has been misused, but enough is as good as more. Will any other institution provide a similar opportunity where the *essentials* may be thrashed out?

Lead. The lead market has had a more subdued appearance during the last week or so owing to a certain extent to the lessened activity of buying on behalf of Russia, but also in some degree to a more accommodating attitude on the part of the larger producers in the United States. There is not the smallest doubt that the publication of the official returns of United States output took the market across the Atlantic completely by surprise, showing as they did an increase of about 100,000 tons in 1914 compared with 1913. Nothing like this had been expected by even the most bearishly-inclined people, and the issuing of the figures gave an almost immediate stimulus to the selling movement. Prices have not really weakened very much, but the tone has suffered to a minor extent. The future depends to an unusual degree upon the attitude to be taken up and maintained by the Americans.

If production in the United States is to be kept up to anything like the recent level, then certainly for a pretty long time to come the trade can do without the Mexican supply, the cutting off of which owing to revolution upon revolution has from time to time given rise to the greatest anxiety. Under all the conditions ruling now it is at least probable that we shall continue to receive a fairly liberal quantum of lead from the United States, while according to the indications we should be receiving more and more metal from Australia as the months roll by. Things at Broken Hill should tend to settle down by degrees, and the necessity of keeping labour employed cannot be overlooked. As it is, we can do without any lead from Mexico for the present, any deficiency being made up fully from other quarters.

An encouraging feature is the way in which demands have been kept up in spite of the war. A good deal of metal is naturally demanded for war purposes, but apart from this there is a steady demand from all branches of the consuming trades, and this shows no sign of relaxing. Indeed, the makers of oxide and carbonate have of late been talking in quite encouraging fashion of the rate at which they were meeting with inquiries, and these look like going on.

The activity in the shipbuilding yards is a highly important consideration in this respect, and the possibilities are worth considering. The consensus of opinion regarding the outlook is that there will not be any great alteration in current prices. These are quite high enough at present to encourage producers to keep a full working staff busy, while, on the other hand, lead, compared with some other of the commercial metals, appears to stand at a comparatively attractive level.

The following statistics are interesting at this juncture, showing as they do the imports of lead into the United Kingdom over a series of years :—

1905	229,541 tons.	1910	218,936 tons.
1906	208 253 „	1911	213,704 „
1907	204,695 „	1912	205,375 „
1908	237,508 „	1913	204,136 „
1909	207,660 „	1914	224,194 „

Preferential Terms.

Mr. H. Faraday Proctor's statement regarding the use of arc lamps for photo-printing, published in our last issue, and Mr. Frank Broadbent's comment thereon in our "Correspondence" columns to-day, both touch upon a very interesting question, but both are open to criticism. In the first place, Mr. Proctor deals with the legality of charging for this class of lighting as if it were power. But we submit that the question of legality does not come in at all. So long as the same terms are offered to all consumers of the same class, no illegal preference is given. Even if electricity for photo-printing were sold at lighting rates, it would not follow in the least that luminous radiators would have to be classed as lighting also.

Again, Mr. Broadbent considers it to be generally understood that "electricity used for trade purposes," and not for illumination, should get preferential treatment. But no consumer, of whatever class, should get preferential treatment. Special rates may properly be given for specified classes of use—but not preferential rates.

Mr. Proctor says that the ultimate purpose for which energy is used must be taken into consideration; Mr. Broadbent traverses this statement, and in his last paragraph gets very near to the true root of the matter—namely, the fact that the whole thing depends upon whether the demand occurs during the "peak-load" period or not. Nothing else matters.

Whether the electrical energy is used for lighting, heating, motive power, photo-printing, charging batteries, or driving motor-generators is absolutely no concern of the supply engineer's; all that he need consider is whether the demand under consideration necessitates, or is likely to necessitate, an addition to his capital costs by increasing the maximum load upon his plant, and he should regulate his charges accordingly. Granted that it is impossible in practice to carry out this principle absolutely—just as it is impossible to achieve perfection in any pursuit whatever—the aim of the supply engineer is to approach the ideal as closely as is commercially and practically feasible.

Some day the peak will become of relatively little importance—progress is constantly tending in that direction, with the increased efficiency of lighting appliances and the multiplication of off-peak demands; and when that day comes an all-round flat rate will be in order. May it be soon!

Russia and German Firms.

The question whether Russia can dispense with the assistance of foreign firms is engaging the attention of the leading newspapers in Petrograd, with special reference to German optical glasses, aniline dyes, and electrical engineering work. According to a communication obviously made by a German to a Frankfort newspaper, electrical engineering was introduced into Russia by Teutonic firms, although the part played by Belgium and one United States company is naturally overlooked. But when the correspondent asserts that the Russian authorities have closed the electricity supply works in Petrograd, Moscow and Warsaw, and that these cities are almost enshrouded in darkness, he is certainly taxing the credulity of his readers, especially as the Swiss Ambassador had no such complaint to make when having an interview, almost simultaneously with the date of the communication, with the Russian Minister for Foreign Affairs in connection with the extensive Swiss holding of capital in the Russian Electric Lighting Co. of 1886, which owns the leading supply works in the three cities concerned. Not only so, but the general interests of the three towns would be opposed to the closing of the stations, which are merely to be, or have been, placed under compulsory administration, as in the case of the German electrical manufacturing works, unless the documents to be produced by the Swiss Minister prove conclusively that the majority control of the capital in question is now held by Swiss financiers and French capitalists, the latter of whom are said to have acquired their interests from German holders some time ago. The correspondent of the Frankfort newspaper proceeds to quote a Petrograd professor as having declared that the electrical manufactures now procured from Sweden by Russia are not of Swedish origin, but of German construction, and that their purchase consequently only serves to enrich the enemy which has hitherto exported to Russia electrical manufactures of the value of £2,000,000 per annum, and has received from Russia a further sum of £3,000,000 per annum as the earnings of supply works in Russia. The first-mentioned amount may be correct, but the latter appears to be an exaggeration, unless it also includes the income derived likewise by Belgian and French interests, and the earnings of the Teutonic manufacturing companies in Russia. At any rate, the fact that the Russians are discussing the situation so as to become, if possible, independent of Germany in the future, affords confirmation of our recent remarks on the subject, and it should assist in the development of business relations between Russia and her Allies.

Syndication Methods in Germany.

A recently issued report by Sir Francis Oppenheimer, H.M. Commercial Attaché in Germany, contains a store of information relative to the organisaton and methods adopted by German manufacturers in their quest for world trade. A study of this report, to which we shall refer more fully in a later issue, will indicate which of these methods might be emulated generally and, in particular, turned to advantage in our own electrical trade.

A striking picture is drawn of the height to which concentration of interests has attained. Not merely do we find a combination of manufacturers of certain finished articles gathering into the fold all the concerns who supply them with their partly-finished or raw products, but we also find producers of raw materials acquiring the factories which utilise them. It is admitted that the control of production and sales by this syndication method has prospered more in connection with unfinished products than in connection with finished products. Sir Francis Oppenheimer suggests that such elaborate concentration as obtains in Germany could not succeed save under a system of tariff protection for the home market. Surely, however, a sufficient measure of success has attended various combines—*e.g.*, salt, soap and chemicals—to warrant our engineering trades in trying more co-operative methods. In Germany syndication has made the home trade predominantly lucrative; it is true that the resultant over-production has forced the finding of export outlets even at poorly remunerative prices; but the fact remains that a big export trade has been secured. Without syndication it is doubtful whether preferential export rates could have been obtained from railways and shipping companies, and whether support for commerce could have been enlisted so freely from diplomatic and financial circles. Sir F. Oppenheimer mentions that a big Rhenish-Westphalian combination came to the assistance of the actual banks to which it had originally owed its own phenomenal rise. Such intimate relationship between manufacturers and financiers seems very far from fruition in this country.

Granted that there are various lines of electrical manufacture which can be profitably extended here now that Germany is otherwise occupied, little advantage will be gained by individual British concerns spending money on investigation, perhaps laying down fresh plant, and then engaging in as much price-cutting amongst themselves as used to take place between the nations. But if a joint investigation could be carried out, existing selling organisations utilised co-operatively, and the resulting orders allotted, according to their nature, to those manufacturers best laid out for executing them, then the venture would stand an excellent chance of developing profitably and permanently.

LABOUR PROBLEMS: PAST, PRESENT AND FUTURE.

As we have already stated in some of our comments on industrial questions as affected by the state of war, what we are accustomed to describe as Labour Problems are being considered in an entirely different atmosphere—indeed, some of them are problems no longer, they have automatically solved themselves under the stress of circumstances, and in presence of a noble spirit of patriotism. In all likelihood some of the old controversies and differences which, but a short time ago, loomed so largely in the industrial outlook, and seemed to employer and to social reformer alike matters of prime concern, will not be reproduced, at any rate in the near future and under similar conditions. Politicians all would be well advised to adopt the advice given to the Liberal Party by Lord Rosebery in a famous Chesterfield speech, and start again as far as practicable with a "clean slate." We are far from suggesting that all the old grievances are going to be swept away by this terrible war, but we do suggest that they may be relegated to a position of minor importance in presence of the subjects of far greater national consequence which must inevitably occupy all of our minds for many years to come, and that they will come nearer to a common-interest basis of settlement in presence of the more sympathetic and united spirit which is fairly generally prevalent in these days.

While it is perfectly true, however, that some matters are in a state of suspense, and will remain so, it must also be recognised that the war has itself, by its simultaneous demands upon Labour, calling men to arms, and upon industry, clamouring for material of all kinds from thousands of factories, brought certain problems of the familiar class very urgently before our minds, and has created a number of new ones of an engrossing character. The best illustration of this is to be found in the most interesting report which was recently issued by the Departmental Committee which, at the instigation of the Local Government Board, investigated the new and unprecedented question of what employment could be found for the Belgian refugees who had sought shelter in these islands. All the civilised world was placed under an everlasting debt of gratitude to our Belgian Allies for their heroic defence of their country in presence of overwhelming and barbarous forces. All that has been done, and all the gifts that have poured in, could not adequately meet the necessities of their terrible condition. To find money, food and shelter has occasioned much difficulty, calling for scheming and contriving, but all of this has been done in a large-hearted way, and, we believe, to the best of our ability, without infringing any of our formerly accepted internal policies. It is when we get down to the problem of giving employment to our distressed Allies that we are perhaps likely to encounter the greater difficulty, for the permanent interests of the workers of the United Kingdom must not be adversely affected by the measures taken to cope with a particular and temporary emergency. The State has called workers to the Colours, employers have made either them or their families generous allowances, other employés are required to take their places. Under what conditions and at what wage shall Belgian refugees be permitted to take these situations? Everybody will agree that it is a thing not to be thought of that workers now with the forces shall find when they return to resume their avocations that wages have been reduced or the conditions worsened, or that their places at the bench and so forth have been filled by others not of British nationality. With this necessity for affording Protection to British Labour prominently in view the Departmental Committee has considered the whole question of Belgian employment. Happily at the present time there is such a feverish activity at the majority of the factories that there should be little difficulty in absorbing all suitable classes of Belgian Labour available at the same rates of pay as British workers are receiving. It may happen at a later stage, when we lay ourselves out to deal with the requirements of specialised industries established to supersede German imports, that other considerations on this skilled labour question will have to enter into our deliberations, but now we have to deal with immediate needs and with immediately available Allied labour. We believe that wherever Belgians have been at work in English factories latterly, the same spirit of sympathy and co-operation observed in Flanders has been present—each Englishman recognises that he owes to some extent the present security of his own family and home to the kith and kin of those beside whom he works. Under such circumstances the British workman shows that at heart he is not such a bad fellow, and no one desires that old industrial disputes shall be reopened, if they can be avoided, because of the conditions consequent upon the present emergency.

As the President of the Local Government Board has appointed a Commission to put into execution the recommendations of the Departmental Committee, some reference to those recommendations is called for. It goes without saying that no fit and unmarried Belgian between the ages of 18 and 30 should be given employment, their Government having expressed the desire that they should render military service. The Committee lays down two main principles:—

(1) That no Belgian labour should be employed until every reasonable effort had been made to find British labour through the agency of the Labour Exchanges.

(2) That no Belgian should be employed at rates of wages lower, or on conditions less favourable, than those generally observed in the district.

The refugees have been classified in three main groups as to their occupations, the first comprising workers qualified to fill vacancies in industries in which a shortage of British labour exists, such as armament workers, glass-blowers, miners, motor mechanics, &c. It is believed that the majority of those in this group have already found employment, or will find little difficulty in so doing. For professional men, clerks, musicians, lawyers, &c., there are no openings, though for tillers of the soil and other workers in agriculture opportunities will be numerous in the coming months. In the case of qualified workers for whom there is no employment offering, it is proposed that they shall make clothes, furniture, and household goods to take back to Belgium when the invader has effectively been driven out and the land is at rest again. The Committee expresses the fear that in some instances refugees have been employed on unsatisfactory terms and conditions, which circumstance is not calculated to engender good relations with Trade Unions which have subscribed towards the Belgian relief measures. It is proposed that in all Government contracts it shall be made a condition that Belgian labour shall only be employed through the Labour Exchanges, and that a like principle shall be followed both by the railways and mining authorities of the United Kingdom.

Further, Government Inspectors are to impress upon employers the fact that the employment of Belgian refugees at rates of wages and under conditions other than those prevailing for British labour, is contrary to the Committee's regulations.

We believe that the Committee has handled a matter of great difficulty with considerable ability, showing full sympathy for our distressed Allies, and appropriate foresight in regard to British interests.

From various sources we learn of the shortage of general labour. The congestion at the docks in London is in part due to this circumstance, but early relief is very necessary, and it is a pity that we cannot commandeer the services of the loafer, carrying into practice the healthy principle that if a man will not labour, neither shall he eat—or drink. It is also deplorable that the Port of London Authority should have such poor facilities for transferring labour from point to point as it becomes available.

In the matter of skilled labour, however, the difficulty is far greater, and the necessities of the situation in engineering works engaged upon Government orders have, according to an article by the *Times* Sheffield correspondent, led the Amalgamated Society of Engineers, "perhaps the most exclusive among Trade Unions," to "relax its guard and permit untrained, or partially untrained, labour to be employed upon semi-skilled work." The writer states that "of 17,500 Trade Unionists engaged in the construction of steam engines, there are at present only 10 drawing out-of-work pay." We read in another contemporary that an official report shows that employment could be found for over 15,000 workers of various grades in the engineering industry of the country. It is most gratifying to read of the co-operative spirit that prevails between the A.S.E. and the Federation of Engineering Trades Employers in face of our common danger, and if in more peaceful times they can only be brought to regard labour disaffection as an enemy common to both sides, which should be tackled in a reasonable spirit, the hopes for the future of engineering industry and employment may be allowed to run high. Conferences have been held between the A.S.E. and the Employers' Federation, under which the agreement between them relating to unskilled labour shall be waived, in order to assist in the speedy execution of Government contracts for war material. The men have stipulated that several conditions shall attach to the use of unskilled labour for semi-skilled work, and they demand that wages proportionate to the work shall be paid, and that the arrangement shall end when the pressure ceases, their intention being to adopt every means in their power to preserve the province of the skilled man. We believe that the reasonableness of these stipulations will be conceded by the employers, and though perhaps the spirit of the old Trade Union Adam seems to show itself just a little bit, this is no more than is to be expected. Nobody will desire labour, especially skilled labour, which is rendering such magnificent service to the country at this time of crisis, to be placed at a disadvantage after the war. But if there is partly skilled labour available, it would appear ridiculous for requirements to be delayed because Unionists, in the interests of their *confrères*, imposed anti-national restrictions.

We cannot but deplore the trouble that has broken out among the miners of West Yorkshire at a time when their number is seriously depleted by the war, and when the textile factories are utilising fuel and power practically continuously. The peacemakers are at work, and we wish them speedy success. Without attempting to enter into the details of this latest development of minimum-wage controversy, we hope that both sides will fully recognise that the times are not normal, and that national needs demand concessions or compromise, so that peace at home may remain unbroken, allowing everybody to continue to help the Allies in their struggle with the enemy.

The whole question of labour will probably take on an altogether new aspect after the war is finished. In some respects the position of Labour may be strengthened, but we believe also that lessons have been learned by the rank-and-file. We do not want "cheap" labour in England, but somehow the cost of production has got to be lessened in respect of many manufactures by the time when German competition resumes. In absence of information as to when that may be; not knowing how many more men may yet have to be called away from their accustomed occupations; with some uncertainty as to the outlook for industry and trade, and with an almost certain depletion of the resources of skilled labour now in uniform, one can only hint at the prospect of the approach of new problems of labour in place of the old.

RUSSIAN ELECTRICAL AFFAIRS: GERMAN INFLUENCE IN THE PAST.

We learn from a Petrograd paper that at a recent meeting of electrical engineers held in the Electrotechnical Institute of Alexander III, a discussion took place in the course of which M. Dmitrieff spoke at length on the foreign element in Russia's electrical industries. He said that Russia had a total of 137 central stations. Of these 80 belonged to municipalities and served 5,000,000 citizens, and 57 were concessions and served 9,488,000 citizens; that was to say, that although the concession stations were so many less than the municipal stations they served twice the number of citizens. The concessionaires had become the rulers of the most industrial and most densely-populated districts. The district stations in Russia controlled great industrial areas. For example, the 1886 Electrical Co., with its station at Moscow, controlled the Bogorod industrial region; with its Petrograd station it controlled the Petrograd district, and with the Lodz station the town of Lodz. The speaker pointed out the industrial, economic, and even political dangers of such control, and advocated co-operation as the proper basis for such enterprises, particularly on behalf of the groups of small capitalists who cannot afford to install independent plants for their separate use.

M. A. A. Kuznetzoff, referring to the importation of electrical materials from abroad, said that for some weeks after the outbreak of the war there was a great shortage of small electrical goods, whilst large goods could not be had at all. Stations the construction of which had been begun remained without machines. Only a few parts were to be had; the remainder were to be found somewhere, say Nurnberg, &c. All had become dearer in price. It had become necessary to apply to England and Sweden for what must be had. It appeared that Sweden, taking advantage of the products of German industry, had established, after two months of the war, a large electrotechnical industry. On a detailed and a careful examination of the goods imported from Sweden, judged by their type and construction, they are all from Germany, only without German marks. Thus, complained the speaker, "we are supporting Germany with our money." Two-thirds or three-quarters of the total importations must be ascribed to Germany.

All imported goods may be divided into three groups:—(1) Goods the importation of which fluctuates for various reasons, *e.g.*, wire. (2) Goods that have to stand a fair protective duty, or that are protected by the telegraphs or telephones; the importation of such goods into Russia is small. (3) Goods the importation of which into Russia is continuously growing, *e.g.*, electric lamps.

In the main, the production of electrical goods has been concentrated in large specialised factories. These are the following: The Russian General Electrical Co., original capital 12,000,000 roubles; the Russian Electrical Factories Co., Siemens & Halske, 5,600,000 roubles; Russian-Siemens-Schuckert, 15,000,000 roubles; the United Cable Factories, 6,000,000 roubles; the Siemens Polish Factories, 1,000,000 roubles; the Volta Co., 1,050,000 roubles.

Respecting the Tudor and the Dynamo Companies, reliable particulars of their original capital are not available. The Russian A.E.G. is no more than a branch of the corresponding house in Berlin. The chief office is in Petrograd, and the factories are in Riga. There are branches all over Russia; but they are governed by orders from Berlin. The chief shareholders in this company are Germans as can be seen from the minutes of the general meeting of shareholders held on May 7th-20th, 1914. This showed that the largest were the Allgemeine Electricitäts Gesellschaft, the Bank für Handel und Industrie, and representatives of various other Berlin banking houses.

The speaker proceeded to show by specific references that Siemens & Halske and the Siemens-Schuckert Companies likewise derived all their financial and controlling strength from Germany. After these detailed references to the principal Russian electrical concerns, he went on to say that the measures to be taken in the struggle with the Germans were as follows:—(1) To cease giving concessions to foreigners in Russia; (2) orders by the Government and public associations should be executed in Russia by Russian workmen and with Russian material—it is well known that in Russia the machines are only assembled; (3) the imposition of sufficiently high Customs dues; (4) the granting of credit by the Russian Imperial Bank to electrical concerns; (5) restriction of patent rights held by German subjects in Russia. The speaker concluded with these words:—"Our electrical power is abundant. *We have served German capital long enough. We must now serve ourselves.*"

M. P. M. Avaieff having spoken in a similar way, observed that the following electrochemical and metallurgical products were made in Russia in 1913. Electrolytic copper, 1,300,000 poods, value 18,200,000 roubles; electro-steel, 250,000 poods, value 625,000 roubles; aluminium, 80,000 poods, value 1,600,000 roubles; chlorate of potash, 150,000 poods, value 1,200,000 roubles; nitric acid, 3,500,000 poods, value 6,000,000 roubles; calcium carbide, 90,000 poods, value 400,000 roubles; electric accumulators, 210,000 poods, value 1,700,000 roubles. The capital invested in the electrochemical industry yields up to 100 per cent. net profit. Unfortunately, it is nearly all foreign—German.

From the discussion that followed, it would seem that the capital in Russia in the savings banks, and what is used in the organisation of small credits, is practically all under the control of banks that receive their orders from Germany. Hitherto it has been impossible for an independent electrical industry to grow up in Russia, for *the Germans used large capital in order to snuff out any such efforts!*

ELECTRIC LIGHTING AUTHORITIES AND THE LAW OF RATING.

[From our Legal Contributor.]

Most of our readers will have received ere now a copy of a species of summons requiring such of them as be ratepayers to supply certain particulars to the overseers of the poor. This is a document which is served upon metropolitan ratepayers once in every five years, and it is one which should receive very careful attention.

To ascertain the rateable value of an ordinary dwelling-house is a comparatively simple matter. The overseers in one of the metropolitan boroughs make the following statement:—

"It may be mentioned for your information that the Council's Valuation Committee are required, in making the New Valuation List, to fix the gross value of all properties in the borough at an amount corresponding to the annual rent which the tenant might reasonably be expected, taking one year with another, to pay for the premises, if the same were let on an annual tenancy, and the landlord undertook to bear the cost of repairs."

When, however, we come to consider a highly complicated piece of property like an electric lighting undertaking, the ascertainment of the hypothetical rent is by no means a simple matter. Those who pay rates may be prejudiced either (1) by a rise in rates, or (2) by a rise in rateable value. As the corporate body has no say in the election of guardians who control the rates, its one means of protecting itself against anything in the nature of extortion is to prevent an exaggerated valuation. In these circumstances, it may be found useful if we discuss some of the principles upon which the property of electric lighting companies is rated, with a view to enabling interested persons to ascertain whether, in the light of events during the last five years, their valuation is likely to go up or down.

The law of rating is by no means simple. This is partly due to the fact that Parliament does not define rateable value, and has never attempted to do so. All the Legislature has ever done is to prescribe the means by which rateable value may be estimated. Seeing that the last Act dealing with the subject was passed so long ago as 1862, it is not surprising that it contains no reference to electricity or electric lighting undertakings.

We must, indeed, go back to first principles in order to ascertain the law of rating. The Parochial Assessments Act, 1836, provides that a rate must be "made upon an estimate of the net annual value of the several hereditaments rated thereunto; that is to say, of the rent at which the same might reasonably be expected to let from year to year, free of all usual tenants' rates and taxes . . . if any, and deducting therefrom the probable average annual cost of the repairs, insurance and other expenses, if any, necessary to maintain them in a state to command such rent."

As such a person as an actual "tenant" of an electric lighting undertaking is a creature unknown, it has long been the practice, in rating gas companies and similar undertakings, to have regard to the profits which such a concern would bring in. Three leading principles of law are as follows:—

(*a*) In valuing the works, pipes, &c., of an electric lighting company for the purposes of rating, the profits earned by the company are taken into account.

(*b*) The exercise of the right to lay down wires and send electricity through them, amounts to an occupation in law, so as to be rateable.

(*c*) If the electric lighting works belong to a municipal corporation or other local authority, that body is rateable, although the profits earned are devoted to public purposes.

Let us now examine the method by which the rating authorities endeavour to ascertain the hypothetical rent.

The first step is to ascertain the net receipts. This is done by taking the receipts of the company from every source, and subtracting therefrom the ordinary working expenses (other than the cost of repairs, insurance, &c., which come in later on). Having ascertained the net receipts, it is necessary to inquire how much of them a tenant will be willing to pay as rent to a hypothetical landlord. He would not, of course, pay the whole receipts as rent, as he would not then have any incentive to embark on the undertaking. There must be a deduction for "tenant's profit," sometimes called "tenant's share." It is worked out as a percentage on the tenant's capital. The tenant's capital is the value of his loose stock-in-trade, and a sufficient capital sum to enable him to provide for working expenses. It would not, of course, include the value of the boilers, engines, dynamos or other fixed machinery at the central station, but it would include the meters on consumers' premises, and all the loose tools, &c. A percentage is then taken on the tenant's capital, and considerable difficulty is often experienced in deciding what this should be. At the London Quarter Sessions the usual practice in rating the property of a gas company is to take 5 per cent. for interest, 10 per cent. for trade profits, and 2½ per cent. for risks and casualties, making 17½ per cent. in all.

Having deducted the tenant's profit, we arrive at the gross value of the undertaking. According to the rule laid down in the Statute (*supra*), the cost of repairs, renewals and insurance sufficient to maintain the hereditament in a state to command the rent must be deducted from this, inasmuch as these charges fall on the hypothetical landlord. Making a final reduction of the rates, which the tenant has to pay, we arrive at the rateable value of the whole undertaking.

The above principles of rating can be best understood by looking at the following figures, which were given by Mr. Harold Eve in the course of the case of Charing Cross Electricity Supply Co., Ltd., *v.* Lambeth and Westminster Assessment Committee in 1906:—

Ascertainment of Rateable Value.

Gross receipts	£125,194
Working expenses	50,281
Net receipts	£74,913
Tenants' share, 17½ per cent. on £51,000...	8,925
Gross value, plus rates	£65,988
Repairs and renewals	27,341
Rateable value, plus rates	£38,647
Rates, at 7s. in the £	10,020
Rateable value of whole undertaking ...	£28,627

In London, as the rates are only revised once in five years, it is necessary to consider what year is to be looked at for the purposes of rating.

In Charing Cross, City and West End Electricity Supply Co., Ltd., *v.* City of London Union (1906, Konstam 31), the company appealed against a valuation made in 1905. The question arose as to what year was to be considered. The company published their accounts yearly—not half-yearly. It was held that the case must proceed on the basis of the company's accounts for the year 1904, but counsel for the Union were to be allowed to put questions as to the general working of the company in 1905. The Deputy-Chairman of the Quarter Sessions said:—"Sir E. Boyle (counsel for the Union) must refer only to the general results of 1905, and not to the precise figures. An electric supply undertaking is not like an ordinary business; some other light may spring up immediately and take the place of electric light."

Hitherto we have proceeded upon the assumption that the entire undertaking of the company is situated in one parish or rating area. In such a case there is no necessity to consider whether the profits, upon which the rateable value is founded, are earned at the generating station or at the premises of the various consumers. But, where, as nearly always happens, the undertaking is distributed over many parishes, difficult questions arise. For instance, the generating station, which is only indirectly productive, may be in one parish, while the directly productive part of the works may be distributed over the company's whole area. How are the profits to be apportioned? The difficulty is got over by considering the claims of all the different rating areas together.

In dealing with this question, rating authorities have recognised the fact that the undertaking of a gas or a water company is very similar to that of an electric lighting company. The principle adopted in the case of a water company was laid down in 1847 in the case of R. *v.* Overseers of Mile End Old Town, 1847, 10 Q.B., 208. There the works of a water company extended into several parishes. The rateable value for the purposes of poor rate, of the entire works, was £30,800. The rateable value of the reservoirs, buildings, &c., valued as land and buildings deriving value from their capacity of being applied to the objects of a water company, was £6,500. It was held that the rateable value ought to be apportioned among the several parishes in the following manner:—"The rateable value of the reservoirs, buildings, &c., valued as above, to be first deducted from the total rateable value, and distributed among the parishes in which this portion of the works was situate, according to the extent of such works in each parish; and the residue of the rateable value to be apportioned among the parishes containing the service pipes, in the ratio of the net profits produced in each of those parishes." *(To be concluded.)*

THE N.S.W. GOVERNMENT POWER STATION.

A recent issue of the *Commonwealth Engineer* contained a description of the new White Bay traction power station of the N.S.W. Government Railways and Tramways Department at Balmain. The first section of this station is nearly complete and three 7,500 KW. turbine units will shortly be available to supplement the tramway service.

The station is close to White and Rozelle Bays, giving an almost unlimited supply of circulating water; it is convenient to overseas wharfage and to railway and tramway connections. The complete block of buildings to be erected will be 465 ft. long by 242 ft. wide, and will accommodate ten turbo-alternators, eight for normal use, one under repair, and one standby. At present only half the station has been erected, to accommodate four 7,500 KW. turbine units each supplied with steam from four water-tube boilers.

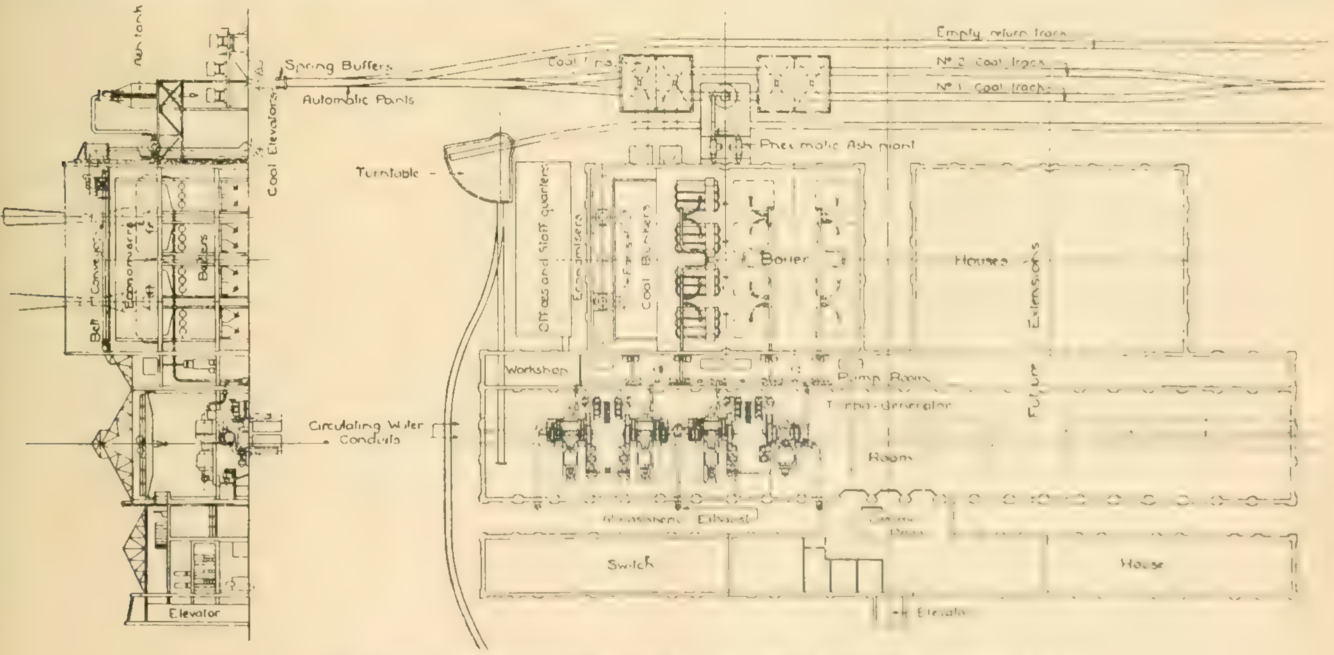

Fig. 1.—General Arrangement, White Bay Power Station, Balmain, N.S.W.

The four batteries of boilers comprising the first installation are arranged on either side of two firing aisles at right angles to the engine room in which the turbine units are placed cross-wise, in pairs, with the auxiliary plant between them. Each turbine, with its boilers, condenser, auxiliary plant and switchgear, forms a complete power unit independent of the others.

The boiler house—which will be divided into sections when complete—contains three floors, *i.e.*, ash basement, firing floor, economiser and fan floor, and coal bunkers are provided over each firing aisle giving approximately 1,000 tons of coal per unit, or about eight days' supply. Fuel is brought in on two elevated railway tracks, equipped with electric capstans, and the trucks, after emptying into hoppers, run down a decline and up a short incline where they strike spring buffers, causing a rebound which is sufficient to send them over automatic points on to an empty truck siding.

A fuel hopper, bucket elevator and belt conveyor (50 tons per hour) is provided to each unit; a Denison coal weigher is provided to each boiler, and the ashes from the latter are collected and discharged into a 40-ton tank over the railway, by means of a pneumatic suction ash plant. The boilers, each of 27,000 lb. evaporation, normal rating, and 40,000 lb. under forced rating, supply steam at 180 lb. pressure, 200° F. superheat. Inclined chain-grate stokers, specially designed for burning coals which are low in volatile hydrocarbons, are fitted. A 288-tube Green economiser is provided to each boiler and one Prat ejector type chimney to each pair of boilers. The boiler, coal, ash and draught plants were all supplied by Messrs. Babcock & Wilcox, Ltd.

A narrow bay between the boiler house and engine room forms the pump room, containing a 360-gallon per minute service feed pump for each unit, of the Mather & Platt six-stage centrifugal type; an emergency steam-turbine driven two-stage pump by Messrs. Mather & Platt is also provided, together with Venturi meters in the pump deliveries and Precision meters in the air-pump discharges to the hot wells.

Three Willans-Dick Kerr 7,500 KW. turbo-alternators have been ordered for the plant, one, however, owing to the conditions at the time, being installed in the Ultimo power house; a fourth 7,500 KW. turbine set was obtained from the General Electric Co., U.S.A., owing to unsettled labour conditions in Great Britain.

The Willans turbines are of the disc and drum type with a guaranteed steam consumption of 13.9 lb. per KW. hour, full load, vacuum 28.3 in. The speed is 750 r.p.m. The American turbine is a six-stage horizontal Curtis plant, running at 1,500 r.p.m.

The generators supply three-phase current at 6,600 volts, 25 cycles; the Dick Kerr machines are ventilated by independent 30-H.P. fans, and the American machine has ventilating fans attached to the rotor; a 125-volt exciter is coupled to each alternator.

Messrs. Willans supplied their own surface condensing plants, while Messrs. W. H. Allen & Son supplied the plant for the American turbine. The circulating water is drawn from White Bay and discharged into Rozelle Bay; two concrete ducts, side by side, connect the two bays passing under the turbine house from end to end. Settling chambers and revolving screens are provided in the ducts, and valves at the power house allow the direction of the flow in the ducts to be reversed and the hot discharge to kill any marine growths.

The condensers are mounted over the circulating water ducts, and owing to the syphon action between the inflowing and outflowing ducts below, the circulating pump having once started the water flow has merely to operate against the difference in level between the two ducts. Except for the 600-volt D.C. motors for the 50-ton engine room crane, the whole of the auxiliary motors are of the three-phase 440-volt type, mostly open squirrel cage machines, although totally enclosed and pipe ventilated motors are used in exposed situations. The H.T. switchgear, supplied by the G.E. Co. (U.S.A.), is situated in a switch house adjoining the engine room.

The main oil switches are all of the motor operated type, while the auxiliary circuits, supplied through six 350 KW. Brush transformers are controlled by solenoid operated switches. Current limiting reactances are provided in the generator circuits, designed to give a 6 per cent. drop at normal load, but capable of carrying 150 per cent. lead continuously with a larger drop.

Aluminium lightning arresters have been installed on each outgoing feeder with a view to surge protection from this end.

In conjunction with the transformers an oil circulating system is in use by means of which the oil can be passed through a filter and dryer to a reservoir, from which it flows back by gravity to the required transformer.

The switchgear is operated by remote control, a bench board—for the generators—and feeder control board being located centrally on the switch house side of the engine room; eight sub-station feeders are allotted to each generator. A complete electric signalling system with illuminated dials is

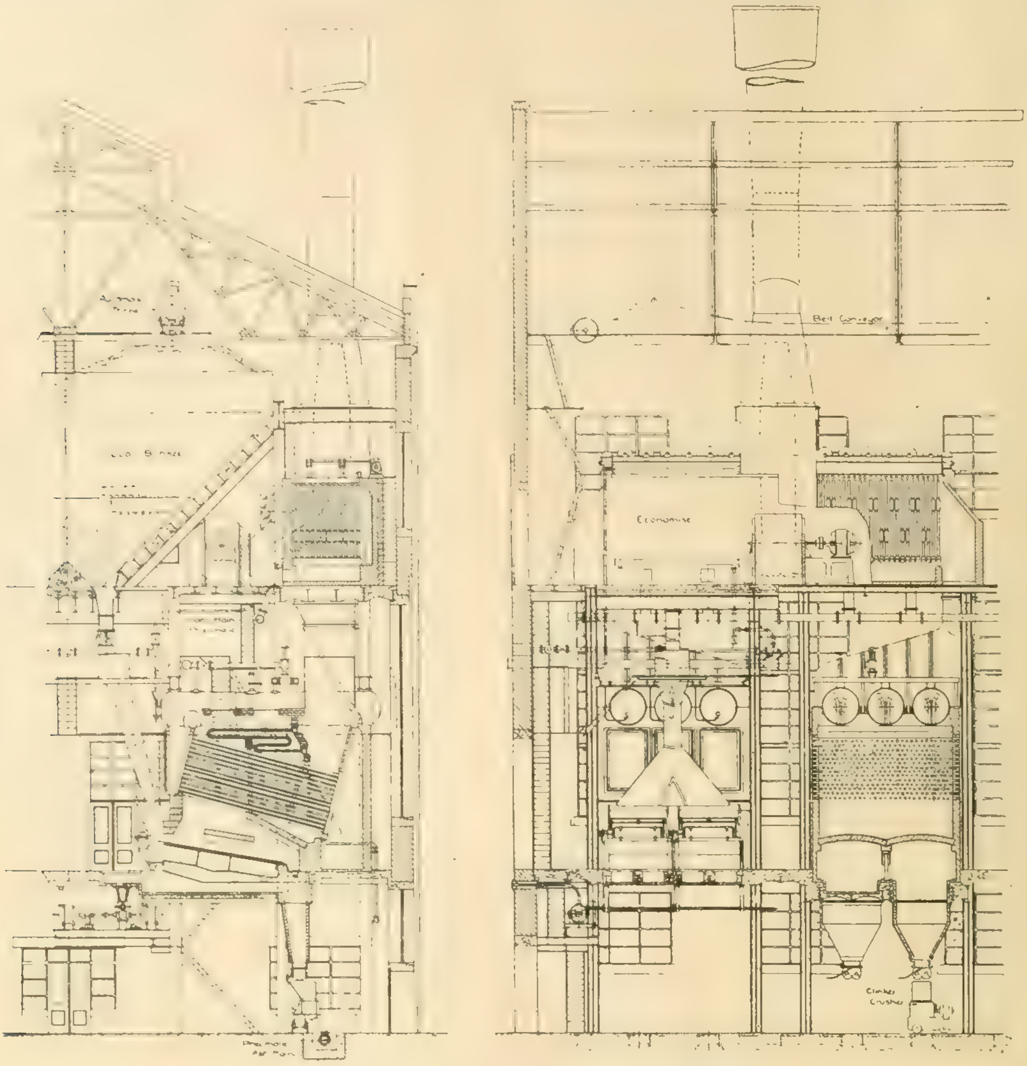

FIG. 2.—SECTIONAL VIEWS THROUGH BOILER HOUSE.

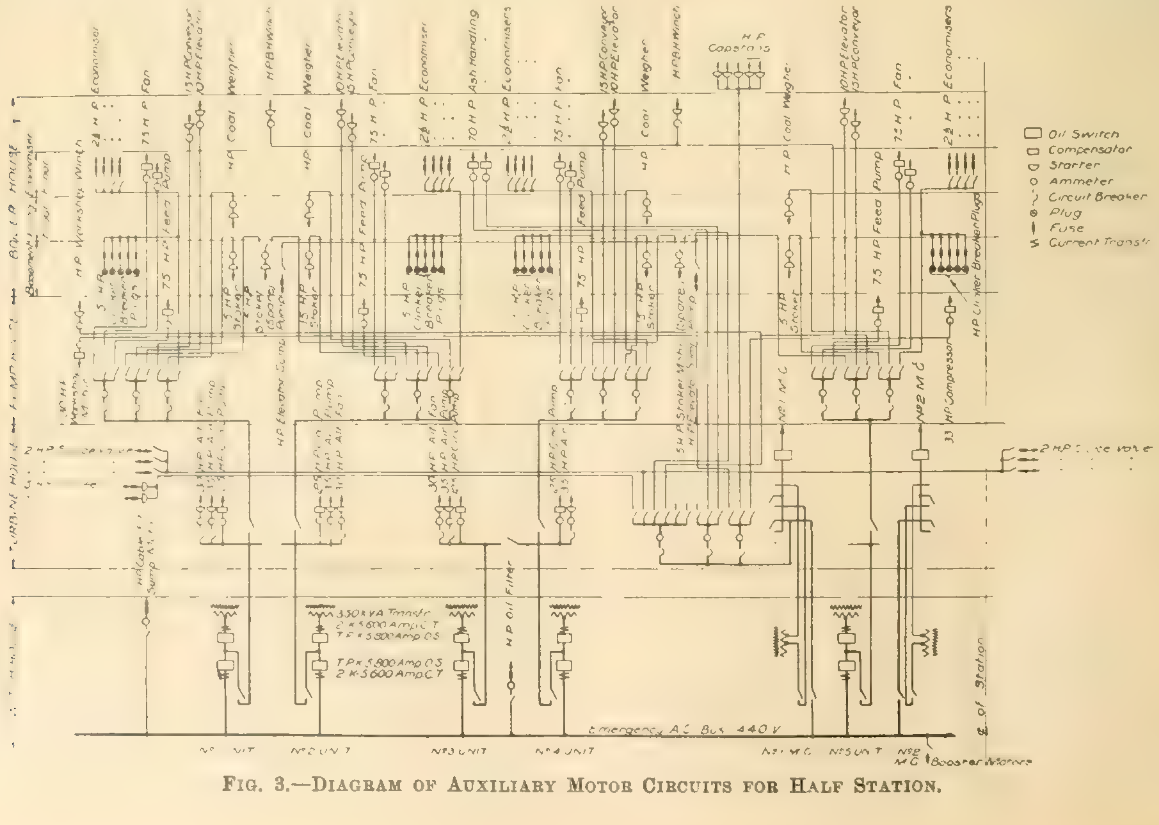

FIG. 3.—DIAGRAM OF AUXILIARY MOTOR CIRCUITS FOR HALF STATION.

provided between the control room and operating staff, while telephones, electric clocks, etc., are also installed.

The alternator leads run through fibre ducts underground to the switch house basement, to reactance coils giving a 6 per cent. reactance drop at normal load; the leads then pass through glazed brick chases to the oil switches. A ring 'bus system has been adopted; the H.T. leads are all carried in separate chases and conduits, the chases being continued on the ceilings.

A complete workshop and general store, offices and staff quarters, equipped with shower and plunge baths, are also features, while a reserve coal storage yard with crushing and loading facilities is provided at Leichhardt to safeguard the operation of the plant, from all of which it will be gathered that the Railways Department has provided for a modern installation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A.C. v. D.C. for Lighting.

Referring to the letter in your issue of the 8th inst., signed "X-Gas," under the above heading, your correspondent can set his mind at rest as regards the suitability of low periodicity alternating current for lighting. Current at 40 cycles is used in a great part of Cardiff, and as a matter of fact this letter is being written by its aid. Quite a number of small towns and villages in South Wales are lit by current at 25 cycles, supplied by the South Wales Power Co., and my own house is so lit. Personally, I have not experienced the least inconvenience.

More than this, a very large number of the collieries and works are being supplied by the South Wales Power Co., and I know that where this current is used for the lighting of machine shops, it is found to be entirely satisfactory. Occasionally one comes across a metal-filament lamp with rather loose filaments, and these vibrate in synchronism to the periodicity, but even in such cases, where a Holophane or other shade of similar type is used, the vibration effect is entirely lost.

Theodore Stretton.

Cardiff, *January 12th*, 1915.

Garage Heating.

With reference to "Interested Inquirer's" letter in your issue of January 8th *re* above, in my opinion your correspondent has been ill-advised to install a radiator of the red-hot element type. While it is true that the normal temperature attained by these elements may not be sufficient to ignite an explosive mixture of petrol vapour and air, there is always present in a garage some dust in the form of particles of lint, say from brushing the upholstery down, or straw, etc., which will almost assuredly incandesce in contact with the red-hot elements, and be sufficient to ignite the mixture or petrol vapour.

I have seen a motor-cycle set on fire by a smoker drawing at his cigarette when the carburettor was flooding, the incandescence from the edges of the paper doing the trick.

The safest possible heater to use is the electric convector or air warmer. Several types are to be had of small dimensions, notably the circular tube type with perforated case, 500 or 1,000 watts.

A plug should *not* be fitted on the heater, or if one is fitted on a standard it should be fixed up so that it cannot be removed, as the flaming sometimes caused when putting the plug on might be fatal to spare petrol, not to speak of the car.

If it is desired only to keep the water from freezing, one of the small immersion heaters dropped in the radiator tank through the filler cap and suspended by a stop of some kind to prevent its total immersion over the terminals is a good plan. An electric flat-iron has been used for this purpose by placing it against the bottom face of the car radiator, but this is not fair to the flat iron.

Chas. H. Archer, *Electric Heating Specialist*

King's Norton, *January 11th*, 1915.

Wireless in Warfare.

I have the honour to inform you that the following notice in your periodical of October 2nd, 1914, on page 470, has attracted my attention:—

"Wireless in Warfare.—It is suggested that the German cruiser *Emden*, which has been so successful in capturing British ships in the Bay of Bengal, has been receiving information regarding the movements of shipping from the Telefunken stations in the Dutch East Indies; these are, of course, on neutral territory, but are probably worked by German officials."

With respect to this notice I am obliged to give the following rectification:—The wireless stations in Netherlands East-India are owned by the Government and are operated by Netherlands officials only, who during the whole war time have got and strictly followed the most positive orders with regard to maintaining our neutrality. No German or any other stranger has been on the stations or is allowed even to enter the grounds, as the stations are under constant watch of the military department. Moreover, I am able to contradict most positively that the German cruiser *Emden* received any telegrams or any information from the operators regarding the movements of shipping.

I should esteem it a favour if you would be kind enough to publish as soon as possible a rectification in that way.

Batavia, *December 4th*, 1915.

G. R. C. Plop,
The Chief of General Direction of Posts, Telegraphs and Telephones in Netherlands, India.

[We are very pleased to publish this letter, and regret that the Dutch stations were unjustly accused of a breach of neutrality.—Eds. Elec. Rev.]

Wonderful Accumulator Cells.

It is not necessary for me to answer Mr. Faraday Hawdon's questions, because he answers them himself. I am sorry that he cannot "follow the inference suggested by the statement," "The positive plate is now of normal size"; perhaps others can. I am quite well aware of the behaviour of separators, made of unsuitable celluloid, in storage batteries, both large and small. Troubles too numerous to mention were experienced through these twenty years ago in large 61-plate cells. One large firm used asbestos cloth, and kaolin separators were used by Niblett & Sutherland, in their Umpire cell; they are still used for small cells to-day by two firms, differing only in design. Their disadvantages, under certain conditions, are quite obvious, especially when packed tightly between the plates, and very little room left for acid.

Corrugated and perforated ebonite separators are used in many first-class small batteries, and these give no trouble; for large batteries where an efficient separator is required, nothing beats the standard wood diaphragms, properly treated in order to free them from pyroligneous acid, and vasculose, and placed mid-way between the plates so as to allow free access of acid, and to permit free movement of the ions, escaped gas and perfect diffusion.

A. W. B.

Newcastle-on-Tyne, *January 16th*, 1915.

Salaries of Junior Engineers.

A senior assistant of my acquaintance employed in a neighbouring sub-station of 3,000-kw. capacity has recently been "on the carpet" twice, owing to trouble caused by the incapability, negligence and lack of knowledge on the part of the junior assistant under him. The senior had long service with his employers and, previous to the trouble, a clean sheet. The junior, on joining the supply company, was quite "raw" in regard to central station work and plant, and, moreover, too young to undertake the responsible duties assigned to him. The senior has, in consequence of the trouble, been reduced in status and position. All the facts are known to the employers—they holding that, no matter what happens, the senior is to blame and the junior is in no way responsible for any mishap due to his actions. The company also add that, owing to the shortage of unskilled labour, they are obliged to take who they can get.

Ought the skilled men to suffer because the employers are experimenting with unskilled labour? If this is the general attitude of employers, I pity those having raw youths under their charge during the present crisis. Mr. Ebben's remarks are only too true. Employers can afford to be reasonable without being half as hard hit by present conditions as are the poor devils grinding out 56 hours a week, year in and year out, for a paltry 30s. or so

J. Kay.

Manchester, *January 16th*, 1915.

Our old friend Mr. Ebben, has again cropped up and, judging from the tone of the paragraph last but one in his effusion published in your current issue, it would appear that he is rapidly qualifying as a "Hyde Park Orator," and I wonder that he wastes his time in the comparatively tame occupation of airing his and a few of his colleagues' grievances through the columns of your valuable journal.

Of course it is admitted that in a few cases shift engineers and others are badly paid, but on the other hand it must be realised that the smarter of these men are qualifying for better positions. Those with brains and who like work will, undoubtedly, obtain promotion while the remainder cannot expect high wages for subordinate positions. Nowadays, central station work, so far as it affects shift engineers, switchboard attendants and others, is largely a matter of "Rule of thumb" methods and really very little skill is required, all processes, from stoking the boilers to regulating the pressure, being caried out by automatic apparatus, and the real work devolves upon the station superintendent and his assistants who are responsible for the efficient working of this automatic apparatus. In my humble opinion the day of the "collar and cuff" shift engineer has gone, and I would infinitely prefer to have the services of a good, steady experienced engine driver in charge of his shift rather than those of a young inexperienced college man who, when trouble occurs, has necessarily to rely upon the above-mentioned driver to put him right. When things are going well our young college-trained gentleman usually spends his time in playing cards with his switchboard colleague or in some other amusement, while the driver does the work.

If Mr. Ebben himself is a shift engineer he will probably know that my judgment is correct, but as he has always maintained that these gentlemen are overworked I doubt whether he occupies such a position, as if so he could scarcely find time to adopt the rôle of a "Trade Union Agitator" in addition to his multifarious duties. I should strongly advise him to form his Association into a recognised Trade Union, when in addition to being able to air his views without restraint, he, as Organising Secretary, would have a very much better job than he is ever likely to get in a supply undertaking.

Experienced.

Preferential Terms for Arc Lights for Photo Printing.

Referring to your note on Mr. H. Faraday Proctor's letter on this subject on page 86 of the current issue, one is a little surprised to see a point of this kind raised, because it appears to be generally understood that electricity used for trade purposes, and not for illumination, should get preferential treatment. On several installations which come under my supervision electricity is supplied at special rates not only for the arc lights used for photo-printing, but also for the red and yellow lamps used in the dark rooms for delevoping. In both cases the lamps are used for trade purposes, and not for illumination; in fact, the rooms are artificially darkened to keep out daylight so that the processes may be carried on during daylight hours. For the same reason that this class of work is supplied at special rates, so also is battery charging when carried on during day time, although the stored energy is afterwards used solely for lighting purposes; a motor generator, however, would not be entitled to motor rates if used for lighting purposes.

Preferential terms are given not because the electricity is used for lighting, or power, or heating, but principally because it is used during the hours of daylight, when the demand for lighting is small

London E.C., *January 15th*, 1915.

Frank Broadbent.

I notice that the legal correspondent of the *Municipal Journal*, in the issue of January 15th, states that "he is unable to change his opinion," but by his own words he admits that my contention is right, viz.: That the ultimate purpose for which electrical energy is used is to be taken into consideration in determining whether such use is lighting, power or heating. In the issue referred to he says:—"But in law and in fact such undertakings do charge according to whether the energy is for lighting or power. A reference to the analytical tables in the 'Municipal Year Book' shows this beyond dispute." I may only add that it is equally beyond dispute that electrical energy used for photo printing is not "energy for lighting," or to employ the more correct term, "for illumination purposes."

H. Faraday Proctor,
Hon. Sec., I.M.E.A.

Bristol, *January 18th*, 1915.

[We refer to this matter in our leading columns.—Eds. Elec. Rev.]

Advertising and Character.

I do not agree with your correspondent who states that "an advertisement does or should reflect the character of the firm issuing the announcement." Very artistic and clever advertisements have before now been employed to advertise comparatively worthless productions, and one need not go outside the confines of electricity to add "notorious swindles." On the other hand, I hold that advertisements should be designed to attract the character of the individual whose enquiries are solicited. This is a very different proposition, and calls for a recognition of the diversity factor in the human mind. None of the theories put forward up to now in this correspondence is wholly confirmed by my experience as an advertiser. While each of the suggestions put forward may be sound, they would, in my opinion, only be separately effective, and in a limited sense, and each would fail by repetition. Were I a professional advertiser, I should deem it necessary to appeal in turn to the diverse personalities we know to exist; in other words, to "ring the changes." One only needs to peruse your correspondence columns on this subject to realise the variety of taste there is to cater for. There is the man with æsthetic taste and the man without; there is the man who appreciates detail and the man who, having no time for it, turns the page over quickly. There is "Consultant," who objects to be reminded of a special brand of whisky during his comic intervals, and his antithesis who would welcome such a reminder under any circumstances. There is the man (Mr. E. I. Hill reminds us) who always reads his technical journals during business hours, and is not in the right frame of mind to be amused, and there are the men, myself included, who never read those journals during office hours, and therefore welcome a little mental relaxation by way of humour in the advertising and editorial columns.

Then there is the British reader in the Colonial market who plumps for British solidarity; the Canadian in the same market who finds British methods leave him with "cold feet," and who searches for the latest American "stunt"—and, finally, a large community who object to advertisement in any and every form. Obviously it is impossible to attract everybody at once, so again I say, "ring the changes."

I have advertised in technical journals for many years and with varying success, and it may interest the votaries of publicity to know that the advertisement to which "Consultant" referred in his "critique" is the only one I have ever caused to be inserted which has brought letters of congratulation from all directions, many of them enclosing valuable and lengthy enquiries. Truly, its complete success was marred by a regrettable oversight. Owing to my enforced absence from the office when giving written instructions, I completely overlooked the fact that our mailing list includes the names of a few people who probably do not read the Electrical Review. Such people only received one-half of my message, and the other half revealing my identity, being in the advertising columns of the journal, I fully realise that it must have been extremely annoying to the Electrical Review to be asked for a copy or to be bothered in any way in connection with a matter in which they had no concern whatever. Undoubtedly the postcards should have borne my company's address; it would have improved the value of the advertisement without diminishing its exceptional effectiveness. As I have remarked, that was an oversight for which, the circumstances being known, I hope I am forgiven. But here again is a strange anomaly. Some of the most complimentary replies were received from people who stated that they had quite a difficulty in obtaining a copy of the magazine, and this appears to have given them quite an added interest in the advertisement.

In conclusion, if any of your correspondents are sufficiently interested to care to see some of the original remarks the advertisement evoked, I shall be most happy to show them.

Herbert Berry.

Hove, *January 19th*, 1915.

With further reference to the above and to Mr. E. J. Reed's remarks in your current issue to the effect that "Technical Advertisements have special consideration," I would like to add that I consider that to be a thorough advertising man a sound acquaintance with technical terms, and buyers' and users' requirements is essential in at least 90 per cent. of the trades which employ publicity. That this is so may be either known from sufficient personal experience or clearly seen in many rubber, electrical, petrol, motor and general engineering journals where publicity work is turned over by manufacturers to general advertising agencies who place the copy and designs. The inevitable results are always very flat, sometimes pitiful. In the case of commodities which appeal to the crowd, the general "fluent" professional advertisement writer is good enough, as the crowd are not technical in their requirements in respect to pills, plasters and cure-all balms.

In stating that his reason for prefering British to American advertisements is the same as that which prompts him to prefer a gentleman to a costermonger, Mr. Reed leaves himself open to be caught in his own trap, as the average costermonger is far superior to the average gentleman in business instincts and aptitude. As an American by instinct I thank your correspondent for his somewhat subtle, though unintentional compliment.

Arthur Mallord Turner.

London, S.W., *January 18th*, 1915.

Jowers Protective Leakage Device.

Although I have not seen this device and can only go by the description recently given, it would seem that the remedy may easily be worse than the disease.

In the first place the device only operates on one pole. Should an earth occur on the opposite pole, and the starter arm return to the "off" position, current will still continue to flow through the fault and probably bring the breaker out. In the event of the earth being on the same pole as the starter and the device operating the whole of the current through the fault, at practically the line voltage (less of course in a three-wire system), would be broken on the starter arm and first contact. This would be bad for the starter. Again, take the case of the "heedless operator" making persistent attempts to start up the motor with the fault on it. To energise the trip coil it is necessary, according to the diagram, to get the starter arm on the first contact. If the "heedless operator" held the arm there for any length of time he would in all probability burn out the resistance, while if he let go of the handle he would stand a good chance of getting burnt by the resulting arc. In conclusion, if it is seriously intended to place this device on the market, I would suggest that the insulated wire be taken to the trip coil via the frame of the starter or control panel as this is quite as liable to trouble as the motor.

Ernest F. Butler.

London, W.C., *January 18th*, 1915.

Stray Magnetism from Tramway Feeders.

A jeweller in this town complains that owing to one of our tramway feeders being within 10 ft. of his shop window the watches in his shop become magnetised, and an ordinary compass fixed in the window certainly shows considerable movement. I should be very much obliged if any of your readers would explain this, and, if possible, suggest a remedy. Our cables and insulation are in good order, and so far as I know there is no leakage from the tramways overhead equipment.

The jeweller's shop has been in its present position for about six years, and it is only within the last few years that the watches have become magnetised, and within the last six months more than usual. If you, or any of your readers, could give me a solution I should be extremely obliged.

Magnet.

[At the distance stated, a current of 1,000 amperes would produce a field of less than 1 C.G.S. unit.—Eds. Elec. Rev.]

WAR ITEMS.

Australians and Electrical Contracts.—According to a report in the "Sydney Morning Herald," the Sydney Council Electric Lighting Committee on October 26th affirmed the principle of British preference. We quote our contemporary's statement without alteration in order that the reader at home may observe how these matters are viewed in Australia. "Several tenders for electrical supplies had been received, including one from an American firm and another from a German firm. Alderman Meagher said he did not intend to make a spread-eagle display of patriotism, but, taking a cold common-sense view, he thought they would all see the wisdom of giving preference every time to Empire-made articles. He moved that a recommendation be made to the Council that, during the currency of the war, a preference to the extent of 10 per cent. be given. He was inclined to make the margin still bigger, but the Federal tariff, he believed, already gave a slight preference. Alderman Lindsay Thompson considered that they should not only give preference during the war, but for all time. He hoped that the Council would set an example to the public, and not go crawling back to the cheapest market, irrespective of what market it was, as soon as the war clouds rolled away. Alderman Hagon stated that he had been informed that no less than 90 per cent. of the firms trading in electrical goods in England were actually German firms, although they did not all bear German names. Some of these companies had an English director holding a few shares, but the great bulk of the profits went to Germany. The Council, therefore, needed to be very careful how it acted. Alderman W. P. M'Elhone remarked that, in view of this statement, they might actually give an advantage to a German concern under a British name if they failed to make the fullest investigation. He was in full sympathy with the motion. Alderman Meagher suggested that each tenderer be requested to furnish a certificate containing certain data. Ultimately the matter was left in the hands of a sub-committee, consisting of Aldermen Stephen and Meagher, the Town Clerk (Mr. Nesbitt), and the City Electrical Engineer (Mr. Mackay)."

The War and Factory Premises.—In their report for 1914 Messrs. Leopold, Farmer & Sons, of Gresham Street, E.C., state that the year was far better than 1913 in respect of sales and letting of factory property, wharves, land, etc. This result is in a large measure due to the war, which has produced a demand for factories and commercial property, partly to war equipment, and secondly for the manufacture in this country of goods previously imported. The firm report that an unprecedented demand still exists for properties of all kinds, and they have disposed of a large number of factories with and without plant and machinery at figures running into many thousands of pounds. Premises that previous to the war had failed to find tenants for years, have been rapidly taken up, owners in many cases having obtained increased prices through competition. The firm add:—"The Declaration of Peace should mean the opening up by our manufacturers of an enormous overseas trade both with our colonies, new possessions, and the world's markets in general, and then will come the time for us to 'capture the trade' hitherto to a large extent held by Germany. We can safely say the outlook for further deals in factory property is good, and think we are justified in hoping to report a continuance of the demand and supply of commercial properties of all descriptions in the present year."

Capturing German Trade.—Referring to the note in "War Items" in our last issue concerning the Board of Trade Electrical Exchange Meeting, the Walsall Electrical Co., Ltd., inform us that they are manufacturing milli-ampere meters similar to those on exhibition, and are also making various pocket type meters which were illustrated. They have every confidence in stating that as soon as the labour and material markets resume their normal conditions they will be able to supply these various items at the same price as the Germans and Austrians have hitherto sold them at. They have on their books at present orders for over 800 milli-ampere meters, the greater portion of which are for use in connection with telegraph and telephone work, and about one-third for use in connection with medical work. The company state that they are laying themselves out "to manufacture certain items in large quantities, and thereby departing from the usual practice of British manufacturers of making everything but making nothing well." It is only by receiving support from the wholesale houses and exporters that they will be able to do so, and they look with every confidence for this support. We congratulate the company on the enterprise exhibited, and hope that the results will be all that they could wish.

The Industrial Situation in Denmark.—The director of the Northern Cable & Wire Works, of Copenhagen, is reported to have stated in a communication to a local newspaper that great difficulties are experienced in connection with the procuring of the requisite stocks of lead, copper and rubber, and that, in his opinion, the export veto of the Danish Government ought to be sufficient security to the British Government against any re-export of these materials to Germany. Nevertheless, the British Government prevents the export of such materials which have been purchased by Danes in England, and also hinders the obtaining of supplies from America. As a consequence, it is said that the Danish copper and lead rolling mills and the lead cable works have been compelled to suspend their activity, whilst the electrical firms and other industries keenly feel the effects of the prevailing scarcity of raw materials.

Sydney Municipal Council and its Contracts.—Our contemporary "Tenders" states that the following recommendations have been made by the Sydney electric lighting committee:—That in connection with contracts which have been affected by the war, the following be approved and adopted:—

(*a*) That the Council allow to a contractor, as an extra on his contract price, in respect of contracts entered into before the outbreak of the war, the extra freight and insurance paid by him in consequence of the war, not exceeding the actual amount of his actual loss. That the contractor be asked to satisfy the Council's general auditor upon this question in any case where a contribution is sought.

(*b*) With regard to contracts, tenders for which were received before the outbreak of war, but acceptances of which were not sent out by the Council until after the outbreak of war, the Council's acceptance be of the tender at the price mentioned in the tender, with the extra freight and insurance (if any) which the contractor can show to the satisfaction of the general auditor he has been compelled to pay over the ordinary rates, the extra amount being due to the abnormal conditions caused by the war.

Board of Trade Assistance.—In connection with their campaign to assist British manufacturers and merchants to secure trade formerly in the hands of German or Austro-Hungarian firms, the Board continue to receive a very large number of inquiries for the names of sellers or buyers of articles of which the sources of supply or market have been interfered with by the war. The seventh list of articles which inquirers desire (a) to purchase and (b) to sell, is now ready and may be obtained, together with copies of the previous lists, on application to the Branch.

Telephones Wanted.—With reference to the appeal of the National Service League for telephones which appeared in our issue of January 1st (page 17), we learn that generous and greatly appreciated assistance has been rendered by Messrs. J. B. Saunders, Ltd. (railway telephones), General Acoustics & Dictaphone Co. (loud speaking telephones), and the Western Electric Co., Ltd., who are sending two of their Lister portable telephone sets of the regular military pattern. Probably there are others who have such apparatus that they will be willing to place at the disposal of the League.

Prices of Installation Materials in Germany.—It was reported about the middle of December that the prices of installation materials had been advanced by the Bergmann Co. by 10 per cent. in consequence of the increased cost of all raw materials, and partly finished manufactures, particularly in the case of metals, and that other firms would probably follow the example. It is now announced that the syndicate of makers of installation materials has raised prices by from 10 to 25 per cent., owing specially to the greater cost of copper and rubber.

The R.A.C. and X-Ray Apparatus.—The "Auto-Cycle Journal" states that a subscription has been started at the Royal Automobile Club with the idea of presenting a full X-ray apparatus with a petrol-electric set to supply the necessary current to the Officers' Base Hospital at Havre.

Blackpool Lights.—The arc lamps on the Blackpool Promenade are being blackened on the seaward side, in anticipation of an order by General Adam, commanding the Territorial Division in Blackpool.

Manchester Roll of Honour.—A roll of honour has been prepared by the Manchester Tramways Department on which the names of 1,232 employees of the tramway department who are serving with the colours have been inscribed.

Personal.—Mr. Edward S. Carling, who has represented the Electrical Co., Ltd., in the South of England for the past ten years, has been called up under the householders' return and has joined the Royal Engineers.

Mr. C. J. Oake, second engineer-in-charge at the Bermondsey Electricity Works, has obtained a commission in the Army.

Roll of Honour.—Sergt. Wm. Deakin, of the 1st Manchester Regt., for five years a car-driver in the Salford Corporation Tramways Department, has been killed in action. He was 32 years of age, and had served in South Africa.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Adapter for Small Cooking Apparatus.

When an electric kettle, say, is connected to the circuit by plugging into a lampholder, the lamp is necessarily put out of use for the time, and is liable to be broken in repeated handling. To do away with this inconvenience, the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have patented an adapter, illustrated herewith, which keeps the lamp in use. It will be seen that the device consists of a two-way fitting, the lower way receiving the lamp, and the side socket providing for the heating circuit. A litttle turn switch enables the lamp to be lighted or extinguished, as desired, without interfering with the heating circuit. The latter may take up to about 3 amperes. Small nuts on the pins of the plug enable the adapter to be fixed firmly to the lampholder.

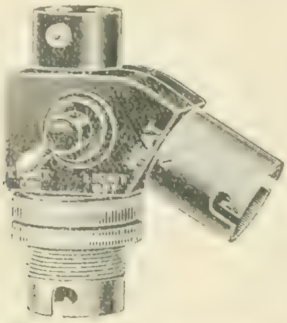

Fig. 1.—G.E.C. Two-Way Adapter.

Henley Fuse-Boxes.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., of Blomfield Street, London Wall, E.C., have for some years specialised in self-contained fuse-boxes and sealing chambers, and we illustrate in fig. 2 one of a number of similar devices contained in their latest list of service fuse-boxes. The figure illustrates a 20-30-ampere D.P. fuse-box with hinged cover, and below, and combined with it, is a three-way sealing chamber.

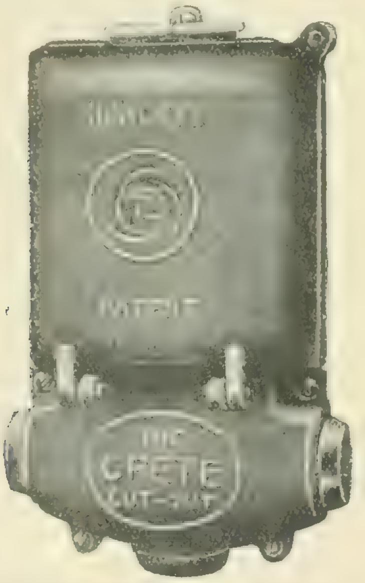

Fig. 2.—Henley Fuse-Box and Sealing Chamber.

This set is very compact, weighing only 4¾ lb., and measuring 8½ in. long × 5 in. wide × 2¼ in. deep overall.

A particular feature of these cut-outs is the separation of the sealing chamber from the fuse chamber by a horizontal iron diaphragm cast integrally with the box, the holes through which the bare conductors pass to the terminals being insulated with porcelain bushes. The sealing chamber is designed to take either vertical or horizontal service cables.

Veritys' Fixtures.

A new edition of Vol. 3 of their catalogue of electric supplies has been issued by Messrs. Veritys, Ltd., of King Street, Covent Garden, W.C. It is a fine production of more than 500 pages, and in the work of illustration, which is most excellently and lavishly done, a highly glazed art paper lends considerable assistance. The volume is a business-like production, and in style, size, &c., is uniform with Vol. 2, to which we referred several months ago, though, of course, it is bulkier. Introductory notes in the English, Spanish and French languages are followed by serviceable general codes, including measurements and technical and commercial phrases. By the way, the firm is shortly to publish a schedule of prices and particulars in the language and coinage of various countries, a further effort in the Verity bid for export trade; there is nothing so likely to win the favour of the foreign purchaser as putting before him in his own tongue, and in ways that he can understand, the information of which he is in need. Alphabetical and numerical sections lead us to the descriptive and illustrative part of the catalogue, which is divided up into 18 sections. We might enter into a great deal of comment by way of eulogy, perhaps tempered with only a very small amount of the spice of mild criticism, concerning the hundreds of varieties of designs and types that are illustrated and priced, but seeing that a fittings catalogue is intended for all tastes and all types of men—and women—whatever we might say could not be representative of anybody's thoughts save our own, and in matters of detail such as this that is not called for. Some of the fittings lead us on to thoughts of marble halls and country houses, others into industrial surroundings such as obtain in mills and factories, others into the ships in the North Sea, yet others into hospital life, or into the streets which will be better lighted again someday, and to shops which will light electric signs more brilliantly

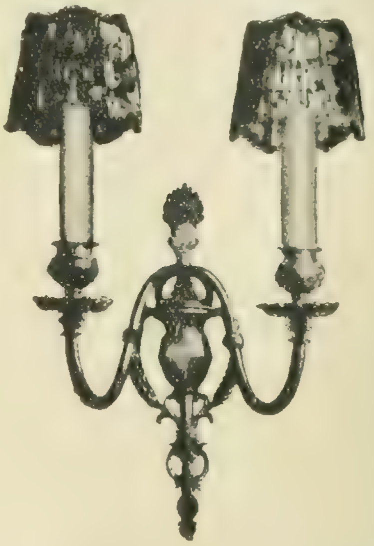

Fig. 3.—Veritys Two-Light Bracket.

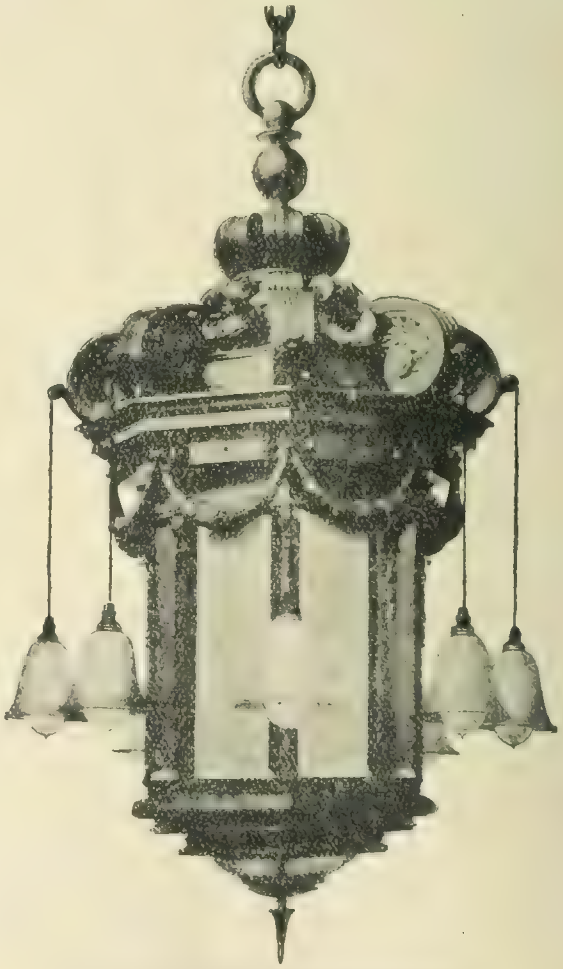

Fig. 4.—Lantern for Entrance Hall.

when little Willie's Imperial Father sues for peace, but we forbear, and fall back upon the prosaic summary of the contents given in the front of the catalogue in order to show the character and the wide extent of the fixtures covered in the book. This summary runs thus, and it appears in the three languages already mentioned (as do also the illustrations, of course, though the accompanying matter does not):—One, two and three-light brackets, pendants and indirect and sliding ditto, shade and ceiling lights, electroliers, standards, French brackets, lanterns and electroliers, bronze statuettes, hospital fixtures (a complete selection of designs), radiators, watertight and street lighting fixtures, signs, glass shades and bowls (here the firm does not conceal its regret that British glass makers have been remiss in the past and it indulges in a forecast that such will be a less pronounced weakness in the future), silk shades, switchplates and accessories. We select a couple of examples of fittings for the purpose of brightening this notice, though we cannot expect thereby to do more than give the reader a taste to see those on the other 400 odd pages. Our fig. 3 is an example of two-light bracket work, and fig. 4 is an impressive lantern form of electrolier suitable for the entrance hall of a large public building. That Veritys is a British house, that it is perhaps the oldest house associated with our electrical industries, that it has long specialised in the design and manufacture of electric light fittings, are matters upon which it is hardly necessary to dwell at this date, but when so much is being said about the constitution, &c., of different firms, it should be made clear here that its capital, directorate, management and staff are "entirely British." It may also be added that large stocks of the manufactures here catalogued are on exhibition at the firm's various showrooms in London and the provinces, that most of the contents of the book are easily adaptable for the requirements of the Canadian, South American and Continental markets, and that the firm will welcome applications for copies of this handsome volume.

Street Lighting Fitting.

The Wardle Engineering Co., Ltd., of 196, Deansgate, Manchester, have sent us particulars of a fitting designed to eliminate upward rays, and give wide distribution of light on the ground, which should be very suitable for use under the existing lighting *régime*.

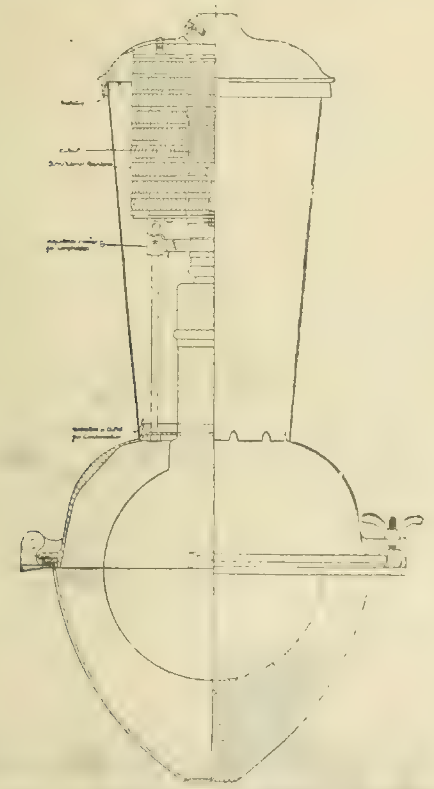

Fig. 5.—Section of "Primus" Lantern.

Fig. 5 is an illustration of the No. 515 Primus lantern, from which it will be seen that the filament does not project below the bottom of the internal reflector. The polar curve, fig. 6 (taken by the Manchester Corporation testing department) shows an increase by nearly 50 per cent. of the candle-power at 17° below the horizontal; if the height of the lantern is 25 ft., the 17° ray will reach a radius of over 80 ft., whereas a 30° ray will only reach a radius of 44 ft. To obtain even illumination it is, of course, very important to get the maximum candle-power very near to the horizontal, but this is very difficult if upward rays and glare are to be eliminated.

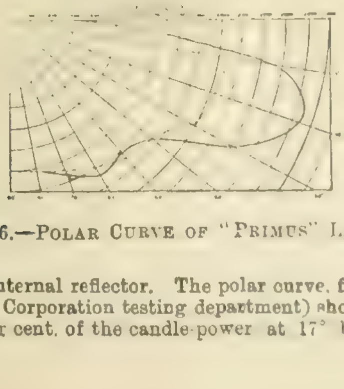

Fig. 6.—Polar Curve of "Primus" Lantern.

THE MAGNETISATION OF IRON.

By J. S. NICHOLSON, B.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Glasgow, December 8th*, 1914.)

In the testing of iron stampings at high flux densities by means of alternating currents, great difficulty is experienced in maintaining an electromotive force of sine-wave form at the terminals of the magnetising winding, and in ensuring that the electromotive force induced in the windings of the tester shall also be of sine-wave form.

If the induced electromotive force varies according to a simple sine function of the time, then the flux density in the core of the tester will also vary according to a simple sine function of the time, so that B_m the maximum value of the flux density can be obtained in the usual way from the induced electromotive force and the number of turns in the secondary winding, &c.

If, however, the flux and therefore also the induced electromotive force do not vary in this way, it becomes difficult to ascertain, even approximately, the value of the maximum flux density in the core corresponding to a particular value of the induced electromotive force. The author shows how at flux densities with maximum values of 20,000 lines per sq. cm. and upwards in Stalloy the flux in the tester core was approximately maintained as a simple sine function of the time.

Some idea of the possible divergence of the wave-form of induced electromotive force from the simple harmonic form, and of the magnitude of the error in B_m when calculated, may be obtained by a study of the oscillograms reproduced in fig. 1. These were obtained from a ring tester connected between two lines of a 40-K.V.A. star-connected three-phase alternator giving an electromotive force of simple sine-wave form on open circuit. The induced electromotive force in a search coil corresponded to values of B_m of 17,500 and 20,000 lines per sq. cm. respectively, but the actual values were 16,600 and 18,100 respectively.

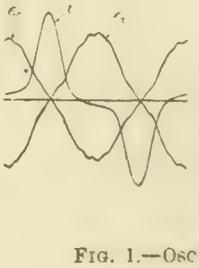

Fig. 1.—Oscillograms of e_r, i and e_t.

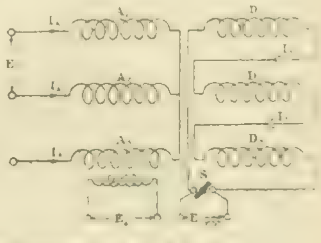

Fig. 2.—Three Similar Ring Testers each with two Magnetising Windings, A and D, uniformly Distributed. The A Windings are Star connected, and the D Windings Mesh-connected and Short-circuited.

The above results are typical of what may be expected when tests at high flux densities are being carried out with an alternator of medium size, and they illustrate how misleading would be a curve showing the number of watts lost in the iron core of the tester if such a curve were plotted against the induced electromotive force or against B_m (apparent). The correction which must be applied to the apparent value of B_m increases so rapidly that it is probable a point may soon be reached at which, with increasing terminal electromotive force, the maximum value of the flux density in the tester core actually begins to decrease.

The divergence of the terminal electromotive force from the simple sine-wave form is mainly due to the presence of higher harmonics in the magnetising current.

In order that each of the harmonics of this current may be maintained in the circuit of the tester and alternator there must be an electromotive force of corresponding frequency acting in the circuit. If we assume that there is no third harmonic in the alternator's induced electromotive force, then the only possible source of this electromotive force is the tester. The tester behaves like a frequency converter, taking in power from the alternator at the fundamental frequency f, and delivering power to the circuit at frequencies $3f$, $5f$, $7f$, &c.

The author has been experimenting for a considerable time with testers having two distinct magnetising windings. One of these windings carries the triple harmonic component of the magnetising current, I_3, and multiples thereof, while the other winding carries the fundamental and all other components of the magnetising current.

A simple method of isolating I_3 and of limiting the magnitude of the electromotive force, E_3, necessary to produce I_3 is illustrated in fig. 2. The magnetising windings, A, are supplied with currents I_A from a star-connected three phase alternator, giving a sine-wave electromotive force on open circuit. The currents, I_A, will have no third harmonics, but they will include the 5th, 7th, 11th, &c., harmonics. The D windings, being mesh-connected, can only carry currents of triple frequency, or multiples thereof.

With switch S, in mesh windings D, closed, the resultant mesh voltage, 3 E_3, sends a current I_3, of triple frequency round the mesh circuit. This secondary current, I_3, and the primary current, I_A, combine to give a total magnetising current, $i = i_A + i_3$, this producing a flux which is very approximately of simple harmonic form. The resultant mesh voltage, 3 E_3, becomes very small, since it is now approximately equal to $I_3 \times 3 r_D$, where r_D is the resistance per phase of the windings D.

Oscillograms of I_A, I_3, I, E, per phase, and E per line of three-phase alternator, are given in fig. 3.

Instead of allowing the iron cores to generate their own third-harmonic electromotive force and current, we may entirely eliminate the triple-harmonic component of the induced electromotive force, and also avoid the determination of the mesh copper watts by connecting the terminals of the mesh circuit to a single-phase alternator giving an electromotive force of the required frequency and magnitude. The resulting current, I_3, is then adjusted in magnitude and in phase with reference to the current, I_A, in the star-connected windings until the resultant induced mesh voltage is zero, and, neglecting terms of frequency $5f$, $7f$, &c., the flux density in the cores varies according to a simple harmonic law. Experiments on these lines have been carried out by the author at intervals during the past 18 months and a number of interesting results have been obtained.

Tests were carried out at 22·5 and 15 cycles per second. The results are given for temperatures of the Stalloy cores of 55° to 65° C. The B-H curve, fig. 4, for the Stalloy cores was obtained by the method of reversals. The core losses have been analysed in the usual manner into hysteresis and eddy-current losses, and curves of hysteresis losses plotted against B_m are also shown in fig. 5.

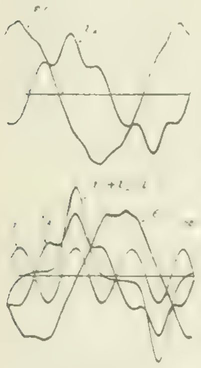

FIG. 3.—OSCILLOGRAMS WHEN B_m (APPARENT) = 17,500.

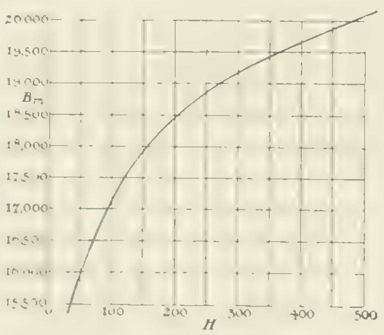

FIG. 4.—B-H CURVE FOR STALLOY CORE.

The index of B_m in the hysteresis formula was found to be 1·58, from 17,500 to 19,500 lines per sq. cm.

For values of B greater than 19,500 lines per sq. cm. the index seems to be greater and the constant, η, smaller. The flux density in the tester cores consisted mainly of a simple sine function of the time with a very small fifth harmonic ripple which did not exceed 3·2 per cent. of the fundamental term. The total corrections at 22·5 cycles per second amounted to 1·6 per cent. at B (apparent) = 18,000, and to 4·15 per cent. at 21,000.

Referring to the use of static transformers as frequency changers, the author draws attention to the relations which hold between the various harmonics of the magnetising current for flux densities in the Stalloy cores ranging from 17,000 lines per sq. cm. to 20,500 lines per sq. cm. (actual maximum values).

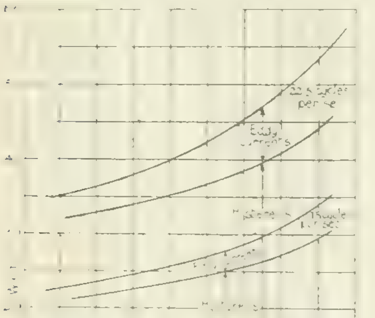

FIG. 5.—STALLOY CORE LOSSES.

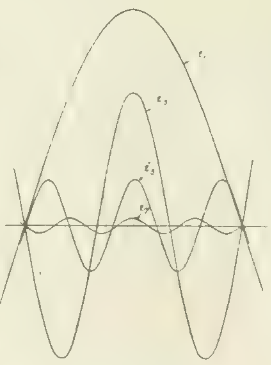

FIG. 6.—ANALYSIS OF MAGNETISING CURRENTS.

Fig. 6 shows the analysis of the current i into its harmonics, and may be taken as typical of all the current waves from the tests. It will be seen that the peak in the magnetising current is due to the approximate coincidence of the peaks of all the various harmonics.

In the above investigation the aim has been to obtain a flux in the Stalloy cores varying according to a simple harmonic law, this manner of variation being considered ideal. The deviation of the actual flux from the apparent flux is mainly due to the fifth-harmonic component of the flux. This harmonic would practically disappear if the fifth harmonic in the magnetising current could be short-circuited in a manner similar to that of the third harmonic, I_3, as in fig. 2 when the switch S is closed. This method being impossible with three-phase currents and three testers, the next best method, probably to insert condensers and variable inductances between the lines of the three-phase circuit and gradually to vary the inductances until resonance with the fifth harmonic is obtained. Considerable success has already been attained by shunting the fifth harmonic in this manner.

DISCUSSION.

Professor BAILY (Edinburgh) said that Mr. Nicholson's method was most ingenious—the method of using a three-phase system and using the mesh winding to emphasise the triple harmonic and star windings to stamp it out. Twenty years ago he had to use the calorimeter method. They did not in those early days trouble much about the triple harmonic, but what he had done was, as Mr. Nicholson had pointed out, to over-estimate the flux.

Mr. HIRD (Glasgow) thought the paper appeared more fitted for a society of pure physics than for that Institution. The theory of the paper, however, seemed to him to be a very reliable contribution to the science of the magnetisation of iron. As to the value of such an elaborate method purely from the testing point of view he had some doubt. When they measured the losses in the iron circuit of a dynamo where they had the dimmest notion as to what the flux would actually be, and what the respective densities were in each different part, the nearest approach such as they got in commercial testing was, he thought, quite as useful and as serviceable as the most elaborate methods which could be evolved.

Mr. W. W. LACKIE (Glasgow) said that the point in the paper about the third harmonic appearing in a star-connected transformer brought to his mind the case of a star-connected choke coil on a static balancer in connection with a continuous-current machine. The simplest form of this was two slip rings and a single choke coil, the middle-wire connection being taken from the middle of the choke coil. This did not give particularly good balancing, and the next step was to have four slip rings and two choke coils, the middle points of each being connected together and the middle-wire connection taken from this. It was suggested that the star-connected choke coil connected to three slip rings might be used, but he was informed by a manufacturer that this had been tried and they had been bothered with a third harmonic giving fluctuating pressure.

Mr. A. S. MACWHIRTER (Glasgow) said that the advantages of using a three-phase tester in preference to a single-phase tester were very striking, viz., the elimination of the third harmonic in the star-connected windings, and the possibility of supplying the required triple harmonic component of the magnetising current in the mesh windings. There was also the advantage that the wattmeters connected as shown were measuring the power at a much higher power factor than would be possible with a single-phase tester and the likelihood of errors in the wattmeter readings was thus diminished.

Mr. A. L. TACKLEY (Glasgow) said the results of the paper showed that within the limits of maximum flux density 17,500-20,000 lines per cm² the shape of the magnetising current wave to provide a sine wave of flux reaching to high flux densities was approximately constant. He had mathematically worked out exactly the conditions necessary in order that the shape of the current wave might be truly constant.

Mr. B. PARKER HAIGH, in a written communication, stated that in the ordinary Epstein iron testing apparatus the wave of flux deviated very considerably from the sine wave, and the iron losses determined in this manner did not truly represent the losses for any particular flux density with simple harmonic variation. Mr. Nicholson had previously shown how several difficulties were overcome when the watts were measured by means of a secondary coil, wound within the primary coil of the Epstein apparatus, and it seemed regrettable that such a coil was not more generally employed. It was not easy to appreciate the advantage of using a sine wave flux, for by integrating the oscillogram of induced E.M.F., it was simple to ascertain the maximum value of the flux—upon which alone the hysteresis loss per cycle was believed to depend. But unless the wave form was constant, a difficulty existed in separating the eddy current and hysteresis losses, and it was there that improvement on ordinary methods was desirable.

Dr. ALEXANDER RUSSELL (Faraday House, London), in a written communication, said that Mr. Nicholson's researches proved that it was absolutely necessary to know the law according to which the magnetic flux density in the core of the sample under test varied. On the other hand, those who sent samples of iron to be tested usually specified that they wanted the watts lost per pound at a given maximum induction density and at a given frequency, the wave of potential difference applied to the magnetising coil being sine-shaped. From the oscillogram of the induced electromotive force in the secondary coil they could easily find the area A′ of the positive (or negative) half of the E.M.F. wave. From this they found at once that the maximum value of the flux density in the core in this case Bm = $10^8 A'/(2\,n\,A)$ where n was the number of turns in the secondary coil and A was the cross sectional area of the iron. The value of B_m must be found in order to get the Steinmetz coefficient for the hysteresis loss. In order to calculate the eddy-current losses they found from the oscillogram of the E.M.F. wave, in the same way as shown in the paper, the values B_1, B_3, B_5 . . . for the harmonics of the flux density. Then, making the assumption that the amplitudes of these harmonics were approximately constant over the cross section of the iron strips, the eddy-current loss per cubic centimetre of the iron was given by

$$1\cdot64\ (t^2/\rho)f^2(B_1^2 + 9\ B_3^2 + 25\ B_5^2 + \ldots\ldots),$$

where t was the thickness of the strips in centimetres and ρ equalled the resistivity of the iron in C.G.S. units (about 10,000). As the wattmeter reading gave them the sum of the hysteresis and eddy-current losses they could, if they knew the Steinmetz index, easily find the Steinmetz coefficient. Mr. Nicholson's method of getting a sine-shaped flux, whilst most ingenious, was rather too complicated for every-day use.

Mr. D. J. Mackellar wrote asking Mr. Nicholson whether the magnetic leakage at the high flux densities employed had been found to have any appreciable effect on the flux distribution in the tester cores, and whether it could be reasonably assumed that the flux density was uniform over the whole tester.

Mr. A. M. Taylor (Birmingham), in a written communication, said that the information contained in the paper, had it appeared a year ago, would probably have saved mistakes in the design of a frequency-changer which proved expensive to rectify. He described his own large-scale experiments, and said that Mr. Nicholson's connections were virtually those of the Spinelli frequency changer.

Mr. Nicholson replied to some of the points raised, and deferred detailed reply to the report in the *Journal*.

BUSINESS NOTES.

Deed of Assignment.—L. Fawcett, automobile and electrical engineer, Leeds.—Claims must be sent in by February 13th to the trustee, Mr. C. H. Baker, 1, Albion Street, Leeds.

Edinburgh.—The North British Rubber Co., it is understood, have received large orders from the Admiralty and War Office which, along with their general business, necessitates a considerable addition to their factory.

Book Notices.—*High-Speed Telegraphy* is the title of a handsome brochure issued by Messrs. Creed, Bille & Co., Ltd., which describes the Creed system and its progress during the year ending June last. It has been adopted by a number of British Colonial and foreign Governments, cable companies, newspapers, and the British Post Office, and the makers claim that it has solved the problems of high-speed telegraphy. The Marconi Co. has adopted the system for its circuit between London and Towyn, in connection with the trans-Atlantic service, and it has been used largely by submarine cable companies for many years. Nothing could be more satisfactory than the enthusiastic letters from the proprietors of leading newspapers as to their experience with the Creed system. The apparatus, which was described in the Electrical Review in 1907 and 1908, is now capable of working at a maximum line speed of about 200 words per minute, and instances are cited in which it has run for periods up to eight hours without stopping, at 140 words a minute. It is gratifying to note that, as the high-speed telegraph was developed in this country, so we still lead the world in this respect.

"Records of Railway Interests in the War." Part I. British, August-December, 1914. London: *The Railway News*. 1s.—This publication contains portraits of the heads of our great railway systems, and tells much concerning the all-important part that they have been, and are being, called upon to perform in the transport of troops. Most interesting and excellent pictures are given showing the equipment of trains for conveying the wounded.

The Engineering Standards Committee has issued an interim report on British Standard Sizes of Single-Row Ball Journal Bearings for Automobiles (C.L. 2,582). The Committee is also dealing with the question of specifying suitable tolerances to be allowed, and a complete report will be issued at a later date. The report can be had gratis on receipt of postage 1d. from the Committee, 28, Victoria Street, S.W.

"A.E.S.E. Progress" is the title of the official organ of the Association of Electrical Station Engineers, of which the first number, dated January 15th, has been received; it will be issued monthly to the members. In a foreword the hon. secretary, Mr. W. J. Ebben, who appears to be the editor, points out that while for the present the active efforts of the Association to remedy the troubles of its members have necessarily ceased, at the close of the war there will be more men than jobs available, and a strong organisation is necessary to prevent the reduction of salaries. The journal is, therefore, intended to maintain interest in the Association, and to increase the membership. The attitude of the I.E.E. towards the A.E.S.E. is discussed by J. W. Thomas, a couple of short stories follow, and about half the journal is devoted to Association affairs and correspondence. It is a neat and creditable production, and should prove a valuable aid to the Association's work.

"*Journal* of the Institution of Electrical Engineers," Vol. 53, No. 240; January 15th, 1915.—This issue contains papers on "Automatic Protective Switchgear for Alternating-Current Systems," by E. B. Wedmore, and "Coal and its Economical Use," by P. S. Thompson. There is also a "First List" of over 600 Members of the Institution who are serving with the Colours.

Calendars and Diaries.—Mr. P. D. Morris, of 26, High Street, Islington, N., is sending out to his friends a refill pocket notebook on the multi-ring loose-leaf principle.

A celluloid pocket tablet from the Key Engineering Co., Ltd., of Trafford Park, bears a calendar for 1915 with metric and English measures at opposite edges.

From the Edison & Swan United Electric Light Co., Ltd., Ponder's End, we have received a neat metal stand containing a perpetual desk calendar. It is a handy little contrivance.

Messrs. Flowerdew & Co., engineering translators, &c., of 14, Bell Yard, Temple Bar, London, W.C., have prepared a wall calendar with monthly slips for 1915.

Catalogues and Lists.—Messrs. Alfred Herbert, Ltd., Coventry.—Sixteen-page illustrated price list of Carpenter taps and dies.

Electric Supplies Manufacturing Co., 24, Wilde Street, Liverpool.—Pamphlet giving illustrations and particulars of various designs of electric fires, and combined heaters and hot-plates.

Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, London, S.W.—New four-page leaflet (H 19 P/1) giving full description and tabulated prices of their D.C. motor control pillars.

Messrs. Mickelwright, Ltd., Alperton, Wembley.—Hanging card showing illustrations of the dimmers, rheostats, resistances and other lines which they manufacture.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Sixteen-page illustrated pamphlet (No. A 710), containing descriptions of their various types of loud-speaking marine telephones.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—20-page pamphlet (No. 20 D) containing a full description of the Peebles motor-converter and a list of users, also a comparison of same with rotaries and motor-generators.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C.—Leaflets dealing with the "Geekoduct" demon-grip continuity fittings, and electrical novelties in the shape of pocket lamps, torches and portable lamps and refills.

British Thomson-Houston Co., Ltd., Rugby.—New price leaflet No. 4,501—B giving particulars of B.T.H. lightning arresters for C.C. circuits; also descriptive list No. 3,120 (28 pages) containing full information relating to their A.C. switchboard panels for three-phase systems up to 6,600 volts, more than half of its pages being devoted to dimensional drawings and diagrams of connections.

Private Arrangements.—Felgate Installation Co., Ltd., Broadway Buildings, Station Road, Reading.—Pursuant to the provisions of the Companies' (Consolidation) Act, a meeting of the creditors of the above was held last week at the Reading Gas Co.'s Lecture Hall, Cross Street, Reading. It was stated that the company had passed the usual resolution in favour of voluntary liquidation, and had appointed Mr. A. G. West, C.A., of Market Place, Reading, to act as liquidator. According to the statement of affairs presented, the liabilities amounted to £2,115, of which £1,180 was due to the trade, and £426 to cash creditors, while there was an overdraft at the bank of £509. The assets were estimated to realise £674, and consisted of book debts £230, fixtures and fittings £70, stock as per balance-sheet of September 30th last £333, work in hand £31, rent receivable £5, and shares in an electrical company £5. No deficiency account had been prepared, but it was stated that the present position had been brought about through the war. A discussion took place as to the advisability of a joint liquidator being appointed, but eventually it was decided to confirm the voluntary liquidation, with Mr. West as the sole liquidator.

Liquidations.—The Hilsey Wireless Telegraph Co., Ltd.—This company is winding up voluntarily, with Mr. J. B. Edwards, of 25, Victoria Street, S.W., as liquidator. A meeting of creditors is called for January 23rd.

The Electric Stores, Ltd.—A meeting of creditors was held on Friday last (January 15th), at 204, Wolverhampton Street, Dudley (Worcs.).

Leitner Electrical Co., Ltd., Maybury, Woking. Mr. G. E. Corfield (with a committee of inspection) was appointed liquidator, December 23rd, 1914.

The General Electrolytic Parent Co., Ltd.—Particulars of claims must be sent by February 10th to the liquidator, Mr. J. Barron, of Middlewich, Chester.

Australia.—A firm already representing several British manufacturers wishes to take up agencies for the whole of the Commonwealth for dynamos and motors, accessories, cables and flexible wire, insulators, &c. The name of the firm can be ascertained at the Board of Trade C.I. Branch in London, and communications should be addressed to H.M. Trade Commissioner for Australia, Commerce House, Melbourne.

For Sale.—The Stretford U.D.C. invites tenders for the purchase of two 100-KW. engine and dynamo sets, particulars of which are given in our advertisement pages to-day.

Trade Announcement.—Mr. F. Marchant, electrician, has removed to 2, College Road, Bromley (Kent).

Bankruptcy Proceedings.—F. I. Behrens (F. Burns), electrical engineer, Barnsley.—Trustee (Mr. B. S. Briggs, Official Receiver, 21, King Street, Wakefield) released December 14th, 1914.

Albert Whiteley, electrical and mechanical engineer, Llandudno.—Receiving order made January 14th, on debtor's own petition.

J. W. Garsden (J. W. Garsden & Co.), electrical engineer, Blackburn.—Debtor's discharge suspended for one month, on July 6th, 1914.

J. Swanison (J. Swanison & Co.), electrical contractors, Manchester.—A first and final dividend of 10d. in the £, is payable on January 29th, at 27, Brazennose Street, Manchester.

LIGHTING and POWER NOTES.

Australia.—A scheme is being furthered by the N.S.W. Railway Department for the utilising of electric current in connection with the Sydney metropolitan tramway system, to provide illuminating power on several of the railway stations within the suburban section. At Petersham, Newtown, Ashfield, and other stations on the main suburban lines the fittings have already been put into position. The department, it is understood, also proposes at a later date to make use of electricity as an illuminant for the signal disks.—*Commonwealth Engineer.*

The Municipal Council of Manley, a suburb of Sydney, N.S.W., has decided to consider the question of resuming the Manley electricity works and running them for the benefit of the municipality.

The St. Leonards Council (Tas.) has decided to ascertain further particulars from the Launceston Council on the question of extending the electric light to St. Leonard's.—*Tenders.*

The result of the first year's working of the Port Melbourne municipal electricity undertaking with current supplied in bulk from the Melbourne City Council, shows receipts amounting to £2,512, and expenditure to £2,751. The number of private consumers is increasing every month, including several large industrial concerns attracted by the new tariff for power recently adopted.—*Melbourne Age.*

The Waverley Municipal Council has entered into an agreement with the Sydney Municipal Council for the supply of energy.

The Nunawding (Vic.) Council is floating a further loan of £5,000 for the extension of the electric lighting system, and a second scheme is to be undertaken as soon as the funds and equipment are available.

At Nuttagong (N.S.W.) a poll of the ratepayers resulted in favour of the proposed electricity supply and pumping scheme for the town. The scheme is estimated to cost £3,600.—*Tenders.*

Ballater.—E.L. Scheme Inaugurated.—On December 23rd last, the electric supply system at this Scotch holiday resort was inaugurated by Mr. Duncan, of Tillycorthie, who has taken a prominent part in the inception of the scheme. The cost of the installation, some £6,000 has been borne by Duncan's Electricity Supply Co., which is running the system for a period of years. The installation has been carried out by Messrs. T. C. Smith & Co., of Aberdeen, and includes at the generating station, two 68-B.H.P. Fielding & Platt suction gas engines driving 42-KW. B.E.P. dynamos, working in conjunction with a Chloride battery. There are about 100 street lamps, 40 of 50 C.P. and 60 of 25 C.P. each, and 120 private consumers, the total lamp connections being about 1,500. The Great North of Scotland Railway is understood to be going to wire its premises for 220 25-C.P. lamps. The distribution system is by means of overhead wires. Mr. Duncan, at a banquet held in honour of the event, expressed his regret that they should have had to use coal as fuel at their plant, owing to local opposition to the use of the ample water powers which were available in the neighbourhood. The charges for energy are 6d. per unit for lighting and 4d. per power.

Barnes.—The surveyor has informed the B.C. that in Limes Avenue where electric light is installed, the tenants wish to have gas stoves fixed, but the Gas Co.'s charges appear excessive. The electrical engineer was instructed to prepare a report and estimate for providing electric cookers.

Barnsley.—Proposed Loan.—The T.C. has agreed to apply to the L.G.B. for sanction to borrow £4,800 for electric lighting purposes.

Bawnboy (Co. Cavan).—Street Lighting.—The R.D.C. has accepted the Ballyconnell Electric Light and Power Co.'s tender for lighting the town.

Beccles.—Prov. Order.—The Public Lighting Committee of the T.C. has recommended that a prov. order be applied for, for street lighting by electricity and a special meeting of the Council is to consider the matter.

Bexley.—The West Kent Electric Co. has submitted to the U.D.C. a plan for an extension of the mains into Crayford parish, in order to supply the works of Messrs. Vickers. The proposed main will run from Eltham.

Bingley.—The U.D.C. has lodged an objection with the B. of T. against the proposed Keighley Corporation Electric Lighting Extension Order, so far as it affects East Morton, and a petition against the Yorkshire Electric Power Bill.

Bournemouth.—Reduced Tariff.—The Bournemouth and Poole Electricity Supply Co., Ltd., has reduced the price of current for lighting to 6d. per unit, as from the March quarterly readings of the meters.

Bury.—Bulk Supply.—The agreement by which the T.C. agrees to supply electricity in bulk to Heywood T.C. has now been completed.

Carlisle.—Restricted Hour Tariff.—At a meeting of the T.C. on the 12th inst., a resolution passed by the Electricity Committee that in the case of bulk supplies of energy under agreement, on the restricted hour system, the fixed charges be reduced from £4 5s. to 15s. per KW. of demand per annum, was referred back. A long discussion took place, in the course of which it was urged that such action by the Electricity Committee would lead to corresponding reductions by the Gas Committee, and result in loss all round.

Chesterfield.—The T.C. has reduced the charge for current for lighting in the Whittington district from 4½d. to 3¾d. per unit.

Chile.—A decree has been published approving the project presented by Don Federico Baechler for the installation of an electric lighting system in the town of Puente Alto, in the Department of La Victoria.

Colchester.—The T.C. has decided to augment the supply of current to the Lexden district by laying a further cable, at a cost of £235. This will enable the sub-station plant to be driven from the lighting mains instead of the tramway mains as at present.

Continental. — France. — In Paris, which has not yet been subjected to lighting restrictions to anything like the extent that London has, the military authorities have submitted proposals to the Government for diminishing the volume of outside and private lighting; this is also to apply to the suburbs of Paris, especially to the workshops where work is carried on night and day, and the light is visible from a distance.

Edinburgh.—Prov. Order.—The T.C. has approved of the Corporation Prov. Order, 1915, subject to a modification of one clause, in which the power to supply energy to lessees of new tramways has been abandoned.

At a recent meeting of the Merchants' Association, the T.C.'s proposal to trade in electrical fittings and open showrooms were keenly discussed, a deputation from the Contractors' Association attending. Mr. Stevenson, convener of the E.L. Committee, voiced the Corporation's views on the matter, pointing out that the proposal was not to sell anything or to do any wiring. He was convinced that there was a great future for hiring in the city, and that people would not hire from the individual trader.

Epsom.—School Lighting.—The U.D.C. has entered into an agreement with the College authorities for a three years' supply of current, on the following scale:—Minimum of 3,000 units, 4d. per unit; 3,000 to 6,000, 3½d.; 6,000 to 9,000, 3d.; 9,000 to 12,000, 2¾d.; as soon as the consumption arrives at a minimum of 12,000 units per annum, the charge to be on a flat rate of 3d.

Goring.—Failure of Supply.—Owing to a breakdown of the engines and to the water turbine becoming waterlogged the electric light supply has been stopped for more than a week.

Harrogate.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for permission to borrow £500 for electric service mains and a similar amount for transformers.

Holme.—Regarding the Bill of the Yorkshire E.P. Co., the U.D.C. has asked for an undertaking that the Bill will not hinder the Council or a local company from running its own E.L. plant.

Holmfirth.—Proposed Loan.—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow £7,500 for carrying out the electricity scheme.

Langport.—Prov. Order.—The R.D.C. has decided to lodge objections against the prov. order for E.L. being applied for by Messrs. Christy Bros., the area of supply of which includes the parishes of Compton, Dundon and Somerton.

London.—Islington.—Plant Extensions.—The B.C. is recommended to carry out extensions at the electricity works to meet the increasing demands for energy. The electrical engineer has prepared reports and estimates for additional plant, coal bunkers, &c., and Mr. Albion T. Snell, the Council's consulting engineer, is in agreement with the scheme, with slight alterations. The Lighting Committee recommends (1) the Council to apply for sanction to borrow £52,757, the estimated cost of the extensions; (2) that the Lighting Committee be authorised to proceed with the necessary works; and (3) that the amount of loan outstanding in respect of boilers to be displaced be repaid out of the reserve fund of the undertaking

LAMBETH.—ELECTRICITY CHARGES.—At a meeting of the B.C. on Thursday last week, the Finance Committee reported that it had had under consideration the circular letter of the South London Electric Supply Corporation, Ltd., in which the company gave notice of its intention to increase the charge for the supply of electrical energy for lighting purposes from 4½d. to 5½d. per unit, but to grant a rebate of ½d. per unit in cases where the corporation's supply was used as the only illuminant upon the premises. Certain members of the Committee met directors of the corporation in reference to the increased charge, who stated that proceedings had been instituted in the High Courts in respect of the proposals, and it was then thought inadvisable to pursue the matter further. At the hearing before Mr. Justice Eve, the corporation admitted that in granting the rebate referred to, it was acting in breach of the provisions of the Electric Lighting Act, 1882, and it was willing to submit to a declaration to that effect, whereupon Mr. Justice Eve made the declaration. Mr. F. Kinnaird inquired if it was not a fact that the Council and other consumers were paying 5½d. per unit, whilst others were paying 5d. or less. Councillor Hunt said they were not aware of any such cases.

The Poplar, Shoreditch and Stoke Newington B.C.'s and the Loughton U.D.C. are to petition against the London and District E.S. Bill and the London E.S. No. 2 Bill.

SHOREDITCH.—The B.C., on the recommendation of the Electricity Committee, has decided to establish a municipal rifle range on ground belonging to the electricity department. The cost for providing and equipping the range with butts, targets, &c., is estimated at £100; wiring, £10; and rifles, £15.

ST. PANCRAS.—LOAN BALANCES.—The L C C. Finance Sub-Committee has again taken up with the B.C. the reductions of the outstanding periods of the 42-year loans on the electricity plant, pointing out that the Treasury had written stating its view that not only must renewals and replacements be provided otherwise than by loan, but that it was desirable to accelerate repayment of any balance outstanding in respect of plant retained for occasional use, or spare on the installation of new machinery. The B.C. asked for a copy of the correspondence with the Treasury, and decided to adjourn the matter pending its receipt. The question for the B.C. was whether the new plant could be considered as a "renewal or replacement," and it was decided that it undoubtedly could not be so considered. The Council has already agreed to write off unpaid balances on six engines at Regent's Park station, superseded by a 5,000-KW. turbine.

The B.C. has been recommended to petition against the London Electricity Supply and the Supply (No. 2) Bills.

Lurgan.—The Council has decided to apply for powers for the transfer of the undertaking of the Lurgan Gas Light and Chemical Co., also to make further and better provision with regard to the supply of water and electricity.

Luton.—PROPOSED PLANT EXTENSIONS.—The electrical engineer reports that the new plant now being installed at the electricity works together with the existing plant will be barely sufficient to supply the demands, and that it will be necessary to make arrangements, at an early date, for purchasing further plant, at an estimated cost of £27,000, exclusive of the cost of any additional mains which may be required.

Oakworth.—The U.D.C. is to oppose the proposed Bill of the Yorkshire Electric Power Co.

Penistone.—WORKHOUSE LIGHTING.—The B. of G. has referred to Messrs. C. Hodgkinson and J. M. Marston as experts a draft agreement with the Yorkshire E.P. Co. for the supply of current to the workhouse for lighting and power.

Penketh.—In connection with the proposed electric light prov. order for the district, the Warrington Electricity Committee has asked the P.C. for the approximate number of houses in, and population of the parish.

Penshurst.—The P.C., after discussing the Electricity Extension Bill of the Tunbridge Wells T.C., has decided to oppose the application so far as Penshurst is concerned. The R.D.C. has agreed to the P.C.'s action.

Penryn.—E.L. SCHEME.—Mr. Rickard, a resident of the town, has applied to the T.C. for permission to erect steel poles for overhead wires through the town for the purpose of electric lighting. The matter has been referred to a Committee for consideration.

Rawdon.—PUBLIC LIGHTING.—The D.C. has received a letter from the Yorkshire Electric Power Co. asking to be given an opportunity of quoting for public lighting, and has asked for a quotation for the lighting of the Leeds and Otley Roads.

St. Helier.—E.L. SCHEME.—Steps are being taken to provide a supply of electricity for the district. A company, for this purpose, has been registered, and it is hoped to have a supply of current available by the end of the year.

Selby.—E.L. SCHEME.—The R.D.C. has decided to assent to the application of the Yorkshire E P. Co. for powers to extend the area of supply, so as to include the R D.C.'s district.

Sevenoaks.—The U.D.C. has decided to give notice to petition against the London and District Electricity Supply Bill.

Southampton.—The Electricity Committee has decided to purchase an air filtering apparatus in connection with the turbo-alternator at the electricity works.

South Africa.—The Worcester (Cape Province) municipality is inviting applications for its local loan of £15,000 to cover the expenditure on the proposed electric lighting scheme. Both the scheme and the loan are very popular.

The Cape Town City Council has decided to make a charge for connections to the electric light supply of £3 for the first 100 ft. plus the actual cost of labour and material required in providing any additional length. For several years it has been the custom to make free connections within 100 ft. of the supply mains. The cost of connection may if desired (in cases where within 100 ft.) be paid for in 12 monthly instalments of 5s.

Surrey.—The C.C. has decided to seek protective clauses in the prov. orders for E.L. being applied for by Mr. Gilbert Allom, for the parishes of Chipstead, Coulsdon, Woodmansterne, Banstead, Kingswood, and Walton-on-the-Hill.

Truro.—PROPOSED LOAN.—The T.C. has received the consent of the B. of T. to the proposed site for the generating station, and has decided to apply to the L.G.B. for a loan of £10,000 for carrying out the E.L. scheme. The period for which the order was granted expires next August.

Walsall.—PUBLIC LIGHTING.—The T.C. has adopted the recommendation of the General Purposes Committee to light a new thoroughfare with eight electric standards, each carrying three 50-C.P. metal lamps, at an inclusive contract rate of £2 14s. 6d. per annum. The gas department offered 320 C.P. per lamp, at £2 15s. per annum. A long discussion occurred in the Council, where it was pointed out that the desire was to obtain the best form of lighting, not necessarily the cheapest. Up to the present the electricity department's share in the street lighting has been 19 arc lamps, which are being converted to half-watt lamps, while the gas department has about 1.400 lamps, and, judging by the remarks made, the local gas lighting would appear to be so defective as to give no guarantee that the suggested 320 C.P. would be obtained. One speaker aptly remarked: "Eternal vigilance is the price of decent gaslight."

Wells.—PROV. ORDER.—The T.C. is recommended to oppose the application of Messrs. Christy Bros. for a prov. order. One of the grounds of opposition is that the proposed area of supply is too restricted.

West Ham.—ELECTRIC COOKING.—The Education Committee has been recommended to install electric grillers at the Rosetta Road School.

Woodford.—The U.D.C. has decided to withhold consent from the prov. order for E.L. being applied for by the County of London Electric Supply Co. Wanstead U.D.C. is also opposing it.

Whitstable.—The U.D.C. has decided to have the E.L. installed throughout the Council's offices. A specification is to be prepared, and tenders will be limited to local firms.

Windsor.—RESTRICTED LIGHTING.—On account of the restricted lighting order, the Windsor Electrical Installation Co. has reduced the Corporation's lighting account for the past quarter by £17.

Yorkshire Power Co.'s Bill.—At a conference of West Riding boroughs, held at Leeds, it was decided to oppose the Yorkshire Electric Power Co.'s proposed Bill.

TRAMWAY and RAILWAY NOTES.

Argentina.—BUENOS AIRES UNDERGROUND RAILWAY.—The Compagnie Générale de Tramways de Buenos Aires of Brussels reports that the first section of the underground railway of the Anglo-Argentine Tramways Co. in Buenos Aires was opened for traffic in December, 1913, the length being 4·2 miles. During the first nine months of working the average receipts, if applied to a whole year, would amount to £46,000 per km. per annum, as compared with £31,200 in Paris, £22,400 in London, and £47,200 per km. in New York. As a consequence of the financial crisis in Argentina the construction of the second underground section has been indefinitely postponed, although the hope is expressed that an extension of time will be granted by the authorities. The European war has reacted unfavourably on Argentina and a reduction in the working results of the tramways is held in prospect.

Australia.—The new tramway from Camberwell to Melbourne, *via* Richmond, is expected to be open for traffic next September. The work of construction is proceeding rapidly; tenders for the supply of rails have been received, and wherever possible substantial preference will be given to Australian manufactures and material in connection with the works.

The Fitzroy and Northcote (Vic.) municipalities have agreed to the construction of an electric tramway to connect with Preston.

Belfast.—NINE MONTHS' WORKING.—The report of the tramway working for the nine months ended December 31st shows a balance on net revenue account, after allowing for all fixed charges, of £20,133.

Bingley.—The U.D.C. proposes to apply to the B. of T. for a further extension of time for the construction of the tramway round Rishworth Hall corner.

Bury.—The Chamber of Commerce has decided to forward the following resolution to the Associated Chambers of Commerce :—"That in the opinion of this Association considerable commercial advantage would accrue through the utilisation of municipal tramways for the transit of goods, and recommends individual Chambers to exercise their influence to further this use."

Chile.—The German Electric Tramways Co. in Santiago de Chile has suspended operations owing to a disagreement with the local authorities, who have prevented it from charging double fares.

Dundee.—The Corporation Tramways Committee has sanctioned the expenditure of £1,565 on the laying of larger cables in certain roads, where the existing cables are said to have led to breakdowns

Fife.—The Dunfermline and Kirkcaldy District Committees of the County Council have decided not to oppose the Dunfermline and District Tramways Order.

Glasgow.—Opposition is to be offered by the T.C. to the proposed Caledonian Railway prov. order, which, among other matters, seeks powers to provide and work road vehicles. Correspondence has taken place with regard to the powers sought, and it has been reported to the Parliamentary Bills Committee of the T.C. that these, if passed, would adversely affect the tramway department, and are wider than those obtained in recent years by other railway companies, and that the Municipal Tramways Association, with the secretary of which the manager has been in communication, has on several occasions successfully opposed similar clauses.

Hindley.—RUNNING POWERS.—The U.D.C. has decided to allow the Wigan Corporation to run its cars over the lines leased by the Council to the South Lancashire Tramways Co., and to assist the Corporation to obtain the best possible terms. Such running is to cease unless the Corporation undertakes within three years to construct a new line from the terminus of the existing line to the Hindley boundary.

Hyde.—With a view to obtaining clauses for the protection of the borough, the T.C. is to petition against the proposed Bill of the Joint Tramways and Electricity Board, which provides for extension of tramways.

Mossley.—The T.C. has decided to recommend the Stalybridge Joint Board to include in its proposed Bill a clause to provide for the running of motor-'buses along Lees Road to connect with the tramways at Springhead.

Preston.—ANNUAL REPORT.—The receipts for the year ended March 31st last of the Corporation tramways were £45,946, an increase of £2,675 ; the gross balance fell from £9,023 to £6,340, owing chiefly to increased working expenses. Out of the net sum available £1,300 was contributed to the rates, leaving £2,551 to go to the reserve fund, instead of £5,374.

Southampton.—SIX MONTHS' WORKING.—Receipts on the tramways for the six months ending September last amount to £37,000, an increase of £702 as compared with the same period 12 months previously. To get this increase an extra mileage of 128,841 was run, and an extra 148,252 passengers carried, whilst the energy consumed shows an increase of 34,287 units. The receipts per car-mile showed a decrease of 1·385d. for the period under review.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Government is making arrangements to equip the trans-Continental railway works with four wireless plants, so as to enable the working parties to keep in touch with each other, and thus avoid delays in the exchange of instructions. The sets have been designed by the Commonwealth engineer for radiotelegraphy (Mr. Balsillie). Each will have a range of about 150 miles, but will rarely be required to work over 20 to 30 miles. They will be used chiefly at the head railway works. There is to be a truck fitted with wireless plant at the railhead on the Western Australian end of the line and another at the South Australian end. Several water-boring parties and other gangs of workmen are ahead of these points preparing the way for the construction of the earth works and the laying of the rails. Two wireless plants carried in motor-cars are to accompany these parties.—*The Age.*

Japan.—A Bill has been introduced in the Japanese Diet to provide a sum of £115,000 for a new submarine telegraph cable between Nagasaki, Japan and Tamsui, on the Island of Formosa. The new Budget also includes a sum of £1,500,000 for the extension of the telephone system in Japan.

The Telephone Service.—Several new exchanges in London are approaching completion, and an underground cable, costing over £100,000, is being laid between London and Brighton, which will provide junction lines sufficient to give a direct service without the formality and loss of time incurred by giving a trunk call. The improved service will also be extended to towns in the South of England as far as Bognor and Chichester.

United States.—The Compagnie Universelle de Telegraphie et de Téléphonie sans Fil has filed a petition in the New Jersey Courts against the German owners of the Tuckerton wireless station, claiming that an agreement was entered into whereby the property and patents of the defendants were to be turned over to the French firm in all countries except Germany. The German company failed to complete the agreement on account of the war. The wireless station is at present controlled by the United States Naval authorities.

CONTRACTS OPEN and CLOSED.

OPEN.

Aylesbury.—February 6th. U.D.C. Supply of electric motors to consumers (hire-purchase agreement). See "Official Notices" to-day.

Australia. — ADELAIDE. — February 10th. Testing instruments, for Postmaster-General. See "Official Notices" January 1st.

BRISBANE.—March 10th. Motor-generator, power board, &c., for Postmaster-General. See "Official Notices" January 15th.

BRISBANE.—(Extension of time to March 16th.) Common battery multiple switchboard and automatic or semi-automatic switchboard, &c., for the Deputy P.M.G.—*Board of Trade Journal.*

PERTH.—February 10th. Telephone switchboards and parts, for Postmaster-General. See "Official Notices" January 8th.

Melbourne, Brunswick and Coburg Tramways Trust.—February 24th. Special work, bonds, steel and wood poles, overhead materials, H.T. cable, trucks, and sub-station electrical equipment. March 10th. Car equipments (motors, &c.), car bodies, wheel guards. Specifications for each item, £2 2s. (returnable), from the office of the Engineer (Mr. Struan Robertson), Sydney Road, Coburg. Copies can be seen at the Board of Trade Commercial Intelligence Department in London.

Beckenham.—January 25th. U.D.C. One 120-KW. D.C. generator and switchgear to couple to 120-KW. steam alternator. See "Official Notices" January 8th.

Bolton. — February 11th. Corporation. Low-tension sub-station switchgear, for the Electricity Department. See "Official Notices" January 8th.

Bury.—January 30th. Extension to reinforced concrete retaining wall at the electricity generating station, Chamber Hall. Specifications, &c., from Mr. J. A. Settle, Borough Engineer.

Cardiff.—February 22nd. Installation, 750 points, at New Technical Institute, Cathay's Park, for the City Council. See "Official Notices" to-day.

Cheltenham. — January 30th. Corporation. Twelve months' supply of electric light fittings, &c. Forms of tender from Mr. J. S. Pickering, Borough Engineer.

Colchester. — February 6th. Corporation. Twelve months' supply of stores, including lighting fittings, car equipment, overhead equipment, cable, &c. See "Official Notices" to-day.

Croydon. — January 25th. General stores, for the Corporation Tramways Department, for a year. The Manager, Thornton Heath.

Darlington.—February 2nd. Corporation. Alternative tenders for 2,000-KW. and 3,000-KW. turbo-alternators ; separate tenders for condensing plant. See "Official Notices" January 15th.

Dundee.—February 1st. Corporation. Supply of 15-ton overhead travelling crane for Walton electric sub-station. Specification from Mr. H. Richardson, Engineer, Electricity Department.

Halifax.—February 15th. Corporation. Twelve months' supply of stores, including lighting fittings and electrical accessories, cables, telephone wire, meters, &c. See "Official Notices" to-day.

Hong Kong.—February 3rd. No. 5, steel structural work ; No. 6, coal-handling plant. Specifications, &c., £1 each (returnable), from Messrs. Preece, Cardew & Snell.

Larne.—January 29th. For lighting public streets and roads by electricity for three years from August 1st, by the U.D.C. Particulars from Mr. W. G. Younge, Clerk to the Council.

Leeds.—February 20th. Corporation. Twelve months' supply of stores, including cable, mains boxes and fittings, jointing and insulating material, electric lamps, fittings, &c., for Electric Lighting Department. See "Official Notices" to-day.

London.—L.C.C.—January 26th. Platelaying, &c., for electric tramway, Grove Road and Burdett Road, &c. Specifications, &c., from Mr. G. W. Humphreys, County Hall, Spring Gardens, S.W.

January 25th. Lighting installation (200 wiring points, 260 lighting points) at Exmouth Street Elementary School, Hampstead Road, N.W. See "Official Notices" January 15th.

January 26th. 10,000 or 5,000 driving and pony wheel tramcar tires. Specification, &c., from Chief Officer, L.C.C. Tramways, 62, Finsbury Pavement, E.C.

BERMONDSEY.—February 5th. B.C. Twelve months' supply of carbons and brushes, cable and jointing material, stoneware conduits, meters, demand indicators, main fuses, oils, meter boards, street frames, covers and joint-boxes. See "Official Notices" to-day.

Middleton.—Tenders are invited for coal required at the Corporation electricity works. Mr. Pauls, Electrical Engineer.

Newcastle-under-Lyme.—February 5th. Three-wire single, L.T. paper, lead-covered cable, armoured feeder and distributor mains, for the Electricity Department. See "Official Notices" to-day.

New Zealand.—WELLINGTON.—February 28th. Public Works Department. 18 step-down transformers, for the Lake Coleridge power scheme. Specification at the Public Offices, Wellington.

Portsmouth.—February 3rd. Corporation. Twelve months' supply of stoneware pipes, castings, street work, &c., for the Electricity Department. Forms of tender from the Electricity Station, Gun Wharf Road.

Redditch.—U.D.C. Two turbo-alternators, each 1,000 KW., with condensers, cooling tower, &c.; two synchronous motor-alternators of 300 KW. and 150 KW. respectively. See "Official Notices" January 8th.

Rochdale.—January 27th. Tramways Committee. Erection and completion of repair shops: (*a*) reinforced concrete foundations and car platform, (*b*) steelwork (steel frame) and (*c*) builders' work. Particulars from Mr. P. W. Hathaway, Town Hall.

Sheffield.—January 25th. Corporation Tramways. Tie-bars. Specifications, &c., 10s. (returnable), from Mr. W. J. Hadfield, Surveyor, Town Hall.

Tunbridge Wells.—January 26th. Cooling tower and pipework, two water-tube boilers, economisers, mechanical stokers, pipework, and feed heater, for Borough Electricity Works. See "Official Notices" January 1st.

Warrington.—January 29th. County Borough Education Committee. Electric lighting and bell installation at Oakwood Avenue Council School. See "Official Notices" to-day.

Wigan.—January 26th. Forty tons of street tramway rails, B.S.S. No. 3, and 200 cranked tie-bars. Mr. A. J. Gooseman, Borough Engineer.

Woodstock.—February 4th. Generating plant, switchboard, battery, wiring, lamps and fittings (120 points), for the Union Workhouse Guardians. See "Official Notices" January 15th.

CLOSED.

Ayr.—In connection with the new enteric fever block at Heathfield Hospital, the tender of Messrs. Reid & Co., Ayr, at £145, has been accepted for electric light installation work.

Heywood.—The T.C. has accepted the tender of Messrs. James Mills & Co. for electric motor and gas engine at Botany Bay sewage works.

Glasgow.—The T.C. Tramways Committee on Works and Stores has recommended acceptance of the following:—

Section pillar switches.—B.I. and Helsby Cables, Ltd.
Insulators for same.—Taylor, Tunnicliff & Co., Ltd.
·6 sq. in. V.I.R. cable.—B.I. and Helsby Cables, Ltd.
Conduit for Millerston Extension.—Albion Clay Co., Ltd.
Motor spirit.—James Ross & Co.; Oakbank Oil Co., Ltd.; Young's Paraffin Light and Mineral Oil Co., Ltd.; Broxburn Oil Co., Ltd.
Benzole.—Brotherton & Co., Ltd.

The T.C. Committee on Electricity received tenders for the supply of rotary converters to be put down in the Fairfield Engineering Works, Govan, and agreed to recommend acceptance of an offer by Messrs. Dick, Kerr & Co. for three 1,000-KW. sets and two 100-KW. sets, at £7,816, it being the lowest.

Hornsey.—The Council has accepted the following tenders:—

E.H.T. switchgear.—A. Reyrolle & Co., Ltd., £1,148. Eight firms and companies tendered.
L.T. generator and feeder switchboard.—Electric Construction Co., Ltd., £683. Nine firms and companies tendered.
E.H.T. cable.—Western Electric Co., Ltd., £1,093. Nine firms and companies tendered.

Chairman Moritz said that the tender for cable from a German firm was not given any consideration.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

WAR OFFICE.

Asbestos-cement sheet.—Bell's United Asbestos Co., Ltd.
Electric drills.—S. Wolf & Co., Ltd.
Electric lighting sets.—Austin Motors Co., Ltd.
Electric lamps.—Brimsdown Lamp Works, Ltd.; Cryselco, Ltd.; Dick, Kerr & Co., Ltd.; Omega Electric Lamp Co., Ltd.; Pope's Electric Lamp Co., Ltd.; Rugby Lamp Co.; "Z" Electric Lamp Mfg. Co., Ltd.
Telegraph equipment (leather goods).—J. Angus & Co.; Beckworths, Ltd.; G. G. Bussey & Co., Ltd.; Hathaway, Son & Co.; Hepburn, Gale and Ross, Ltd.; J. A. Jacobs & Co., Ltd.; T. Keave Lycett Saddle and Motor Accessories Co., Ltd.; McKinstry & Co.; Manufactures, Ltd.; Martins, Birmingham, Ltd.; Philpot & Sons; J. A. Pritchard; R. W. Stiby.
Wiring for electric lighting.—At Aghada Camp, Craig & Paton, Ltd.; Ballykinler Camp, W. Coates & Son, Ltd.; Clandeboye Camp, Craig and Paton, Ltd.; Curragh Camp, Maguire & Gatchell, Ltd.; Randalstown Camp, J. Robinson & Co.; Tipperary Camp, W. Coates & Son, Ltd.

CROWN AGENTS FOR THE COLONIES.

Cables and boxes.—British Insulated and Helsby Cables, Ltd.
Electric cranes.—Ransomes & Rapier, Ltd.
Electro-pneumatic hammer.—B. & S. Massey, Ltd.
Telegraph poles.—Bullers, Ltd.
Wireless telegraph apparatus.—Marconi's Wireless Telegraph Co.

INDIA OFFICE, STORE DEPARTMENT.

Cells.—Siemens Bros. & Co.
Dynamos.—J. Stone & Co.
Cable.—Siemens Bros. & Co., Ltd.
Motors.—Lancashire Dynamo Co.

POST OFFICE.

Laying lines of stoneware ducts.—At Ware (Watton Road), J. Mowlem and Co., Ltd.; Sheffield-Doncaster, Section 1, R. & T. Howarth; Section 2, J. W. Pearce.
Laying lines of cast-iron pipes, U troughing (with cables), and stoneware ducts.—At Hove, J. Mowlem & Co., Ltd.; at Sidcup, F. G. Brummell.
Laying lines of cast iron pipes and stoneware ducts.—East Barking Cemetery, F. G. Brummell; at Inverness Terrace, Bayswater Road, J. Mowlem & Co., Ltd.; at Waterloo, Liverpool, W. Pollitt & Co., Ltd.
Laying lines of cast and wrought-iron pipes and stoneware ducts.—Lower Clapton, N.E., G. J. Anderson; at Inverness, H. MacVinish; at Waltham Cross, W. Griffiths & Co., Ltd.
Laying lines of cast-iron pipes, steel tubes and stoneware ducts.—Finchley Road, N.W., D. R. Paterson, Ltd.; at Barking-Grays, J. Mowlem and Co.
Laying lines of stoneware ducts.—Victoria Street, Parliament Street, S.W., J. Mowlem & Co., Ltd.; Museum Exchange-Gray's Inn Road, O. C. Summers.
Laying lines of underground conduits.—At Shoreditch, Stepney, &c., O. C. Summers; at Fulham, &c., O. C. Summers; at Paddington and St. Marylebone, O. C. Summers; at Kensington, O. C. Summers; at St. Pancras, D. R. Paterson, Ltd.; at Hendon, Finchley, &c., O. C. Summers; at Camberwell, S.E., O. C. Summers; at Hammersmith, F. G. Brummell.
Manufacturing, supplying, drawing-in and jointing paper-core lead covered cables.—London-Colchester, Siemens Bros. & Co., Ltd.; Sheffield-Doncaster, Johnson & Phillips, Ltd.
Supplying and installing two motor-generators, controlling switchboard, cable, wire, &c., at the G.P.O. (West), E.C.—Mawdsleys, Ltd.
Installing electric lighting and power supply cable at Birmingham H.P.O. Extension.—G. E. Taylor & Co.
Installing electric light at Dublin P.O.—Grindlay, Ross & Co.
Telephone exchange extension equipment.—At Putney, S.W., Western Electric Co., Ltd.; at Brixton, S.W., Western Electric Co.; at Sevenoaks, Western Electric Co.
Protective apparatus.—British L. M. Ericsson Mfg. Co., Ltd.
Telegraphic apparatus.—Siemens Bros. & Co., Ltd.
Telephonic apparatus.—Automatic Telephone Mfg. Co.; British L. M. Ericsson Mfg. Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Western Electric Co.
Submarine cable.—India Rubber, Gutta Percha and Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Porous cells.—British Insulated and Helsby Cables, Ltd.; Siemens Bros. and Co., Ltd.
Cable distribution plugs.—Siemens Bros. & Co., Ltd.
Solder.—B.I. and Helsby Cables, Ltd.
Cable suspenders.—P. Huntington & Co.
Battery zincs.—Eyre Smelting Co.; Siemens Bros. & Co., Ltd.
Jointing bronze sleeves.—Dugard Bros.

London.—STEPNEY.—Lest any reader should imagine that the British Central Electrical Co., Ltd., is a French concern, we are asked to state that the word "France" appearing after the name of the company, on page 51 of our issue of January 8th, was merely intended to indicate that France was the country of origin of the carbons for which it quoted.

ISLINGTON.—Last month we reported the decision of the Lighting Committee to continue the existing contracts for the supply of goods and materials to the Electricity Department for a further period of 12 months, provided the contractors concerned gave their consent. The following firms have agreed to the Committee's proposal:—

Chamberlain & Hookham [illegible]
I.R., G.P. & Telegraph Works Co.—Ditto.
Crypto Co.—Ditto.
B.I. & Helsby Cables.—High and low tension cables.
W. Lucy & Co.—Service and network [illegible], &c. [illegible]
J. Gibb & Co., Ltd.—Ditto.
[illegible] Bitumen Co., Ltd.—[illegible]
British Electric Transformer Co., Ltd.—Transformers and accessories.
Dick [illegible] Co., Ltd.—[illegible]
J. Gibb & Co., Ltd.—Ditto.
A. [illegible]
Vacuum Oil Co.—Oil and lubricants.
First Anglo-Russian Oil Co.—Ditto.
J. Knowles & Co.—Earthenware pipes, &c.
Turner & Lisney, Ltd.—Ditto.
Doulton & Co., Ltd.—Ditto.

The under-mentioned contractors are prepared to continue their contracts, subject to an increase in price:—

General Electric Co.—[illegible]
[illegible]
[illegible]
Leeds [illegible]
B.I. & Helsby Cables.—Service and [illegible]
Callender's Cable [illegible]
Johnson & Phillips.—Transformers and [illegible]

In some cases contractors have expressed their unwillingness to continue their contracts, and the Committee proposes to purchase the goods or materials as and when required in the most favourable market. The Committee has decided to accept the offers of the above-mentioned contractors.

Newport (Mon.).—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, at £150, for a steam feed water heater and accessories.

Southampton.—The following tenders have been accepted by the Town Council :—

John Brown & Co.—48 steel tramway tires, at £15 10s. per ton.
B.I. and Helsby Cables, Ltd.—Three miles of tramway trolley wire, at 8¼d. per lb.

Sunderland.—The T.C. has accepted the following tenders :—

S. Z. de Ferranti, Ltd.—Meters.
B.I. and Helsby Cables.—Trifurcating boxes.

Watford.—The B. of G. has accepted the tender of Messrs. Rogers & Gowlett, Ltd., for the electric light installation at the new nursery block at the workhouse, at £33.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, January 22nd. At 8 p.m. At 39, Victoria Street. Paper on "Rotary Air Pumps," by Mr. A. Arnold.

Friday, January 29th. At 8 p.m. At 39, Victoria Street. Debate on "London's Future Electricity Supply," opened by Mr. P. C. Batstone.

(Sheffield and District Branch).—Friday, January 29th. At 8 p.m. At Cutler's Hall, Sheffield. Ordinary Meeting.

(Midland Section).—Saturday, January 30th. Social Evening.

Institution of Mechanical Engineers—Friday, January 22nd. At 8 p.m. At Storey's Gate, S.W. Paper on "Standardisation of Pipe Flanges and Flanged Fittings," by Mr. J. Dewrance.

Physical Society of London.—Friday, January 22nd. At 5 p.m. At Imperial College of Science, South Kensington. Paper on "Practical Harmonic Analysis," by Dr. A. Russell.

Royal Institution of Great Britain.—Saturday, January 23rd. At 3 p.m. At Albemarle Street, W. Lecture I on "Aerial Navigation—Scientific Principles," by Dr. R. T. Glazebrook, F.R.S. January 30th. Lecture II.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, January 23rd. At 4.30 p.m. At Royal Technical College, Glasgow. Joint Meeting with National Association of Colliery Managers. Paper on "Electricity at the Coal Face," by Mr. J. Bowman. After the meeting several Visual Signal Indicators will be exhibited.

(Notts. and Derby Branch).—Saturday, January 23rd. At 3.30 p.m. At University College, Nottingham. Ordinary meeting.

(Lancashire, Cheshire and North Staffordshire Branch).—Saturday, January 30th. At 6.30 p.m. At Grosvenor Hotel, Deansgate, Manchester. Presidential Address by Mr. B. Shaw, and paper on "Prevention of Electrical Accidents in Mines," by Mr. T. J. Nelson.

Association of Engineers-in-Charge.—Saturday, January 23rd. At 3 p.m. Visit to Messrs. D. Napier & Sons' Works, Acton Vale, W.

Saturday, January 30th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Discussion on "English *v.* German Superiority of Business Methods."

Royal Society of Arts.—Monday, January 25th. At 8 p.m. At John Street, Adelphi, W.C. Cantor Lecture (II) on "Oils, their Production and Manufacture," by Dr. F. Mollwo Perkin.

Institution of Civil Engineers.—Tuesday, January 26th. At 8 p.m. At Great George Street, S.W. Discussion on "The Lateral Pressure and Resistance of Clay, and the Supporting Power of Clay Foundations," opened by Mr. A. L. Bell.

Wireless Society of London.—Tuesday, January 26th. At 8 p.m. At the Institution of Electrical Engineers. Presidential address, by Mr. A. A. Campbell Swinton on "Some Electrical Phenomena—Illustrated by Experiments." Members of the I.E.E. of all classes are invited to attend.

Institution of Electrical Engineers.—Thursday, January 28th. At 8 p.m. At Victoria Embankment, W.C. Sixth Kelvin Lecture on "Lord Kelvin's Work on Gyrostatics," by Prof. A. Gray, F.R.S.

(Manchester Local Section).—Tuesday, January 26th. At 7.30 p.m. At Engineers' Club, 17, Albert Square. Paper on "Electric Steel-Making Furnaces," by Mr. T. D. Robertson.

(Birmingham Local Section).—Friday, January 29th. At 7.30 p.m. At University, Edmund Street. Lecture on "Kelvin's Work on Gyrostatics," by Prof. A. Gray, F.R.S.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 29th. At 7.30 p.m. At Bolbec Hall, Newcastle. Ordinary Meeting.

(Graduates' Section).—Saturday, January 30th. At 7.15 p.m. At Bolbec Hall. Paper on "Some Notes on Ship Resistance," by Mr. A. P. Patterson.

NOTES.

Educational.—On Monday the Manchester Educational Authority opened a new junior day technical school for boys between the ages of 13 and 16 who desire to enter the electrical engineering, building, or allied trades. The school, which is at Newton Heath, is a new feature in local education, and about 40 students have passed the entrance examination. A second school is to be opened in Openshaw, another industrial district, at Easter.

Singular Electric Blasting Accident.—An accident unique in the history of electric blasting occurred on the Rand on December 12th at the City Deep circular shaft, resulting in the deaths of two white men and two natives, and the severe injury of a third native, whilst two other natives were badly shaken. The European victims were Messrs. R. Kenny, leading sinker, and J. Lawson, his helper. They were leaving the bottom of the shaft at 6.30 a.m., after having connected up the round of holes ready for blasting, and the sinking bucket in which they were being hoisted had reached a spot about 20 ft. from the bottom when the whole round of holes went off. The force of the explosion blew the bucket and its occupants on to the platform about 50 ft. above them. In the ordinary way the men would have been hoisted to the surface, and, after the usual precautions to ascertain that all the men had left the shaft, the connected holes would have been fired by the switch on the surface. The accepted explanation of the terrible accident is that a fierce flash of lightning during a thunderstorm, which was raging at the time, struck the ropes of the skip or the guide ropes, and that these acted as a conductor connecting with the cable or the wires at the bottom of the shaft. This shaft is known as No. 3, the big circular ventilating shaft, and is now nearing completion. It may be remembered that in the discussion that took place some time ago on the subject of electric blasting on the Rand the possibility of accident from this cause was pointed out.—*South African Mining Journal.*

In a letter to the editor of the *Journal*, "A. J. K." says :—The defunct J. Lawson mentioned at the accident at the City Deep was (I am almost sure) a miner at Jagersfontein at the time (October, November, December, 1900,) Jagersfontein was in a state of siege. Mines were set at certain strategic points, to be blasted on emergency by electricity. The insulated wire that should have been used for the connections was not then procurable. On four separate occasions, with my own eyes I saw four of these mines exploded. The flash most probably did not strike directly on the wires, but certainly may—or did—have set up some sympathetic current in the earth itself. But the flash certainly caused the explosions. J. Lawson must have known this. On the other hand, he was at the bottom of a shaft, of which the depth is not recorded. In such weather as has been obtaining of late, those wires should not have been allowed to protrude at the surface. Either they should have been stationed some 20 to 30 ft. from the surface, or the miner should have unwound them off a reel in the act of ascending—or, failing these precautions, he should have been warned from the surface that thunder conditions existed. Lawson, with his experience, would never have been killed from a cause of which he well knew the danger.

Institution and Lecture Notes.—**Institution of Electrical Engineers** (YORKSHIRE LOCAL SECTION).—At the meeting on Wednesday last week, Mr. E. B. Wedmore read his paper on "Automatic Protective Switchgear for Alternating Current Systems." The discussion was closed.

Swansea and District Institute of Engineers.—A paper entitled "Invisible Light Waves" was to be read by Mr. A. L. Stanton, yesterday, in which X-ray equipments and their operation were specially treated with a view to assisting members of the medical profession.

Electrical Association of N.S.W.—The last meeting of the Electrical Association of New South Wales was held in Sydney on November 13th. The Association will in future be known as the N.S.W. Section of the Electrical Association of Australia. The annual report, referring to the licensing of wiremen, stated that rules had been drafted for the purpose, and it was expected that they would come into operation at the beginning of the new year. The Council placed on record the continued and valuable services given to the Association by the hon. secretary (Mr. F. W. McAlister) and the hon. treasurer (Mr. G. R. Hodson). The balance-sheet showed a credit balance of £156.

Mr. W. H. Myers, who has been elected first President of the N.S.W. Section, has been a strong advocate of the federation of the electrical associations throughout the Commonwealth, and the basis upon which the amalgamation was arranged was largely along the lines of the scheme put forward by him. Mr. Myers is an assistant engineer in the N.S.W. Government tramways department.

Mr. R. Vine Hall, mains superintendent of the Sydney City Council, has been awarded the N.S.W. Electrical Association's Rooke premium for the best paper read during the session just concluded, the subject being "Distribution of Energy by Overhead Mains."—*Commonwealth Engineer.*

Mr. Donald S. Munro delivered a lecture on "Modern Electrical Wiring," on Saturday last, to the Scientific Society of the Royal Technical College, Edinburgh. Examples of a new method of wiring devised by Mr. Munro were exhibited.

Mr. Bernard Price has been elected President of the SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS for the year 1915.—*South African Mining Journal.*

Disinfection by Electrolysis.—According to the *Hospital* very satisfactory results have been obtained at Bexley Mental Hospital with hypochlorite of soda produced by the electrolysis of a 4 per cent. solution of common salt in water. The electrolytic tanks take 10 amperes D.C. at 220 volts, and the output is 12 gallons of hypochlorite solution per hour, which is diluted with nine times its volume of water before use in the laundry. Dr. Faulks, assistant medical superintendent, states that the solution is effective in destroying micro-organisms and removing stains, and does not injure textile fabrics appreciably.

Appointments Vacant.—Switchboard attendant (30s.) for Kendal Corporation ; sub-station superintendent (£200) for Salford Electricity Department ; assistant for testing and calibrating mercury motor meters (during war only) for Edinburgh Corporation ; fitter-driver (35s.) for Severalls Asylum, Colchester ; senior switchboard attendant (37s. 6d.) for Salford Electricity Department ; fitter-driver (£2 2s.) and switchboard attendant (35s.) for Clacton U D.C. ; switchboard attendant (27s. 6d.) for Electricity Works, Lancaster. Particulars are given in our advertisement pages.

Late Legal.—Pneumatic Bell Dispute.—In the City of London Court on 19th inst., before his Honour Judge Rentoul, K.C., the London Pneumatic Tube Co. made a claim against Veritys, Ltd., for £3 16s. for making a pneumatic Ambulance bell with a 12-in. gong for them. Mr. Clark, who was the plaintiff, said that on September 16th defendants wrote and said they wanted an ambulance bell for their Bristol house. He saw the defendants' manager and told him the bell would have to be specially made. Defendants' manager said they wanted the bell to act similarly to the bells attached to the City of London Police Ambulances, only those were electric, whereas the bell ordered was to be worked by the driver, their cars having no electricity. Defendants asked for an estimate, and he said it would be £3 16s. Then the defendants asked for a blue print, but he said he must design the bell, and he could not give him a blue print without it was regarded as a definite order. Defendants gave him a definite order, and later on wanted to cancel it, which he would not agree to, as he had done half the work. He had had to pay 18s. for a gong, and he designed the striking arrangements.—Mr. Kenelm Preedy, defendants' counsel, said that their Bristol House found that their customer would not go into the matter further. They then told the plaintiffs the order must be regarded as cancelled. The firm order was subject to the approval of the blue print, and it was not approved.—Mr. Clark said there was nothing of that in the correspondence or in the conversations.—Judge Rentoul, K.C., said that the defendants could not play tricks with the plaintiffs as they had done. It was a provisional order, and if the defendants got the order from Bristol then the plaintiffs would get the order. It was necessary to buy a 12-in. gong.—Mr. Clark said he could not have got on without it. He bought it of Barwell's, of Birmingham. He had never seen one before, and he hoped never to see another.—Defendants called a witness, who said that the plaintiffs were told it was a provisional order. It was a new idea, and they only made an inquiry of the plaintiffs. Plaintiffs need not have bought a gong. Defendants referred the matter to their Bristol House. "Blue print to be approved before proceeding," was on the order.—Mr. Clark said that was done after the firm order was given.—Judge Rentoul thought there had been a serious misunderstanding between the parties. He gave judgment for the defendants without costs.

Attorney-General at the Relation of the Ilford Gas Co. *v.* the Ilford Urban District Council.—This action, by which the plaintiffs sought declarations and injunctions in respect of alleged *ultra vires* acts committed by the defendants in connection with their electric light supply, was settled before Mr. Justice Sargant on Wednesday, January 20th.

Mr. Mark Romer, K.C., who represented the plaintiffs, said that the defendants had agreed to submit to judgment, but they sought to impose certain terms and conditions which the plaintiffs were not prepared to accept. The action might be divided into two parts, one relating to the method by which the Council carried on its electric lighting business, and the other to preferential rates it was alleged they were giving to certain consumers. With regard to the first, the plaintiffs asked for a declaration that the plaintiffs were acting *ultra vires* in carrying on the business of supplying electric lamps, motors and appliances, and in having a showroom for the exhibition of such goods. There was no longer any question that the Council were not entitled to carry on that business, and they did not oppose a declaration to that effect, but the plaintiffs asked for an injunction to restrain them from doing any acts under contracts made in connection with that business. With regard to the second part, which related to the alleged undue preference under the Electric Lighting Acts, there was no question now, having regard to a recent decision of the Court of Appeal, that the new tariff which the defendants proposed to set up was *ultra vires*, because they were favouring the owners of premises which were electrically lighted throughout. The defendants were willing to submit to the declaration the plaintiffs asked for ; with respect to that the plaintiffs proposed merely to take the declaration with liberty to apply for an injunction if necessary. With regard to the other part of the case, the defendants said that they having entered into a number of contracts for the supply of flame arc lamps, electric motors and wiring, they were willing to submit to a declaration that such matters were *ultra vires*, but they wanted the plaintiffs to agree not to apply for any injunction in respect of anything done in connection with the agreements that were in force at the present date for a period of 12 months. The plaintiffs, of course, could not consent to anything of the sort. They were willing to assent to three months, but that the defendants said would not do.

His Lordship asked what was the length of these arrangements.

Mr. Romer said he did not know, but there could be no question that they were all *ultra vires*.

Mr. Martelli, K.C., who represented the defendants, said that some were for a year and some were for longer. He was quite willing to submit to a declaration that all these matters were *ultra vires*, and the only question was how long his Lordship would give the defendants to make the best terms they could with those they had contracted with, some of these contracts having many years to run, some five years and some only one year : if the Council were merely to take possession of the motors which were working under the hiring agreements, works would have to be shut down, and a number of people thrown out of employment. There might be considerable difficulty in getting back those arc lamps and motors, with the loss to them of several thousands of pounds, which the councillors might have surcharged against them. It was quite impossible for the users of these arc lamps to make other arrangements, presumably with the Gas Co., for some little time.

Mr. Romer said he could not accept the defendants' statements as to the agreements.

Mr. Martelli said he desired to state quite frankly what the position of the Council was. They took the view that the sale of these arc lamps and motors would not be carrying on a business that was *ultra vires*, and they intended to sell them if they could in order to cut their loss.

His Lordship said that if an injunction was applied for merely because the Council had sold these lamps to a customer who had had them under a hiring agreement, he did not think he should grant it.

Mr. Martelli said that after that expression of opinion, and as no injunction was being asked for, he would leave the matter where it was.

His Lordship : Then I will make the declarations asked for, with liberty to the plaintiffs to apply for an injunction if necessary, and the defendants must pay the costs of the action.

Inquiries.—Makers of black ivoride sheets, "Comstick" dressing for commutators, and automatic staircase switches that switch off after two minutes, are asked for.

University of Hong-Kong.—Not the least remarkable result of the European conflagration has been the demonstration of affection and loyalty which it has called forth from India and this Colony. In the remote island of Hong-Kong the local Chinese have already come forward splendidly, and, together with the British residents, have provided nearly £30,000 for the Prince of Wales's Fund. Nearly all of the British firms, with headquarters in Hong-Kong, have subscribed to the London fund direct, so that the above sum may be considered to come from the residents of the Colony, the very large majority of whom are Chinese. The University of Hong-Kong, which, as our readers know, is entirely equipped with British machinery presented by home firms, has organised a day of demonstration of apparatus, &c., and the students' Union has taken the matter up so energetically that many hundreds of visitors are expected. The charge for admission will go, together with students' subscriptions, direct to the Prince of Wales's Fund. Our readers will also be interested to know that at the outbreak of the war the whole of the members of the Engineering staff volunteered to run night shifts on the local searchlights, so as to enable some of the R.E.'s to go to the front. "Business as usual" has been carried on at the University, despite the night work at the forts.

The Electrical Industry in France.—With the issue for January 2nd our esteemed contemporary, *La Lumière Electrique*, announces that after an enforced cessation of activity due to the loss of the greater part of its staff on account of the mobilisation, it has succeeded in reorganising its arrangements and resuming publication. Tendering our congratulations and good wishes, we add the hope that the valuable services which the journal renders to the electrical industry may never again be interrupted, and that its former prosperity may soon be restored.

The course of events in the financial world since July is reviewed in a special article, and a long list is given of German and Austrian electrical concerns in France over whose affairs control was assumed by the Government.

Copper Famine in Sweden.—According to a wire from Gothenburg it seems that the Swedish State has very great difficulties in getting the necessary supplies of copper for various purposes, on account of the stoppage of the import of the mineral. The telegraph department has been obliged to discontinue the erection of new telegraph and telephone lines because there is a lack of cables and wires. Private industry, and the electrical industry in particular, suffers also from lack of copper, and this applies especially to the large electrical plants at Trollhättan, where the stocks of copper seem to have been nearly exhausted. On the other hand, the United States official returns show that the amount of copper imported from America into Sweden has enormously increased in comparison with previous years. Of course, Sweden would not dream of selling copper to Germany, where the copper famine is said to be even more severe.

Guaranteed Wiring.—At the meeting of the Council of the Electrical Contractors' Association, Incorporated, held at Leeds on Friday last, the 15th inst., it was decided to adopt the guarantee scheme (which has been before the Association for the best part of two years) in its entirety. The scheme, which provides that the Association, as a whole, shall guarantee the wiring work of each of its members individually up to a certain specified amount, will come into force on October 1st of this year. The general indemnity, which is extended to any employer of one of the Association's members, is subject to certain limits and conditions, copies of which will shortly be obtainable from the Secretary upon application. The standard adopted will be practically in accordance with the rules issued by the Institution of Electrical Engineers. It is believed that the effect of this guarantee will be very far-reaching, and that it will remove for ever, as far as the E.C.A. is concerned, the accusation that electric wiring contractors are essentially shoddy workers.

Fatalities.—HEBBURN.—An inquest was held at Hebburn on January 12th on the body of Leslie Oliver Hunt (18), an apprentice electrician, who sustained fatal injuries while following his employment at the works of Messrs. Reyrolle on 6th inst. Deceased, it was stated, received instructions to examine and report respecting an electric lift, and after setting the lift in motion put his head inside the protecting bars, with the result that a counterweight descended upon his head and crushed it. It was further stated that it was unnecessary to act as deceased had done to examine the lift, but the firm undertook, as a further protection, to construct a screen at one end of the lift. A verdict of "Accidental death" was returned.

CAMBUSLANG.—In Gateside Colliery, Peter McCourt, a miner, who was working an electrically-driven coal-cutting machine, was caught in the machinery and sustained fatal injuries.

GLASGOW.—It is reported that whilst fitting up electric wires in a warship at Fairfield Dock, on 12th inst., James Aitken, electrician, aged 44, fell backward, striking an iron guard, and was killed.

KIDSGROVE.—On 14th inst. an inquest was held into the cause of death of William Holley, aged 29 years, who died on 8th inst. as the result of an electric shock received at Birchenwood Colliery. The general manager of the colliery (Mr. Allott) said that the deceased was working as a labourer with the boiler smiths who were repairing the quenching machine on No. 1 coking plant. The machine had five fixed electric lights, 100 volts each, arranged in series, and the current was taken from one phase of the power supply (500 volts A.C.) to the motor operating the machine. Light was taken from the power circuit because the machine was a travelling one. It was understood that the lights were not to be interfered with. According to the *Stafford Sentinel*, Mr. Allott said that in order to provide light for the purpose of completing the repairs, current was brought from the 110 and 120-volt lighting mains 30 yd. away. The electricians fixed two lights by which the boilersmiths could see during the night. In the afternoon a fitter engaged on another part of the machine gave instructions to a youth to fix an extension on to one of the five lights, thinking that because each lamp was at 100 volts the current was at that pressure. Later the deceased handled this particular light, and received a shock from which he died. After other evidence had been heard, the jury returned a verdict of "Accidental death."

Electricity Supply Rifle League.—As a large percentage of the members of the above League are now serving with the Army at home and abroad, the matches between the various clubs composing the League have been postponed. Information is to hand that there are new clubs formed and in process of formation in connection with electricity works, and as some of the League clubs are in a position to arrange friendly matches, such new clubs are requested to get into communication with the League secretary, Mr. E. Mathews, at 306, Mare Street, Hackney, who will be pleased to put them into communication with those clubs who are open for fixtures.

The annual meeting and dinner have been abandoned for this year, but should circumstances permit of a resumption of contests later in the season a meeting will be called to arrange for them.

Some of the League clubs' ranges have been handed over to the military authorities, whilst others are doing good work in connection with local enthusiasts who are patronising the club ranges and taking advantage of the instruction offered by members of the various clubs.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On January 13th at St. Cuthbert's Church, Sprowston, CAPTAIN G. G. EWER, A.M.I.E.E., 7th Battalion Essex Regiment, was married to Miss Amy Liell Willett, eldest daughter of Captain W. A. Willett, of Leigh-on-Sea. The officers and men of F Company were present at the service, and afterwards formed a guard of honour outside the church. Captain Ewer, who, in normal times, is sales engineer to the Stepney Borough Council electricity department, has been serving with his regiment on the East Coast since the outbreak of war.

The *Commonwealth Engineer* states that MR. E. E. STARK, who for several years past has been city electrical engineer at Dunedin, N.Z., has resigned his position. Mr. Stark originally went to New Zealand from America as engineer for the Waipori Falls power scheme, and, on the retirement of Mr. Goodman as city electrical engineer, Dunedin, to occupy his present position with the Adelaide Municipal Tramway Trust, Mr. Stark succeeded him.

The Bury Electricity Committee has advanced the salary of MR. JOHN MURRAY, chief shift engineer.

The Sunderland T.C. has granted the following increases in salary in the electricity and lighting department:—Chief assistant, from £275 to £300 per annum; works superintendent, £250 to £275 per annum; four shift engineers, £156 to £169 per annum; clerk, £91 to £97 10s., and at the end of 12 months £104.

The Salford Electricity Committee has appointed MR. J. COLLINGE as station superintendent at his present salary.

MR. A. BROWN, chief assistant engineer at the King's Lynn municipal electricity works, has tendered his resignation, he having secured another appointment.

MR. W. A. BROWN, distributing engineer at the St. Pancras electricity works, has resigned his appointment, and will receive a testimonial under the Borough Council's seal in respect of his 17 years' service.

MR. P. J. S. TIDDEMAN, manager of the Llanelly and District E.L. and Traction Co., Ltd., who has received a similar appointment at Carlisle, has been presented by the employés with a bicycle.

MR. JOHN A. PARKER, chief assistant of the Greenock electricity works, has been appointed chief assistant of the Croydon electricity works. There were 187 applicants for the position.

Tramway Officials.—MR. ERNEST JORDAN has been appointed station engineer of the Northampton Corporation Tramways, as from December 1st last. Mr. Jordan was previously assistant engineer and formerly with Messrs. Cammell, Laird and Co., Ltd., of Sheffield.

General.—MR. ALFRED LONGDEN, Assistant Superintending Engineer of the North-Eastern District, has just retired after 45 years' service in the Post Office Engineering Department. A farewell smoker was held at Leeds recently, attended by representatives from the Engineer-in-Chief's office in London, and the principal district officers, and Mr. Longden was then presented with a clock and vases, and Mrs. Longden with a handbag. Mr. T. B. Johnson, Superintending Engineer, made the presentation.

MESSRS. A. A. DIRCKS, electrical engineer for Victoria in the Postmaster-General's Department, G. H. MORGAN, Telephone Manager, Melbourne, and S. L. MONAGHAN, Assistant Telephone Manager, Sydney, who have been investigating telephone traffic requirements in America and the United Kingdom, have returned to Australia.

On Monday next at St. Paul's Church, Whitley Bay, the marriage will take place of MR. GEORGE G. L. PREECE, branch manager in Manchester for Messrs. Bruce Peebles & Co., Ltd., to Miss May Bowie, of Newcastle-on-Tyne, fifth daughter of the late John Bowie. Mr. and Mrs. Preece will reside at Seddon Road, Hale, Cheshire. We are sure that Mr. Preece's many friends in the electrical world, including his former associates at Messrs. Glover's, at Trafford Park, will join with us in congratulating him, and in wishing him and his wife that is to be long-continued happiness.

Obituary.—The death has occurred at Eastney Barracks, Portsmouth, of LANCE-SERGEANT FRANK TOON, of the Royal Marine Artillery. Some years ago deceased was apprenticed as electrician at Shirebrook Colliery. Later he enlisted in the Royal Marine Artillery. After various voyages he was appointed head electrician in the Eastney Barracks. A verdict of "Death from gas poisoning" was returned.

NEW COMPANIES REGISTERED.

W. E. Raybould & Co., Ltd. (138,934).—This company was registered on January 8th, with a capital of £250 in £1 shares, to carry on the business of electric lighting, heating and telephone engineers, suppliers and fixers of electric lighting sets, petrol lighting and private telephone installations, sub-contractors for gas lighting and heating, and hot-water heating, dealers in, contractors for, and constructors of, electrical work, &c., and to adopt an agreement with W. A. Raybould. The subscribers (with five shares each) are:—W. A. Raybould, Theatre Chambers, Babington Lane, Derby, incorporated insurance broker; W. E. Raybould, Jacksons Chambers, St. Peter's Street, Derby, electrician. Private company. The number of directors is not to be less than two or more than five; the first are W. A. Raybould (secretary), and W. E. Raybould; qualification, five shares. Registered office, Jacksons Chambers, St. Peter's Street, Derby.

Stanley Goodwin & Co., Ltd. (138,998).—This company was registered on January 14th, with a capital of £500 in £1 shares, to take over the business of mechanical and electrical engineers carried on by S. Goodwin and W. T. Keetley, at Glebe Street, Stoke-upon-Trent, as "Stanley Goodwin and Keetley." The subscribers (with one share each) are:—S. Goodwin, Victoria Square, Henley, electrical engineer; W. T. Keetley, 10, Riseley Road, Hartshill, Stoke-upon-Trent, electrical engineer. Private company. The first directors are not named; qualification, 50 shares. Solicitor, F. Collis, Stoke-upon-Trent.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Veritys, Ltd.—Capital, £210,000 in 7,000 5 per cent. first pref. 7,000 6 per cent. second pref. and 6,980 ord. shares of £10 each, and 200 management shares of £1 each. Return dated May 14th, 1914. 7,000 first pref., 7,000 second pref., 6,692 ord. and 200 management shares taken up. £10 per share called up on 4,670 first pref., 7,000 second pref. and 2,492 ord. shares and £1 per share on 30 management shares. 170 management, 2,330 first pref. and 4,200 ord. shares considered as fully paid. Mortgages and charges: £61,400. Two returns of allotments made up to June 11th and July 28th, 1914, show a further 45 ord. and 243 ord. shares allotted for cash respectively.

James Keith & Blackman Co., Ltd.—A memorandum of satisfaction in full (*a*) on May 15th, 1914, of first debs. dated March 10th, 1903, securing £100, and (*b*) on November 26th, of second debs., dated February 9th, 1914, securing £200, has been filed.

Torquay Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £200 on September 29th, and £200 on November 6th, 1914, of charge dated March 8th, 1911, securing £60,000 has been filed.

Maxim Lamp Works, Ltd.—Debenture dated January 1st, 1915, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Imperial United Lamp Co., Ltd., Caxton House, Westminster, S.W.

James Keith & Blackman Co., Ltd.—Issue on January 7th, 1915, of £100 1st and £350 2nd debentures, parts of a series of which particulars have already been filed.

Brilliant Arc Lamp and Engineering Co., Ltd.—Issue on December 22nd, 1914, of £40 debentures, part of a series of which particulars have already been filed.

Prismatic Art Sign, Ltd.—Particulars of £1,000 debs., created January 4th, 1814, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Printex Accumulator Co., Ltd.—Debenture dated January 1st, to secure £500, charged on company's undertaking and property, present and future. Holder: T. B. Batchelor, Hopwood, Alvechurch, Worcester.

Musselburgh and District Electric Light and Traction Co., Ltd.—A memorandum of satisfaction to the extent of £200 on December 18th and £500 on December 31st, 1914, of charges dated November 13th, 1905, and May 11th, 1909, securing £90,000, has been filed.

City of Oxford Electric Tramway, Ltd.—A memorandum of satisfaction to the extent of £1,000 on December 21st, of charge dated February 20th, 1914, securing £46,000, has been filed.

CITY NOTES.

British Columbia Electric Railway Co., Ltd.—A dividend at the rate of 5 per cent. per annum on the 5 per cent. preferred ordinary stock for the half-year ended December 31st is to be paid.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. on the ordinary capital.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—The directors report for 1914 a net income, after providing for repairs, maintenance and debenture interest, and including £5,521 brought forward, of £32,045. A dividend of 6 per cent. on the preference shares, as against 4 per cent. for the previous year, is to be paid, placing £8,512 to depreciation renewals reserve fund, and carrying £10,725 forward.

Dublin United Tramways Co. (1896), Ltd.—After setting aside £18 000 towards renewal of rails and placing £5,000 to reserve and renewal fund, a further dividend of 2½ per cent. on the ordinary shares, making 5 per cent. for the year, is recommended; £11,366 is to be carried forward.

Montreal Light, Heat and Power Co., Ltd.—A dividend of 2½ per cent. on the paid-up capital stock, being at the rate of 10 per cent. per annum, is recommended for the quarter ended January 31st.

Anglo-American Telegraph Co., Ltd.—The directors announce a balance dividend of £1 10s. per cent. upon the ordinary consolidated stock for the year December 31st, 1914, less income-tax at 1s. 9¾d. in the £; a balance dividend of £1 10s. per cent. upon the preferred stock for the year, less income-tax at 2s. 1d. in the £; a first and final dividend of £1 10s. per cent. upon the deferred stock for the year, less income-tax at 1s. 6½d. in the £. The above dividends, which are payable on February 1st, together with those already paid, will amount to £3 15s. per cent. on the ordinary consolidated stock, £6 per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock.

Paris Compressed Air Co.—The Compagnie Parisienne de l'Air Comprimé (Popp), whose electric lighting business was transferred to the Compagnie Parisienne de Distribution d'Electricité on January 1st, 1914, now solely carries on the compressed air branch, although it holds 48,651 shares in the latter company and 6,000 shares in the supply company known as the Ouest Lumière. During the year ended on June 30th, 1914, the Popp company's revenue from electricity supply and electrical investments experienced a decrease as compared with the preceding year, whereas the compressed air department had an increase. After placing £63,000 to depreciation, the accounts show net profits amounting to £187,000, as contrasted with £207,000 in 1912-13, and it is proposed to pay a dividend of 9 per cent on the ordinary shares, as in the previous year, whilst the founder shares receive £2 4s. 9d. each.

STOCKS AND SHARES.

Tuesday Evening.

THERE can be little doubt but that the re-opening of the Stock Exchange has increased business. Whether it be that there is a sentimental value attached by the public to the fact of their brokers dealing within walls, under a roof and over a floor, or whether it is by mere coincidence, the public are certainly doing more now than they were at the end of last year. The Treasury conditions, laid upon the Stock Exchange as the price for re-opening, have not been extended to outside sources; and the quaint anomaly remains of an alien enemy being able to realise, with the utmost ease, practically what money he likes on his favourite securities, through the medium of channels outside the Stock Exchange, although the members of the House are fettered by regulations so onerous that they extend to every investor, from the largest to the smallest.

If a man wishes to sell 10 British Westinghouse Preference for example, he has to go through a paraphernalia of ceremonies, in exactly the same way as he who realises £34,000 by the sale of 1,000 Canadian Pacifics. They say that there are a few Stock Exchange men who are not above evading the temporary regulations, but it may be asserted with safety that 95 per cent. of the members are doing their best to comply loyally with rules which they are asked to maintain as a contribution to the national interest.

The electrical markets this week are featured by conspicuous firmness in Eastern and Anglo-American Telegraphs, by a further weakening in Mexican Tramway securities, and by fairly active dealings in Westinghouse Preference, Edison & Swan, and a few other manufacturing shares. Our lists show the principal movements in detail:—

HOME ELECTRICITY COMPANIES.

	Mean price. July 27.	Jan. 19, 1915.	Rise or fall this week.
Brompton Ordinary	9⅛	8⅞	—
do. 7 per cent. Pref.	8⅝	8¾	—
Charing Cross Ordinary	5¼	4⅞	—
do. do. do. 4½ Pref.	4¾	4¼	—
do. do. City Pref.	4½	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅝	4¾	—
do. 4½ Deb.	96½	92	—
City of London	16	14⅞	— ⅛
do. do. 6 per cent. Pref.	13½	13	—
do. do. 5 Deb.	116½	114	—
do. do. 4½ Deb.	100¼	98	—
County of London	12	11½	—
do. do. 6 per cent. Pref.	12	11¾	— ⅛
do. do. 1st Deb.	102½	99	—
do. do. 2nd Deb.	100½	97	—
Kensington Ordinary	7½	7⅜	— ⅛
London Electric	1⁷⁄₁₆	1¼	—
do. do. 6 per cent. Pref.	5¹⁄₁₆	5	—
do. do. 4 Deb.	92½	89½	—
Metropolitan	3½	3⅜	— ⅛
do. 4½ per cent. Pref.	4⁷⁄₁₆	4	—
do. 4½ Deb.	97½	91½	—
do. 3½ Deb.	83	81½	—
St. James' and Pall Mall	9⅝	9	—
do. do. do. 7 per cent. Pref.	7	6¾	—
do. do. do. 3½ Deb.	84½	83½	—
South London	3¹⁄₁₆	3	—
South Metropolitan Pref.	1¼	1⅛	—
Westminster Ordinary	8¼	8⅜	—
do. 4½ Pref.	5⅛	4⅞	—

TELEGRAPHS AND TELEPHONES.

	Mean price. July 27.	Jan. 19, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108¼	104	+ 1½
do. Def.	28	22¼	+ 1
Chile Telephone	7¾	7⅛	—
Constantinople Tel.	4½	3½	— ½
Cuba Sub. Ord.	8½	8½	—
do. Pf.	16½	15½	—
Eastern Extension	12¾	12⅝	+ ⅛
do. 4 Deb.	97½	94	—
Eastern Tel. Ord.	130½	128	+ 6
do. 3½ Pf.	77½	76	— 1½
do. 4 Deb.	96½	95	—
Globe Tel. and T. Ord.	11¼	10	—
do. Pf.	12⅝	11¾	— ¼
Gt. Northern Tel.	32½	28	
Indo-European	59	57	— 1
Marconi	1¹³⁄₁₆	1⅝	+ ¹⁄₃₂
New York Tel. 4½	101	97	+ ½
Oriental Telephone Ord.	2⅛	2	—
do. Pf.	1¹⁄₃₂	1¹⁄₁₆	—
Tel. Egypt Deb.	98	97½	—
United R. Plate Tel.	6⅝	6	—
do. Pf.	5¼	5	—
West India and Pan.	1¼	1⅛	—
Western Telegraph	13⅝	13	+ ⅛
do. 4 Deb.	96½	95½	—

HOME RAILS.

	Mean price. July 27.	Jan. 19, 1915.	Rise or fall this week.
Central London, Ord. Assented	83	79	—
Metropolitan	37½	32½	+ 1
do. District	21¼	18	+ [illegible]
Underground Electric Ordinary	2[illegible]	1[illegible]	—
do. "A"	7/6	6/-	—
do. Income	88	81½	+ 1½

FOREIGN TRAMS, &c.

	Mean price. July 27.	Jan. 19, 1915.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅞	4½	— ⅛
do. 2nd Pf.	4¼	4¹⁄₁₆	— ¹⁄₁₆
do. 4 Deb	91	86	
do. 4½ Deb.	98	94	— 2
do. 5 Deb.	96	89	—
Brazil Tractions	66	57½	— ½
Bombay Electric Pf.	11½	10½	
do. 4½ Deb.	96	95	—
Mexico Trams	70	40	— 5
do. 5 per cent. Bonds	84	70	
do. 6 per cent. Bonds	76	65	—
Adelaide Sup. 6 per cent. Pf.	5½	5½	—
do. 5 Deb.	104	101	+ ½

MANUFACTURING COMPANIES.

	Mean price. July 27.	Jan. 19, 1915.	Rise or fall this week.
British Westinghouse Pref.	1¼	1¹⁄₁₆	— ¹⁄₁₆
do. 4 Deb.	74½	72	—
do. 6 p[illegible]	102½	98	—
Callenders	11½	11½	—
do. 5 Pref.	4½	4½	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	[illegible]	[illegible]	+ [illegible]
Edison & Swan, £3 pd.	[illegible]	12/-	— 6d.
do. do. fully paid	1¼	2½	—
do. do. 4 Deb.	[illegible]	60	—
do. do. 2 Deb.	[illegible]	60	—
Electric Construction	[illegible]	11/-	
do. do. Pf.	1⅛	1	—
Gen. Elec. Pf.	10½	10	—
Henleys	15	13½	—
do. 4½ Pref	[illegible]	[illegible]	+ ½
do. 4½ Deb.	10[illegible]	97	—
India Rubber	[illegible]	8	—
Telegraph Con.	[illegible]	36	—

Keen attention is centred upon the opening of Parliament, and the possibilities which this will present in regard to the two Bills that have been deposited in connection with London's electricity supply. The County Council Bill stands first in point of magnitude and importance. Part 2 of the Bill is that which arouses most interest in financial circles, since this proposes to empower the electricity authority to create a new trustee stock, redeemable in 60 years by a sinking fund running for the term of 30 years. The Authority, it is suggested, shall have the power to spend ten million pounds on new capital account, and such further sums as may be necessary for the acquisition of the various undertakings. Rumours that the Bill will be withdrawn met with prompt denial, so presumably it will proceed in the ordinary way, although a little scepticism on that point may be permitted.

Reference to the Bill will show that the proposed acquisition is to be carried out by agreement, which, to the ordinary lay mind, naturally suggests that the companies would demand payment on the basis of profits spread over a number of years, plus goodwill and allowance for undeveloped areas of supply. Putting the number of years, for the sake of argument, at 25—which seems to be a probable period—and making allowance for the other two items and sinking fund requirements, the observer would work out these totals to something like 22 to 25 million pounds sterling. Add the usual trimmings, and it might not be far out to prophesy that something near 40 million pounds sterling would be wanted to work this scheme. A separate Authority is, of course, an integral part of the scheme; and the Bill proposes that if this Electric Authority is satisfied that its receipts on revenue account in any year are likely to be insufficient to meet the charges payable out of revenue, the Authority shall levy a deficiency rate apportioned amongst the Councils in proportion to the assessable value of the areas within the area of supply.

Having regard to the huge field which the scheme covers—East and West, North and South of London—this last suggestion opens up a prospect hardly pleasing to the champions of cheap electricity supply for London, or to those undertakings in a densely-populated area which might be called upon to make up a probable deficiency, at least for some time, incurred by the authority in comparatively sparsely-peopled places in Surrey, Middlesex, Bucks., and Hertford. It might be supposed that the companies would cordially support a scheme whereby they should be paid out on goodwill terms in a trustee stock that would have a first charge upon the revenue of the new authority; but from the point of view of the outsider, interested more as a consumer and ratepayer than as a holder of electricity supply shares, the outlook is less alluring.

The companies—or at least some of them—do not wish to be disturbed, however; and several are promoting a Bill of their own, conceived, as we said before, on more modest lines, but lacking the adhesion of various important members of the London electrical undertakers, without whom it would be practically impossible to attain the great desiderata of central supply and cheap current which Parliament will certainly demand as a condition of authorising any such amalgamation plan.

We must repeat once more that, with the Government a large borrower on war account, any proposals that call for the raising of substantial sums of money are bound to be regarded coldly just now, more especially if they involved such competition as the creation of another trustee security would necessitate. The Treasury has intimated this week that issues for undertakings carried on, or to be carried on in the United Kingdom, shall only be allowed where it is shown to the satisfaction of the Treasury that they are advisable in the national interest, so that the prospects for either Bill look none too rosy at the moment.

It is no part of ours, of course, to fling hyper-austere criticism at schemes that aim at the achievement of such an object as unification of London's electric supply. But, in this part of the Electrical Review at all events, it is finance that counts mostly; and therefore one is bound to examine with a good deal of closeness each proposition as it is brought forward. The critic welcomes each honest scheme, though it may seem unsound in parts, since all these proposals are working towards the goal which must one day be reached. The sooner the end is attained, the better will it be for everybody; but to build upon insecure foundations would simply mean the work having to be done over again, unless London is to be saddled with a burden more heavy and costly than prevails at present, and the great conclusion of cheap lighting and power be defeated through indiscreet action at the outset.

The prices of Home Railway stocks again show advances in most cases on the week. This time the improvement has spread to the electrical issues. Underground income bonds are 1½ up at 81½, and the 4½ per cents. are better at 98½. The company's 6 per cent. 1st cumulative income Debenture stock stands at 112, which is within a couple of points of the mean price at the end of July. Metropolitans have hardened, and Districts rose ¼. There is more business passing in the pre-Ordinary securities. Metropolitan 3½ per cent. Preference changed hands at 76½, District Firsts at 76.

Eastern Telegraph Ordinary stock has risen 6 points, fairly rapid justification for our contention last month that the stock was undervalued at 118, seeing that now it stands at 128. Eastern Extensions move more slowly, and have fallen behind the Eastern stock. The Telegraph market as a whole is very firm. Westerns are better, and both classes of Anglo-American Telegraphs responded to the declaration of the usual dividends, making 6 per cent. on the Preferred, 3 per cent. on the Ordinary, and 1½ per cent. on the Deferred, for the past year. New York Telephone bonds are good; and of the outside shares, Marconis once more gained a small fraction. American Marconis dropped a trifle to 9s. 9d.

The Treasury's restrictions with regard to new issues, already quoted earlier in this article, are welcomed by investment markets in the Stock Exchange, on the assumption that removal of the possibility of such competition as new issues afford will have a strengthening effect upon existing securities. Incidentally, it may be remarked that the Treasury's solicitude to husband home resources is interpreted in some quarters as a quiet hint that there may be another War Loan before long. The recent issue was supposed to provide the sinews of war up to the end of July, but the City looks for further borrowing about May.

Manufacturing shares are generally strong. British Westinghouse Preference have been done at 40s. Henleys are 10s. up at 13½. Another section of noticeable strength is that for Armament shares. Armstrongs have risen from 39s. to 42s. Vickers are better, and lively dealings have sprung up in the shares of the Projectile Company. Castner-Kellners have risen to a little over 3. The Rubber market keeps fairly firm, with a good deal of trade being done in the popular shares.

MARKET QUOTATIONS.

Owing to the war, the prices given below are, of course, more or less nominal.

Wednesday, January 20th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a ,, Nitric	,,	19/-	..
a ,, Oxalic	per lb.	8d.	..
a ,, Sulphuric	per cwt.	5/-	..
a Ammoniac Sal	,,	£49	.
a Ammonia, Muriate (large crystal)	per ton	£49	..
a Bleaching powder	,,	£8 10	
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£18 10	..
a Copper Sulphate	,,	£21 10	..
a Lead, Nitrate	,,	£35	..
a ,, White Sugar	,,	..	..
a ,, Peroxide	,,	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	7d.	..
a Potash, Caustic (88/90 %) ..	per ton	..	..
a ,, Chlorate	per lb.	1/4	2d. inc.
a ,, Perchlorate	,,	1/-	4d. inc.
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	,,	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£5 10	..
a Sulphur, Sublimed Flowers ..	,,	£11 10	..
a ,, Recovered	,,	£8	..
a ,, Lump	,,	£8 10	..
a Soda, Caustic (white 70/72 %) ..	,,	£10 2 6	..
a ,, Chlorate	per lb.	8½d.	½d. inc.
a ,, Crystals	per ton	45/-	.
a Sodium Bichromate, casks ..	per lb.	8½d.	½d. inc.
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£85	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£112	..
b ,, Sheet, in ton lots ..	,,	£112	..
p Babbitt's metal ingots	,,	£50 to £221	.
c Brass (rolled metal 2" to 12" basis)	per lb.	8¾d.	¼d. inc.
c ,, Tube (brazed)	,,	10d.	½d. inc.
c ,, ,, (solid drawn)	,,	9d.	¼d. inc.
c ,, Wire, basis	,,	9d.	¼d. inc.
c Copper Tubes (brazed)	,,	10½d.	¼d. inc.
c ,, ,, (solid drawn) ..	,,	10½d.	¼d. inc
g ,, Bars (best selected) ..	per ton	£80	£2 inc.
g ,, Sheet	,,	£80	£2 inc.
g ,, Rod	,,	£80	£2 inc.
d ,, (Electrolytic) Bars ..	,,	£61 10	..
d ,, ,, Sheets ..	,,	£79 10	..
d ,, ,, Rods ..	,,	£67 10	..
d ,, ,, H.C. Wire	per lb.	8$\frac{5}{16}$d.	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	1/8	..
h Gutta-percha, fine	,,	6/10	.
h India-rubber, Para fine	,,	2/7	2½d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	63/6	
l ,, Wire, galv. No. 8, P.O. qual.	,,	£16	..
g Lead, English Pig	,,	£19 to £19 5	..
m Manganin Wire No. 28	per lb.	..	
g Mercury	per bot.	£11 10 0	5/- inc.
e Mica (in original cases) small ..	per lb.	4d. to 2/6	..
e ,, ,, ,, medium	,,	3/- to 5/-	
e ,, ,, ,, large ..	,,	6/6 to 10/6 & up.	
o Nickel, sheet, wire, &c.	,,	Nom.	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/8½	..
p ,, ,, rolled bars & rods	,,	1/0¾ to 1/2	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/5½	.
o Platinum	per oz.	185/-	
d Silicium Bronze Wire	per lb.	10¾d.	
r Steel, Magnet, in bars	per ton	£70	£5 inc.
g Tin, Block (English)	,,	£161 to £163	..
n ,, Wire, Nos. 1 to 16	per lb.	2/3	1d. inc.
p White Anti-friction Metals ..	per ton	£44 to £194	.
k Zinc, Sh't (Vieille Montagne bnd.)	,,	Nom.	.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

THE NATIONAL ELECTRICAL CODE AND BRITISH WIRING RULES COMPARED.

By FRANK BROADBENT.

In a recent number of the *New York Electrical Review and Western Electrician* a comparison is made between the wiring rules in vogue in the United States, in Germany and in England. The American rules are those known as the National Electrical Code, which is revised every two years, and it is no doubt because the time for the next revision is approaching that this detailed comparison has been made. The rules set out in three parallel columns occupy about eight complete pages of the paper, although the comparison covers only the rules for erection in interiors and does not touch other branches of wiring work or the details of materials.

Generally speaking the National Code appears to be much too detailed, and it is possibly this fact which made such frequent revision necessary. When rules such as those of the Home Office and Institution of Electrical Engineers are drawn up to cover general principles rather than details of manufacture such frequent revision is not necessary, because so long as any new piece of apparatus complies with the general regulations laid down there is no need to modify the rules in order to bring it within their scope.

Take, for instance, the question of fuses or cut-outs: the Home Office Regulation No. 5, consisting of about 80 words, covers not only fuses, but circuit breakers also, and deals with the subject fully from the point of view of danger to workpeople.

In the Institution Rules the whole of the references to fuses, as regards their mode of installation or position in the circuit in which they are to be placed, are contained in about 200 words scattered over many pages, because they appear under several headings, involving a certain amount of repetition. The conditions to be fulfilled by fuses from the point of view of fire hazard are covered by about 320 words, the references covering such things as the prevention of risk to the installation or the apparatus protected, and of the overheating of the fuse itself.

Now when we turn to the National Code we find that something like 400 words are devoted to the method of installing, or the positions in which fuses are to be placed, and in addition there are over 2,000 words of descriptive matter referring to details of construction.

Notwithstanding the considerable amount of space devoted to details, the Code specifically states that these "are but a partial outline of requirements. Devices or materials which fulfil the conditions of these requirements and no more, will not necessarily be acceptable. All fittings and materials should be submitted for examination and test before being introduced for use." From this it might appear that any new or improved device might be condemned by an inspector of the National Board of Fire Underwriters on the ground that it had not been officially passed, even although it might comply with the regulations and be more suitable to its purpose than previously existing types which had satisfactorily passed the test.

"Link" fuses, that is to say bare wire fuses, are approved under certain conditions by the National Code. They must not be mounted on porcelain bases but on slate or marble, and must be enclosed in a cabinet box (equivalent to our distribution fuse box) which itself must be made in accordance with regulations which specify the minimum thickness of the metal to be used, the space between the door and the fuses, and between any part of the metal case and live metal, the thickness of the insulating linings, the thickness of the glass panels, the mode of constructing the doors and so on; and the cabinet must be plainly marked with the manufacturer's name. There are many distribution boxes of approved make in this country which would not comply with the requirements here laid down, and practically all our link fuses are carried on porcelain bases or supports.

Another rule with which British practice does not comply is that wooden or composition cabinets "must not be used on metal conduit, armoured cable, or metal moulding systems." Hard wood distribution boxes, suitably lined with fireproof material and provided with metal plates or other means of bonding the conduits together, are very commonly used for interior wiring when the conductors are run in conduit. In some respects they are safer than metal boxes.

The requirements of the National Code as to the placing of fuses in the neutral wire of a three-wire system do not conform to English practice. According to our Institution Rules "no fuse may be placed in the neutral conductor of a multiple wire system, but fuses must be placed on both conductors of two-wire circuits branching therefrom." According to the National Code fuses, under some conditions, must be placed in the middle or neutral wire, but *may be* omitted "provided the neutral wire is of equal carrying capacity to the larger of the outside wires, is earthed"; and when the fuse *is* omitted, branch circuits must be run as two-wire circuits and protected by fuses on both poles. From this it would appear that when a fuse is placed in the neutral conductor no fuse need be connected in the wires branching from the middle conductor. The reason for this regulation is not at all clear, because if a fuse in the middle wire of an unbalanced system failed, the lamps or motors on one side would receive an abnormal pressure without necessarily blowing the fuse of the branch conductors.

Another point in which the National Code differs from British practice is in regard to fused rosettes or ceiling roses. It appears that "on open work in large mills approved link fused rosettes may be used at a voltage of not over 125, and approved enclosed fused rosettes at a voltage of not over 250, the fuse in the rosette not to exceed 3 amperes." Not only is this against British practice, but it was due largely to the danger arising from fused ceiling roses in textile factories that the practice was originally disapproved, whereas it is precisely in this class of work that it is approved in America. Further, the dangers arising from the scattering of molten metal are greater on the lower than on the higher pressure, owing to the greater mass of metal employed in the fuse, yet bare fuse wires are permitted on the lower voltages.

The plain link fuse with fixed screw terminals is practically obsolete in this country for interior wiring, some form of bridge or fuse carrier being invariably used, and whilst our own rules specifically mention that enclosed fuses are preferred there are many types of bridge in which the fuse metal is exposed. These however are gradually going out of use owing to the fact that they are not in line with the Home Office regulations. The Home Office regulations do not of course apply to ordinary domestic installations, but manufacturers who make fuses to comply therewith, and contractors who carry out both factory and domestic wiring, naturally aim at some kind of uniformity, so that as the Home Office insist upon enclosed fuses, and the Institution Rules express a preference for them, the tendency is all in the direction of the enclosed or protected type.

Another point which will strike British contractors as a somewhat curious one is the fact that on motor circuits where overload circuit breakers are used, fuses must be employed in addition, although single phase motors may have a circuit breaker on one pole and an approved fuse on the other. This rule applies to all circuits where the current is not too great for an approved enclosed fuse. Without further explanation one can only assume that American circuit breakers of comparatively small carrying capacity have not proved themselves to be satisfactory. We have heard of large circuit breakers on railway switchboards welding up solid due to a sudden and abnormal overload and so preventing their breaking circuit, but have never heard of this in connection with comparatively small circuit breakers.

Manufacturers who have hopes of developing export trade to America and Canada will be more interested in the details of manufacture than in the methods of installing the apparatus. As mentioned above, the rules dealing with construction are far more lengthy and more detailed than those dealing with the mode of installing, and in the 2,000 odd words we have rules dealing with the depth of countersinking for screw heads, the melting point of the waterproof composition which covers such screw heads, the number of screws to be used to support fuse bases, the diameter of ferrules, the thickness, width and length of contact blades, and diameter and length of the cartridge tubes; and, in addition to the descriptive matter, there are two pages of dimensions of cartridge fuses, which appear to be the most approved type. In fact an explanatory note lays it down that "the enclosed or cartridge type of fuse cannot be improperly used for higher currents than those for which they are designed." This is distinctly against all experience with cartridge fuses, as not only is it possible to fit a larger fuse-wire in a cartridge than that originally fitted, but it is difficult, and in some cases impossible, to tell by inspection what size of fuse-wire has actually been fitted. In this connection the open type fuse has the advantage, and possibly this is its only advantage. Not only can a cartridge fuse be abused in this way by installation attendants, but it is not uncommon for manufacturers themselves who have run short of stock of a particular size of fuse wire to substitute a larger fuse than that for which the cartridge is stamped, and simply alter the marking. So far as our experience goes there is no fuse on the market, not even the most modern screw plug fuses, which cannot be tampered with, as even these can be short-circuited or by-passed across the terminals with a fuse wire of practically any size. This in fact is what is generally done when such a fuse blows and there is a shortage of refills.

Turning now to the requirements in relation to switches, the Home Office Regulations Nos. 3 and 4 deal in less than 150 words with the question of safety to persons employed on the premises where switches are employed, and also to those actually using the switches. They define generally the position in which switches are to be placed and the principles of construction. The Institution Rules in about 250 words cover the method of installation of switches, and their position and function, and give sufficient general guidance on details of construction to cover the questions of overheating, arcing and protection to users.

The National Code on the other hand, after occupying about three times the space with rules as to the installation and use of switches, contains seven pages, or about 2,000 words dealing with specific details of manufacture. This does not include motor starting switches, to which another six pages are devoted. One cannot, of course, judge as to the comparative merits of a set of rules drawn up to meet similar needs by a comparison of their prolixity, but it will be agreed that conciseness when coupled with clarity of expression is very desirable in a code of rules intended primarily for the guidance of the contractor and wireman, and moreover, the nature of the details specified produces the impression that they have been drawn up rather to suit some particular make of approved switch than to ensure compliance with general conditions based on a definite and scientific plan.

In some respects the National Code is more definite than our Institution Rules, *e.g.*, the rule relating to the installation and function of the main switch. Our rules require that the main switch on an installation fed from a public supply shall be easily accessible and placed as near the entry of supply as possible. They do *not* state that it shall cut off pressure from all apparatus, and it is common practice for supply authorities to fix their main fuses and meters on the live or supply side of the switch, so that they are always alive whether the main switch is on or off. In the National Code the rule is quite definite on this point, viz., "service cut-out and switch must be arranged to cut off current from all devices including meters." Instances have come under notice in this country of clock meters having been inadvertently connected on the consumer's side of the main switch, with the result that after being switched off they do not restart, and unregistered units have been consumed. This may be the principal reason for connecting meters generally on the supply side of the switch.

Among the considerable details of switch construction given in "Class D" of the code, it is specified that nothing but slate, marble or porcelain may be used for knife switch bases unless any other material proposed is first submitted for special examination. The number of supporting screws must not be less than four if the area of the base is over 25 sq. in. Such screws between parts of opposite polarity must be countersunk and there must be at least ½ in. surface distance between the head of any supporting screw or washer and any live metal. Contact jaw mountings must be secured by at least two screws or some equivalent to prevent turning, and nuts or screw heads on the underside must be countersunk not less than ⅛ in. and covered with waterproof compound which will not melt below 150 degrees F. This refers to the base only. Then there are regulations and restrictions as to the hinges of the contact blades, the blades themselves, the cross bars and connections. Thus the contact area of the blades must be the equivalent of 1 sq. in. of pure copper per 75 amperes, and the section of metal must be proportioned for a rise not exceeding 50 degrees F. The electrical test specified is quite moderate, viz., a "50 per cent. overload in amperes and 25 per cent. excess voltage" under the most severe practical conditions. It may be assumed from this that the excess current and voltage are to be simultaneously applied and that the circuit may be inductive.

The foregoing requirements appear to apply to "knife" switches of any size and type, and for any voltage up to 550; so the ordinary tumbler switch or any other pattern which has not a quick make and break would come under this designation. Very few, if any, tumbler switches, which are as rare in the States as "snap" switches are in this country, would meet the requirements.

Another point of interest to manufacturers is that all switches must be plainly and visibly marked with the name of the maker, and the rated current and voltage; and service switches must indicate whether the current be "on" or "off." It would be interesting to know if in the case of a "push-and-pull" switch the position of the knob or handle is accepted as a sufficient indication.

(*To be continued.*)

Portable X-Ray Apparatus.—The French Red Cross, 25, Knightsbridge, W., is badly in want of ten specially constructed cars equipped with X-ray apparatus, dark room, &c., for use immediately behind the firing line. Such cars cost, completely fitted out, about £800 each.

THE CASE FOR THE ELECTRIFICATION OF FLOUR MILLS.

By Ernest P. Hollis, A.M.I.E.E., A.Am.I.E.E.

Flour mill electrification is a problem which has not yet ceased to exercise the mind of the engineer charged with the erection and operation of flour mills. Quite recently the question was debated before the Institution of Mechanical Engineers, and a perusal of the observations then made demonstrates that on many fundamental points the flour mill engineer fails to appreciate the benefits that accrue from the electric drive. As in many industries, the question of electrification as appreciated by the miller turns practically wholly on the cost per b.h.p.-hour at the engine, and if the steam or gas engine maker can convince the miller that the cost per b.h.p.-hour at the engine is less than if the engine were replaced by one motor—for, be it noted that the miller is persuaded that there is little scope for the individual drive—then he considers the case against electrification to be made out.

It is one purpose of this article to traverse many of the statements made against the electrification of flour mills in the hope that they will provide material for an attack upon the rooted convictions against electrification which are largely held by millers.

The Consumers' Engineer in his campaigns is often placed in the difficult position of being unacquainted with many of the processes to which he hopes to introduce electrification. The engineer who goes to talk electrification to a cement works engineer is soon placed in difficulties when the cement works engineer asks "How would you drive the cylpebs? Would you drive them from the same motor as the kominor?" Or if he interviews a flour mill engineer who enquires after the driving of plansifters or cockle extractors, it is not a hopeful augury of success to acknowledge ignorance. It is hoped therefore to afford Consumers' Engineers unacquainted with flour milling the necessary outline of milling to enable them to talk confidently to the miller; and also to acquaint him with the points he is to drive home, the arguments he is likely to meet and how he may controvert them. On the ability to undertake this the success of his mission depends.

First let a brief conspectus of the treatment of the grain be given. Flour milling divides itself into four different processes:—(*a*) grain handling; (*b*) wheat preparing; (*c*) flour milling; (*d*) packing and storing the finished products. The processes are automatic and eliminate labour to a very large extent, and this fact, coupled with the heavy capital cost of the machinery, is responsible for the long running hours of the mill. Often a mill operates continuously 144 hours a week, and in busy times the whole week through.

Although the plant is sub-divided in the manner which has been mentioned, the grain passes automatically from one portion to the other without human intervention, and this fact plays a prominent part, as will be discussed later, in the electrification question.

The four main processes enumerated can be again sub-divided as follows:—

(*a*) *Grain handling plant*:

1. Wheat intake from the boats or trucks
2. Weighing and preliminary cleaning plant.
3. Storage silos.
4. Mixing and conveying plant, passing on to process (*b*).

(*b*) *Wheat cleaning plant*:—

1. Dry cleaning plant.
2. Washing, drying and conditioning plant.
3. Storage bins for conditioning the wheat passing on to process (*c*).

(*c*) *Flour manufacturing or rolling mill plant*:—

1. Granulating or breaking down process
2. Scalping and grading.
3. Purification.
4. Reducing purified stock to flour.
5. Flour dressing, the flour passing on to process (*d*).

(*d*) *Sacking off, warehousing and storing the finished products.*

Grain handling plant.—The grain is elevated by bucket elevators from the quay side and delivered to a travelling band fed at different points by various sets of legs. It passes first to the preliminary cleaning plant, consisting of an automatic weigher registering the number of tips, next through the separator composed of oscillating riddles. While the grain is being riddled powerful air currents remove light chaff and dust. It is then elevated to the silo house or wheat store by travelling bands. These silos are usually large concrete receptacles holding many thousands of tons of wheat. When drawn from the silo for treatment the wheat is fed by bands and elevators into a set of storage bins usually located in the wheat cleaning section. Up to this point different kinds of wheat have been separately stored, but they are blended here in definite proportions. The product then passes on to the wheat preparing plant.

Wheat preparing plant.—Here the berries are treated to remove both smaller and larger impurities; they are rubbed for loosening dirt, scrubbed with stiff brushes, subjected at a number of points to the action of wind currents to carry off the loosened light floating dust.

The next stage is the removal of the small cockle seeds from the wheat by "cockle cylinders." These are composed of rotating cylinders with pitted internal peripheries. The machine relies for its operation upon the difference in shape of the cockle and the wheat, the former being round and the latter oval. When the cylinder rotates the oval grains drop out of the pits first while the spherical ones stay longer, eventually falling on a hopper which separates them from the wheat. They are collected at the bottom of the hopper and removed by a worm conveyor. They are not wasted but are used for cattle food.

An alternative to the cockle cylinder is an extracting band similar in principle and composed of travelling plates given a rapid cross shake. These plates are pitted with holes which hold the cockle seeds which are collected in a similar manner to that previously described.

Wheat Washing.—The wheat is next washed for cleansing and for softening the harder varieties. It is fed on to a washing worm and floats on the surface of the water, the stones remaining in the worm, which is submerged. The flow of water carries the wheat along, and it is drained in a centrifugal machine.

Conditioning Plant.—In the conditioning plant the wheat undergoes a warming process which sweats out the superfluous moisture from the inside of the berry. This moisture is removed by warm and cold currents of air. The wheat is then passed to the conditioning bins where it is stored for a period, after which it is ready for the rolling process.

Rolling Plant.—In the rolling process the berry is broken down and the kernel extracted. The breaking down is done in roller mills, there being about four stages in which it passes through fluted rolls of various coarsenesses. It is worthy of note that no attempt is made here to produce flour which is the outcome of a final rolling later in the process.

The next process is the scalping when the husk is separated from the kernel. As the wheat emerges from the rolling mills into a hopper it is subjected to a light suction from a fan, with the result that the lighter particles are drawn to one side, while the heavier, composed of high class semolina, being less affected by the air suction fall into a different hopper. The heavier particles then pass on to the semolina duster in which they fall through an inclined sieve and the lighter ones are again separated. Again the product drops into a purifier where it is subjected to further air currents and the lighter particles again drawn off. From the purifier the stock passes to the reduction rolls in which it is finally ground. It is then termed "flour." Lastly it goes to the flour dressing machine. Here the flour is reduced to an extremely small size either in a "plansifter" composed of sieves in motion and scraped by brushes, or in a centrifugal machine.

After leaving the dressing process the flour is fed into sacks by means of conveyors, and the dust and other products are disposed of in a similar way. The packing room is usually in the upper floor of the warehouse and the sacks are dropped through sack chutes, or in some other way brought to the ground level.

Grinding.—Another department is the grinding house in which a number of grinding stones are used for the production of wholemeal and the reduction of certain of the by-products to make animal food.

The case for electrification.—The case for the electrification of flour mills is rarely understood by millers. They are obsessed by two assertions which have been urged upon them as militating against the necessity for electrification. These assertions are:—

1. The plant runs as a complete unit from the time it is started until the time it is shut down. Individual drive on which the case for electrification in many industries turns is here, they have been told, useless.

2. The plant is usually driven from a central point, and it is therefore unnecessary to incur the losses due to the change of energy from steam to electrical and its re-conversion to mechanical power.

These specious arguments appeal strongly to the the uninitiated, and it requires a close knowledge of flour milling to be able to convince the miller. Perhaps in the first place it is of interest to know that electricity is called in to assist the miller in practically every installation, for two purposes:—

1. For the lighting of the mill. The explosive nature of the flour dust which permeates the atmosphere absolutely precludes in some of the departments an open light such as gas.

2. In practically every case the outlying drives such as elevators for the wheat intake plant must be driven electrically, and only in a few instances can the rope drive be applied.

When therefore the miller talks of electrification he usually is referring to what may be called the mill proper, and he requires no convincing of the advantages of electricity for lighting and for the outlying drives.

Coming first to the question of individual drive, when it is said that there is no scope for an individual drive the best answer is to show the doubter an electrically driven mill. There he will find much to his surprise that there *is* scope for the individual drive, and that motors are dotted all over the place as one would find them in an ordinary engineering works. Perhaps he cannot understand it, but it must be pointed out to him that the reason why he did not see the necessity for individual drive was because in the steam driven mills, to which he has been used, the designer has been compelled to arrange the machinery in order to meet the exigencies of the drive. The designer has not been free to put his plant where he liked, and has therefore been forced to go in for inconvenient arrangements which conflict with his discretion. In the electrically driven mill the designer puts the plant just where he pleases and is not dictated to by the position of the line shafting. Secondly, there comes the question of efficiency. The miller cannot see that the electric drive is efficient because of the double conversion. The answer is that the losses in converting and reconverting the electrical energy are in most mills less than those incurred in a steam driven mill. Where the line shafting is kept in first-class order and is thoroughly well tended, and where the arrangement of the mill prevents any irregularities in the arrangement of the shafting, it is possible that the electric drive might be at some small disadvantage. But few line shaftings attain the degree of perfection which is disclosed by those on which published tests are taken, and when one comes to examine the matter it is usually found that while the difference in many cases may be only slight it is rarely against electricity.

There is one advantage of electrification which is understood by millers and that is the constancy of speed. A number of operations in the mill depend upon delicately adjusted air currents. If the air currents vary in strength, the desired separations are not effected, and a deterioration in the quality of the product follows. This advantage is generally acknowledged.

Further, there are some important general advantages of electrification which do not occur to the miller and which it is well to impress upon him. First, there is the increased output of the mill. Due to the constancy of speed, the output of an electrically-driven mill is greater than that of the steam-driven mill. This fact is vouched for by so eminent and unbiased an authority as Mr. C. J. Robinson (Proceedings of the Mechanical Engineers, 1913, page 1036) who says:—

"It had been proved, for instance, that an electrically-driven mill could be relied on to increase the output not less than 7½ per cent over the same mill driven by steam power."

This increase of production is an experience common to many industries where the electric drive is introduced, as, for instance, textile mills and rolling mills. In addition, the speed uniformity ensures evenness in the grinding and dressing processes, which tends to a higher class of product. This is the experience of electrically-driven flour mills.

With the electric drive an important advantage is gained by virtue of the ease with which electrical power can be measured. When a prominent manufacturer of flour machinery recently undertook to analyse the power required to drive a flour mill—the results of his investigation form the basis of a paper read at a recent convention of the National Association of British and Irish Millers—how did he make his measurements? There was no other convenient way than by means of an electric motor. Now, it is well-known that in flour mills a great loss of power can be unknowingly incurred. It has, for instance, been found that fluted rolls, as used in the breaking-down mills, when they become dull incur a considerable loss of power. How is the flour miller to detect it in a steam-driven mill? He can only do it by keeping an eye on the ammeter of an electric motor. The same applies to the mill stones, and it will be found, generally speaking, that the miller can effect considerable economies in the power taken without deteriorating the quality of the product or diminishing the output of the mill.

The elimination of long lengths of shafting naturally diminishes the amount of noise made in the mill. This, however, in milling work is no very great advantage, owing to the small number of the employés. The reduction in the length of belting, however, is a material advantage for obvious reasons.

In conclusion, the Consumers' Engineer has a number of examples of electrification of flour mills to which he can point as exemplifying the advantages of the electric drive, and it can be safely said that, if any doubting miller is referred to any of these mills for information, he will receive a satisfactory testimonial which should remove any doubts he entertains on the question.

When Consumers' Engineers have the opportunity of quoting an outside power supply for flour mills it is desirable that they should remember the extraordinary good load factor, and they would do well also to bear in mind that responsible authorities have told the flour millers that in order to make electrification pay it must be supplied at a cost of 0.4d. per KW.-hour or under. This dogmatic assertion is not accepted by electrical engineers but the figure is well worth keeping in mind in order that they may not kill business by quoting an impossible price.

CAB SIGNALS ON BRITISH RAILWAYS.

(*Abstracts of Papers read before the* Institution of Mechanical Engineers, *December 18th*, 1914.)

Electrical Cab-Signalling.

By VINCENT L. RAVEN, Chief Mechanical Engineer, North Eastern Railway.

This system, designed by the author, has been in actual use on the Richmond branch of the North Eastern Railway for over two years, and also on that part of the North Eastern Railway's Co.'s main line which is situated between Durham and Bensham, and during the whole of that time the arrangement has given every satisfaction; and on no occasion has the danger signal ever been omitted to be given. The apparatus is fitted to thirty-six locomotives.

The main objects of the system are:—

1. To advise the driver of his approach to a signalling zone where signals are to be looked for.
2. To give the driver the necessary information with regard to the position of the signals controlling his further advance, and to prevent him from mistaking other signals than his own.
3. To retain control of the driver by the cab-signals until he has passed the last signal-controlling entrance into the section ahead.

The system comprises VISUAL and AUDIBLE indicators, and the apparatus is electrically operated. The VISUAL INDICATORS on the engine consist of a small semaphore, and one or two pointers capable of being deflected to indicate numbers painted on the dial. The semaphore arm, *together* with the operation of the small pointer, indicates "condition" signals, and the small pointer, by the number indicated, also gives the "route" indication. The AUDIBLE INDICATOR is an electric bell, which is separate from the visual apparatus.

The engine circuits are brought into operation by the movement given to a metallic shoe linked to a small switch when passing over insulated metallic bars placed in suitable positions on the track, and currents are collected from the bars by insulated steel wire brushes brushing lightly but firmly over the bars as the engine passes over them.

The semaphore and bell are directly operated by a battery carried on the engine. The "route indicators" are directly operated by currents established by the signalman in the operation of the ordinary levers of the STOP line signals. These currents also indirectly operate the semaphore and bell.

Fig. 1 is a diagram showing the complete cabin equipment for a two-way diverging junction, together with the circuits on an engine approaching the junction. S*h* is the shoe, and S*w* the switch controlling the engine circuits, and *br* are two insulated steel wire brushes, which pick up current from the cabin batteries under certain conditions, by contact with the bars B, C, D, E, and E^1, all of which are connected with the cabin equipment by line wires. The bar A is not connected with the cabin equipment.

Assuming that a train is travelling in the direction shown by the arrow, when the shoe, S*h*, passes on to the bar A, the semaphore arm will immediately rise to the DANGER position, and the "route indicator" pointer takes up the central position between the Nos. 1 and 2. The bell will begin to ring as soon as the shoe, S*h*, has passed over the bar. These indications continue until the engine arrives at the bar B.

If the line signals are at DANGER, as shown in fig. 1, the switch, S*w*, is broken by the lifting of the shoe, S*h*, as soon as the latter runs on the bar. The bell stops ringing whilst the switch, S*w*, is broken, but the semaphore arm remains at DANGER. The brushes, *br*, *br*, run over bar B at the same time as the shoe, S*h*, but as bar B is not energised when the line signals are at DANGER they have no effect. As soon as the shoe, S*h*, is clear of the bar, the switch, S*w*, is made again, and the bell recommences to ring. When passing over bar C, the same action takes place. If the engine is stopped at the HOME signal, the shoe and brushes are resting on bar D. In this position the semaphore arm remains at DANGER and the bell is silent.

Suppose, now, that the HOME and ADVANCE line signals for No. 1 line are lowered for the train to go forward. The small semaphore arm is lowered to OFF and the "route indicator" pointer is deflected to No. 1 on the indicator, and remains there. These indications remain when the engine passes off bar D, whilst passing over bar E, and until it arrives at the bar A of the next signalling point.

Suppose that the signalman had desired to draw the train forward to ADVANCE No. 1 instead of sending it right away. The engine is standing with the brushes *br*, *br*, and the shoe, S*h*, on bar D. The signalman lowers the HOME signal and then taps the small switch T^1 S^1 several times. This has the effect of lowering and raising the small semaphore arm on the engine and calls the driver's attention and gives him to understand that he is only being drawn forward to the ADVANCE. It is thus a cautionary signal entirely distinct from the OFF signal just described. The small semaphore remains at DANGER, and when the engine moves off the bar D, the bell recom-

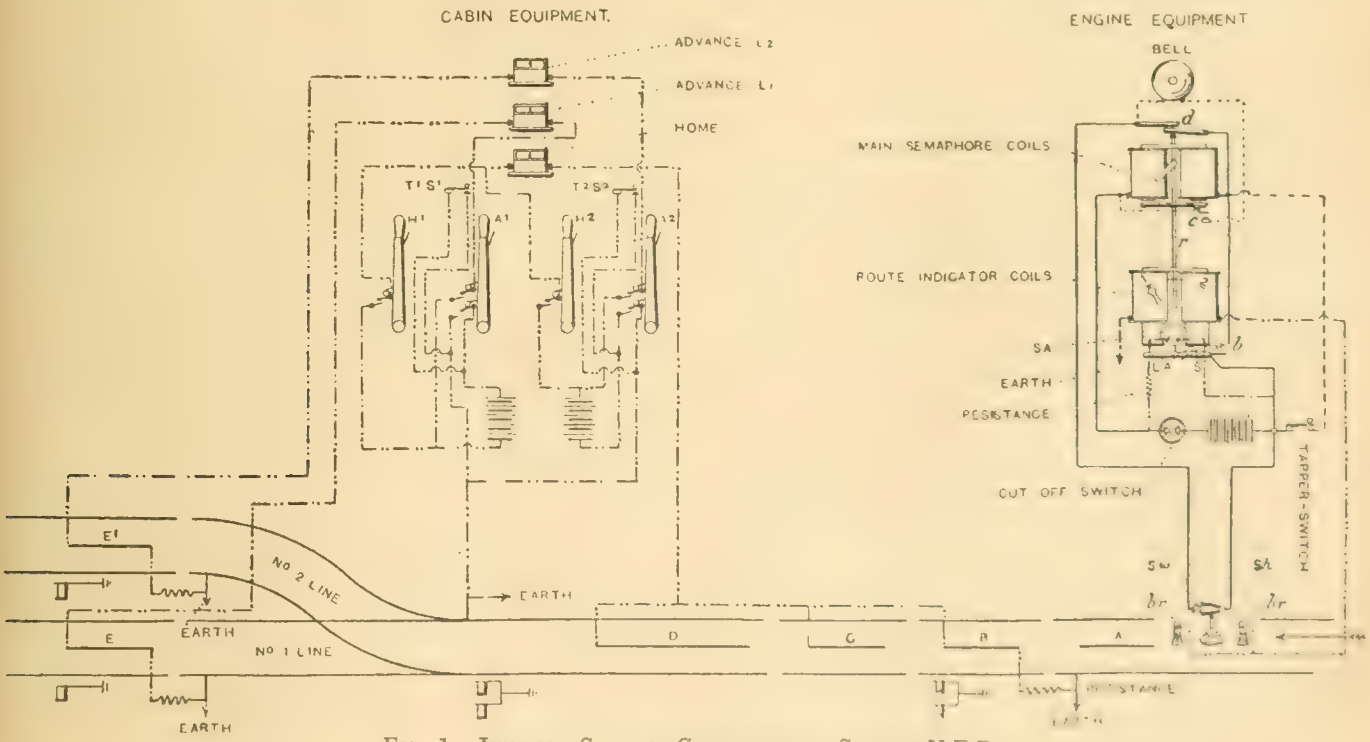

Fig. 1.—Junction Signals, Closed-circuit System, N.E.R.

rises to DANGER. These indications continue until the engine comes to a standstill at bar E.

Suppose, now, it is desired to dispatch the engine standing at No. 1 ADVANCE *line* signal. The small semaphore arm is at DANGER and the bell is silent. The signalman lowers the ADVANCE signal No. 1 by the lever A^1 in the cabin, and the small semaphore arm on the engine is immediately lowered to OFF, and the "route indicator" pointer deflected to 1 on the dial of the indicator. As described before, these indications remain until the engine arrives at the bar A of the next signalling section.

Assume, now, that the HOME and ADVANCE signals for No. 1 line have been lowered before the engine arrives at bar A. On passing over A, the small semaphore arm on the engine rises to the DANGER position, the "route indicator" pointer takes up the central position and the bell begins to ring, and these indications continue until the engine arrives at bar B. Whilst passing over B, the small semaphore arm is lowered to OFF, the "route indicator" pointer is deflected to No. 1 on the dial of the indicator, and the bell then ceases to ring. These indications are continued whilst the engine is passing over the subsequent bars C, D, E, and until it arrives at the bar A of the next signalling section. This constitutes the OFF signal.

Assume, now, that the engine, on passing over B, has obtained the OFF signal as just described, and that an emergency arises which renders it necessary to stop the engine, at the HOME signals if possible. Under ordinary circumstances, the signalman would throw his HOME and ADVANCE line signals to DANGER immediately. This action on his part, with the line signals, ensures a DANGER signal being given either at bar C, or D, or E, according to the position of the engine when the line signals are put to DANGER.

Finally, assume that the engine has passed over a bar B with the line signals at DANGER, and before it has reached bar C the signalman has lowered the line signals. The small semaphore arm is at DANGER and the "route indicator" pointer in the central position and the bell ringing. On passing over bar C, the complete OFF signal will be obtained, that is, the semaphore arm will be lowered, the "route indicator" pointer deflected to No. 1 or No. 2 on the dial of the indicator, as the case may be, and the bell stopped precisely as in the case where the OFF signal was assumed to be obtained at bar B.

It will be seen that the action of the bar A upon the engine circuits constitutes a signal warning the driver of his approach to a signalling point. The continuance of the WARNING signal constitutes a DANGER "condition" relating to the STOP signals for the signalling point which is being approached. The bar A is situated at a distance of about 150 yards from the bar B, and the WARNING signal is, therefore, of short duration only if the STOP signals are OFF. The stopping of the WARNING signal by the return of the small semaphore arm to the OFF position, the stopping of the bell, and the receipt of a "route indication," constitute the OFF signal, which can only be given when all the main line signals are OFF, and then only by the direct intention of the signalman. An indication given at the first signalling bar B can be reversed during the passage of the train from B over the subsequent bars to the ADVANCE signal. The number of points at which these reversals can be obtained is only limited by the number of intermediate bars C. The apparatus is capable of giving CALLING-ON signals as well as the OFF and ON. Currents are sent to the bars by the operation of switches connected and working with the levers operating the STOP signals, HOME and ADVANCE, and the signalman can, therefore, only give the OFF indications by intention.

As already indicated, the bars A, B, C, D, E, etc., act mechanically on the shoe *Sh*, to actuate the semaphore and bell, and electrically, by currents set in operation by the signalman, through the brushes *br*, *br*, to actuate the "route indicator" and indirectly the semaphore and bell. The opening of the switch, *Sw*, causes the armature of the main semaphore coil to be released, raising the arm to danger, and mechanically releasing the "route indicator" pointer from its deflected position. At the same time the contact *c* is made, and contact *d* broken. These alterations of the contacts, *c* and *d*, divert the current through the bell as soon as the switch *Sw* is closed by the shoe *Sh* passing off the bar A. The armature of the main semaphore coil cannot be raised by the closing of *Sw*, because the circuit is now broken at *d*. Hence the bell continues to ring, and the semaphore arm remains at DANGER until further actions take place.

The "route indicator" has two armatures; one is a shuttle-wound armature, SA, capable of turning between the poles and carrying the pointer at the front of the dial; the other is an ordinary lifting armature, LA. The shuttle-wound armature is polarized by a special circuit supplied from the engine battery, as shown. The lifting armature closes the contact *b*, which completes a circuit through the main semaphore coils. The shuttle-wound armature carries a slotted sector, S, having depressions at each end. In the slot rides a freely pivoted rod which, when the sector follows the deflection of the armature, drops into one or other of the depressions and locks the armature, pointer, etc., in the deflected position. The sector and armature is mechanically released by the dropping of the armature of the main semaphore coils, through the rod *r*.

When the engine passes on to the bar B—the small semaphore arm being at DANGER, the bell ringing, and the "route indicator" pointer in the central position—when the STOP signals are off for, say, No. 1 line, a current passes from B, by *br* and *br*, through the "route indicator" coils to the engine frame and earth. The following actions take place in the indicators:—

1. The "route indicator" pointer is deflected to No. 1 on the indicator dial, and locked.

2. The lifting armature is raised for the time the current is passing through the "route indicator" coils and closes the contact *b*.

3. The closing of *b* sends a current through the main semaphore coils, which raises the armature and breaks the contact *c* and also makes the contact *d*.

4. The breaking of contact *c* stops the bell. The making of contact *d* provides another path for a current through the main semaphore coils than that by *b*, which is broken as soon as the brushes *br*, *br* have passed off the bar B. Hence the semaphore indication is restored to what it was before the engine passed over bar A.

In passing over subsequent *energised* bars, the action of the switch *Sw* is neutralised by the closing of the contact *b*, and no change takes place in the indication. Should the engine pass over an unenergised bar after passing over B, it is obvious that the neutralising of the effect of the mechanical opening of the switch *Sw*, by the shoe *Sh*, would not take place, and indications similar to those obtained at bar A would be received. This is the basis of the emergency DANGER signal previously referred to, the de-energising of the bars being effected by putting one or both STOP signals to DANGER.

The line equipment by which bars are energised when required is simple. Movement of the signal levers in the ordinary operation of the signals to the OFF position closes switches connecting the batteries in the cabin with the line wires. Of the latter there are three; one goes to the DISTANT signal, and is connected to the bars B, C, D. One of the others goes to the ADVANCE signal for No. 1 line, and the other to the ADVANCE for No. 2 line. In each case the line wire is connected to the bar. Each of the line wires is provided with an indicator in the cabin, by which the signalman can see whether the bar is energised when he expects it is so. A small deflection only is given for this, the current being limited by the resistances connected to the bars B, E, and E^1. This resistance in no way interferes with the giving of the indications on the engine. A much greater deflection is obtained on the cabin indicators at the moment the brushes *br*, *br* of an engine are on an energised bar, and this, if looked out for, is to some extent an assurance that the apparatus is in order, and that the requisite indications are being duly given.

The cabin circuits are easily followed. H^1 and A^1 are the levers for the HOME and ADVANCE line signals for No. 1 line, and H^2 and A^2 are similar levers for No. 2 line. The circuit set up by the operation of the HOME signal lever is not complete until the corresponding ADVANCE has been operated. On the other hand the operation of either ADVANCE is sufficient to give an indication at the ADVANCE bar. Hence an OFF indication cannot be given at the bars B, C or D, unless *both* STOP signals are OFF—which corresponds to the arrangements necessary to lower a DISTANT line signal under ordinary interlocking—but such an OFF signal can be given at the ADVANCE without in any way interfering with the necessity for giving DANGER signals at the rear. The small tapper switches, T^1 S^1, and T^2 S^2, enable the "calling-on" signal previously mentioned to be given. Their normal position is open, as shown; when closed they simply intermittently take the place of the switch closed by the ADVANCE lever when the OFF signal is being given. As will be readily seen by the diagram, fig. 1, the direction of the currents to the line wire for B, C, D is different when H^2 and A^2 are operated, to what it is when H^1 and A^1 are operated, and the reversal of the "route indication" numbers follows.

The track bars are of steel, of T section, mounted on wood blocks and porcelain insulators.

A consideration of the description of the apparatus will show how fully the system meets the conditions found to be necessary. It is adaptable in many other ways than those mentioned. The design of the apparatus is such as to give the fullest possible indication of failure of the equipment. The normal operating position of the semaphore arm is maintained by a continuous current, and interruption of which places the semaphore arm to DANGER, and inability to restore the arm to the normal running position is proof of such failure.

The arrangements by which the WARNING and DANGER signals are given by the mechanical raising of the shoe, obviate the necessity for relying upon the making of electrical contact with the bars of the track for giving these signals, and any failure to make such contact has only the result of causing OFF signals to be missed, and so does not in any way result in dangerous action. The apparatus is self-testing during the whole time it is in operation.

(*To be continued.*)

Patents and Alien Enemies.—The application of Mr. J. H. Meyer, 12, Lime Street, E.C., for a licence under Patent No. 7617/10 of Podszus, for an electric igniter for explosion motors, has been granted by the Board of Trade.

LEGAL.

The Prize Court.

(Claim by Babcock & Wilcox, Ltd., allowed.)

Presiding over the Prize Court in the Admiralty Division, Sir Samuel Evans decided a question of the right to certain property forming part of an electrical installation, in favour of Messrs. Babcock & Wilcox, engineers and boiler makers, Glasgow. The Crown had applied for the condemnation of part of the cargo of the British steamship *Huanchaco*, consisting of boilers, bricks and other material to be used in connection with an electrical works at Valparaiso, Chile. The goods were seized at Liverpool as enemy property, the contention of the Crown being that the proprietary in the goods was in the Deutsch-Uberseeische Electricitäts Gesellschaft. The goods, it appeared, were shipped by Messrs. Babcock and Wilcox under a contract with the German company, and were intended for a company known as the Chilean Electric Tramway and Light Co., Ltd., which is registered in Great Britain. On behalf of the claimants it was contended that the German company were merely acting as advisers and buying agents on behalf of the Chilean company, in which the German company had a large financial interest, and that the proprietary in the goods never passed to the German company. It was further contended that Messrs. Babcock & Wilcox had never parted with the proprietary in the goods, and that the only persons who would lose if the cargo were condemned were the eminent firm of Scottish engineers.

The President, giving judgment, said that in this case he had come to a definite conclusion upon the matters that he had to decide. The question was whether or not 324 packages containing certain boilers and plant and a large number of loose bricks were enemy property. He had come to the conclusion that the German company were independent contractors, and that there was no privity of contract between Babcock & Wilcox and the Chilean company. But whether that was so or not he did not think mattered. The contract, he thought, was between Babcock & Wilcox and the German company, and the question was whether the proprietary in the goods had passed from the former to the latter. The goods were put on board at Glasgow and the ship proceeded to Liverpool, where they were seized on August 27th. The contract under which the goods were shipped was dated January 7th, 1914. The German company had also some time in 1913 entered into a contract with the claimants for the erection of four boilers in connection with electrical works at Valparaiso. In 1914 it was intended to extend those works, and the contract of January 7th, 1914, was the contract for that extension. Some of the terms of the earlier contract were not again repeated in the later contract, but they were referred to and incorporated in it. According to the contract of January 7th, 1914, what Babcock & Wilcox had to do was to supply a complete boiler installation and accessories for the extension of the works which had already been carried out in 1913. The description of the work was under four heads, and the amount to be paid was distributed between the four items, the total amounting to £7,473. This sum was to be paid by instalments, the last instalment at the expiration of one year's guarantee. The installation was to be erected under the supervision of a man sent out by the claimants, and a certain time was to elapse before the works were taken over. It was not till one year after that that the final instalment was to be paid. The cargo in question comprised only a part of the plant and did not complete the material necessary for the erection of the works. Unquestionably the goods seized were materials which would have been used in erecting the works, but what he had to decide was whether the proprietary in these disjointed pieces had already passed, or whether the passing of the proprietary depended upon something that was to be done at a later stage. The contract between the parties was not for the particular articles in fact seized. The contract was for the installation into which works these materials were to be put. In his opinion there was no passing of these disjointed pieces of goods. They were not sold as such. No separate price was fixed for them. They were only part and parcel of the whole quantity which had to be supplied. The authorities made it perfectly clear that these goods could not be treated as separate goods in respect of which there was a complete contract and a passing of property. Here there was no contract for the separate sale of the goods in question at all, and he held that at the time of seizure the proprietary had not passed. He therefore ordered that the goods be released to the claimants.

Workmen's Compensation.

At the Salford County Court, last week, Charles Atherton made an application under the Workmen's Compensation Act, the respondents being Messrs. Eckstein, Heap & Co., Ltd., manufacturing electrical engineers.

Mr. Sandbach stated that the applicant had been employed by respondents at a weekly wage of 24s. While grinding an iron clam on an emery wheel some of the metal flew off and struck him in the eye, and an operation had to be performed. He attended at the hospital from September 2nd to October 29th last year, and during that time he was paid half-wages, while the respondents also gave him an extra allowance of 5s. per week, as he had a wife and family. On October 29th he returned to his work, but was put on a different job, and was a kind of odd man. His eyes were painful, and he could not see to do his work properly. On December 3rd he was given a week's notice. The man had since tried to get work at several places.

Atherton, in evidence, bore out the opening statement, and added that he did succeed in getting a situation at one place, but was discharged because he could not see to do his work.

Cross-examined: He denied that when he returned to Eckstein's he was discontented and careless, and declared that he did not refuse to do certain work on December 3rd, which led to his appearance at the office of the works manager. He stated that it was not in consequence of his refusal to do certain work that he was discharged.

Dr. Shand, of Regent Road, Salford, stated that he examined the applicant on January 6th. The man's eye, he said, was inflamed, and it appeared to cause him considerable pain. He could not follow his work except under great difficulties.

Cross-examined: Dr. Shand said he was not an eye specialist.

Mr. McCleary, for the respondents, said this was one of those cases where a man would be better off without the Workmen's Compensation Act. He was employed by a most excellent firm, suffered a small accident, and was incapacitated for a short time, and it was fair to assume that if it had not been for the Act the man would have been looked after and would have returned to his work a contented man, and not a discontented man going about spreading discontent among the other workmen and saying the firm could not discharge him. His conduct culminated on December 3rd in his refusal to obey orders.

Mr. Frank Panter, works manager, spoke to the applicant's discontented attitude when he returned to work, and stated that he was put back on his old job, and never complained that he was not able to do the work.

Dr. Wharton said that he had examined the man, and, in his opinion, there was nothing to prevent him doing his work as formerly.

On Judge Gurney's suggestion, the man was examined by both doctors in an adjoining room, and on their return to Court, Dr. Wharton said there was no inflammation, and Dr. Shand said the inflammation had subsided somewhat, but was still present.

Judge Gurney said the doctors had set him a nut to crack, and the best thing he could do, in the absence of a medical referee, was to say that the man was perfectly able to do his work. The award, therefore, would be for the respondents.

Irish Judgment Set Aside.

The King's Bench Division, Dublin, has set aside a judgment against Mrs. Morrow, 3, Upper Leeson Street, for £29 6s. 4d. in an action brought by Mr. J. C. Meldon, electrical engineer, against that lady and her husband, Mr. R. Morrow, for a supply of electrical fittings, the ground stated being that the judgment was marked by surprise and through a mistake on the part of defendant. Mr. Bartley, in resisting the application, said the fittings had been sent to Mrs. Morrow.

Tramway Accident Claim.

In the Glasgow Court of Session, before Lord Ormidale, the record was closed in an action by Janet Henderson and Annie Henderson against the Musselburgh and District Electric Light and Traction Co., Ltd., for £1,000 and £750 respectively for the death of their father, John Henderson, 65, farm labourer, by the alleged fault of the defenders. On March 17th, 1914, he was leading a horse and cart at a walking pace out of the gate at Fowler's Brewery, Prestonpans, and across the car lines, when a tramcar ran into the cart, with the result that the car swung the cart and horse round to the side. The horse took fright, and the deceased was dragged round with them. He suffered from shock, and died the following morning. The defenders deny liability. Issues for trial were ordered.—*Glasgow Daily Herald.*

P.M.G. *v.* Oxford Electric Tramways Co., Ltd.

At the Oxford County Court last week, the Postmaster-General sued the defendants for £6 damage to a telegraph pole. Mr. W. N. Raywood, who appeared for the Postmaster-General, said that the facts had been agreed. A motor-'bus ran into a telegraph pole, the property of the Postmaster-General. The claim was made under Sec. 8 of the Telegraph Act, 1878, which enabled the Postmaster-General to recover damage done to the telegraph line by any undertakers, bodies or people. Mr. Raywood asked for leave to appeal, and his Honour granted the application.—*Oxford Chronicle.*

Norwegian Nitrogen.—The Société Norvégienne de l'Azote reports gross profits of £468,000 for 1913-14, as compared with £442,000 in 1912-13, and net profits of £316,000 and £287,000 in the two years respectively. It had been proposed to pay dividends of 8 per cent. on the preference capital and 6 per cent. on the ordinary shares, but these recommendations are not to be carried into effect. The company had concluded a loan with the Société des Annuités, of which two thirds had been completed on the outbreak of the war. At present the work of extending the plant at Rjukan is at a standstill, owing particularly to the impossibility of securing the delivery of machinery on order, in consequence of the war.

THE HARDENING OF METALS.

The first annual meeting of the Faraday Society was held on November 23rd, and took the form of a general discussion on the important subject of the Hardening of Metals. Sir Robert Hadfield, the President of the Society, was in the chair, and the meeting, which was largely attended, included some of the best known workers in this branch of metallurgy.

There are three fundamental ways in which a metal or an alloy can be hardened:—

1. By cold working.
2. By chilling; usually suddenly from a high temperature, but sometimes by moderately slow cooling. In one instance referred to by Professor Howe, in a valuable communication which he sent from New York, cautious *reheating* is required for hardening, in the case of Maurer's austenitic manganese steel.
3. By the mere admixture of different kinds of molecules.

In the case of pure metals it is obvious that hardening must be caused by some change of state, and the question resolves itself into what is the nature of the change of state. Pure metals, as normally cooled from the molten condition, are crystalline in structure, and the change of state that hardens them must be either a re-arrangement of the crystals or a change of crystalline form, or a change from a crystalline to an amorphous form. Dr. Beilby has within the last few years brought forward a considerable body of experimental evidence which goes to prove that when pure metals are cold worked, and thus hardened, the surfaces of the crystal grains are flowed into a smooth, hard, *amorphous* vitreous layer or skin, and it is this amorphous skin so formed between the crystal grains which is the cause of the hardness brought about by cold working. The question arises as to whether, accepting the theory of the amorphous state, hardening by chilling or the hardening of alloys can be made to fall into line with this explanation of hardening by cold working. Dr. Beilby claims that there is no essential difference between the two processes, the contraction strains due to chilling supplying the mechanical work necessary to convert the crystalline into the amorphous state. The theory has been applied to the general case of hardening by quenching by Professor Edwards and Professor Carpenter, and to the particular case of steel by Mr. J. C. W. Humfrey. The former maintain that the hardness produced by quenching is brought about by crystal twinning, and possibly direct slipping, and the resulting formation of amorphous layers. Mr. Humfrey's theory of hardened steel is an adaptation of the amorphous theory to fit in with the old allotropic theory (somewhat discredited at the Faraday discussion), which considers hardening to be due to the existence above a certain critical temperature of an adamantine γ form of iron which sudden cooling prevents from slipping back into the normal form that is stable at low temperatures.

The amorphous theory was criticised by the President, Professor Howe, Dr. Desch, and Mr. A. McCance. The main ground of Sir Robert Hadfield's objection appeared to be his unwillingness to concede that the extraordinary hardness of steel was of the same character as hardness caused by cold working, and in this he was supported by Professor Turner. It was improbable, said Sir Robert, that the glass-hard surface of a projectile weighing a ton, which would cut through 15 inches of steel without being fractured, could be in a state of strain. The hardness must be brought about by chemical change, and the fact is the carbon and its condition must be the principal factor as a cause of the extreme hardness of steel, and it has been too much overlooked in the theories that have been put forward. In this Dr. J. E. Stead concurred. In his opinion the different behaviour of hardened and annealed steel when treated with chemical reagents proved that there was a difference in their chemical constitution.

Professor Howe considered that the amorphous theory would explain all those cases of hardening where there was a martensitic structure in the hardened steel. There was, however, a non-martensitising way of hardening, namely, by holding manganiferous austenite (Hadfield's manganese steel) slightly below the transformation range (*e.g.*, at 550° C.), whether the cooling thence be fast or slow, and this could not be explained by the amorphous theory, because at such high temperatures amorphous iron should be able to recrystallise.

Mr. McCance objected to the amorphous theory on the ground, among others, that strained α iron and strained γ iron were dissimilar in magnetic properties, whereas if straining produced the amorphous variety the effect in both cases should be the same. Indeed γ iron cannot be made ferro-magnetic by any treatment such as permanent deformation.

The result of the whole discussion left the impression expressed by Dr. Stead, namely, that interesting and important as are the several theories of hardening now current, we have not as yet sufficient data on which to base dogmatic conclusions. What may be called the Sheffield School has little doubt that on the carbon condition mainly depends the extreme hardness of steel, and Sir Robert Hadfield himself feels so strongly on the matter that he has offered a Research Prize of £200 in order to stimulate the study of the carbides of iron and of iron alloys generally.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

103. "Dynamo-electric machines for transforming alternating current into continuous current, or *vice versa*. J. L. La Cour. January 4th. (Convention date, January 2nd, 1914. Sweden.)

112. "Galvanic batteries." C. B. Burdon. January 4th. (Siemens & Halske Akt. Ges., Germany.)

114. "Electric automatic protector." A. W. H. Nash. January 4th.

121. "Means for obtaining a high starting-torque on a continuous-current motor with a relatively small starting-current." A. J. Leigh & H. J. Osborn. January 4th. (Complete.)

123. "Electrical adapters." L. Rosenthal. January 4th.

129. "Magneto-electric machines." R. B. North & A. M. Allen. January 4th.

130. "Magneto-electric machines." R. B. North & A. M. Allen. January 4th.

131. "Electric fusible cut-outs." H. P. Liversidge & Pennsylvania Appliance Co. January 4th. (Complete.)

154. "Electric heating-pad." G. Lander. January 5th. (Luis Zanaboni, Argentina.)

180. "Electric starting devices for motor-driven vehicles." Maschinenfabrik Oerlikon. January 5th. (Convention date, January 29th, 1914. Switzerland.) (Complete.)

188. "Incandescent electric-lamp holders." C. Pressland. January 5th.

190. "Combined mechanical and electrical devices." M. Wuillot. January 5th. (Convention date, January 24th, 1914. Belgium.) (Complete.)

247. "Dynamo magneto-electric generating machines, particularly applicable for lighting, charging, and ignition in connection with internal-combustion engines of motor-cars, launches, aeroplanes and the like." C. H. Melsome-Smith. January 7th.

264. "X-ray apparatus." H. W. Cox & Co., Ltd., & H. E. Donnithorne. January 7th.

270. "Excess wattmeters." A. W. Burke. January 7th. (Convention date, January 21st, 1914, United States.) (Complete.)

275. "Electric wave amplifying apparatus." Western Electric Co., Ltd. January 7th. (Western Electric Co., United States.) (Complete.)

282. "Electric heaters for culinary and other purposes." Benham & Sons, Ltd., & C. R. Allensby. January 7th.

303. "Manufacture of composition for the manufacture of artificial leather, floorcloth, paper, insulating material, boards, paint, and other purposes." W. P. Thompson. January 8th. (Herman Arledter, Austria.)

324. "Electrical transmitter microphones." B. A. Pilkington. January 8th.

350. "Electro-magnetic levitating projector and projectiles therefor." E. P. Bachelet. January 8th.

367. "Electrical switches." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg & G. Pegg. January 9th.

378. "Electric cable joint boxes and the like." A. H. Railing & C. C. Garrard. January 9th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1913.

25,062. Signalling Apparatus. E. C. R. Marks. (Mead Electric Signal Co.). November 3rd.

26,364. Magnetic Separators. A. F. Jobke. November 17th.

26,834. Multiple Arrangements of High-frequency Electric Current Generators. P. O. Pedersen & V. Poulsen. November 21st. (December 12th, 1912.)

28,703. Automatic Control System for Electric Railways. B. F. Hutches. Jun. December 12th.

28,956. Electric Signalling Systems. A. W. Brown & I. H. Parsons. December 16th.

29,063. Regulators for Electric Transforming Apparatus. British Thomson-Houston Co. (General Electric Co.). December 16th.

29,346. Devices for Correcting the Difference of Phase in Telegraphic Receiving Apparatus. A. C. Baronio & K. L. Wood. December 19th. (Cognate application, 16,905/14.)

29,526. Device more particularly intended for use on Electric Light or other Switches or Controls, for Displaying Reminders, Advertisements, Notices, and the like. E. Clarke. December 22nd.

29,562. Self-excited Electric Motors for Operating Sliding Windows and the like. J. F. P. de la Ribcisiere & R. le Grain. December 22nd. (December 23rd, 1912.)

29,655. Machines for Generating Electrical Energy. C. T. Mason. December 23rd.

29,713. Liquid Resistances. Akt. Ges. Brown, Boveri, et Cie. December 24th. (January 9th, 1913.)

29,776. Couplings or Connections for Electrical Conductors. J. Stone & Co. and A. H. Darker. December 24th.

29,861. Retarding or Time-limit Devices. W. A. Coates & Ferranti, Ltd. December 29th.

29,902. Generation of Electrical Oscillations. A. F. Sykes & Ford. December 29th.

1914.

124. Dynamo-electric Machines. British Thomson-Houston Co. & A. A. Pollock. January 2nd.

125. Globe Holders. British Thomson-Houston Co. (General Electric Co.). January 2nd.

1,437. Process for the Electrolytic Production of Malleable or Forgeable Iron. E. F. K. Harbeck & B. Lān. January 19th.

1,715. Magnet Pole-pieces of Telephone Receivers and the like. A. Marr. January 22nd.

2,325. Electrical Heating Device. R. W. Gauntlett. January 28th.

2,495. Portable Electric Lamps. W. A. McKay and M. Claussen. January 30th. (February 11th, 1913.)

3,806. Candle Lamp. C. E. Green & Arctic Light Co. February 13th.

4,261. Electric Chiming and Striking Gear. H. Wilson. February 19th.

5,776. Automatic Voltage Regulators. British Thomson-Houston Co. (General Electric Co.). March 6th.

7,019. Means for Signalling on Trains. W. E. Benn. March 19th.

8,062. Protective Casing for Electric Cables. R. McGeoch. March 31st.

9,376. Printing Telegraph Systems. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). April 15th.

THE

ELECTRICAL REVIEW.

VOL. LXXVI. JANUARY 29, 1915. No. 1,940.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: January 29, 1915. [No. 1,940.

Page

English and American Wiring Rules and Regulations ... 129
National Trade Policy ... 130
British Electrical Exports and Imports during 1914 ... 132
Rubber ... 132
Electric Lighting Authorities and the Law of Rating (*concluded*) ... 133
The National Electrical Code and British Wiring Rules Compared, by F. Broadbent (*concluded*) ... 134
A Mercury Rectifier Locomotive (*illus.*) ... 136
War Items ... 136
Correspondence—
  Advertising and Character ... 138
  Contracts with Alien Enemies ... 138
  Garage Heating ... 138
  Salaries of Junior Engineers ... 138
  A.C. *v.* D.C. for Lighting ... 140
  Commercial Relations with Germany ... 140
  War on German Trade ... 141
  German Trade with Belgium ... 141
New Electrical Devices, Fittings and Plant (*illus.*) ... 141
Legal ... 143
Business Notes ... 144
The Edison & Swan Electric Lamp Works (*illus.*) ... 145
Three-Phase Plant at Ashton-under-Lyne (*illus.*) ... 147
Notes ... 153
City Notes ... 155
Stocks and Shares ... 156
Exports and Imports of Electrical Goods during Dec., 1914 ... 157
Electrical Exports and Imports during 1914 and Previous Years (*illus.*) ... 158
Cab Signals on British Railways, by W. A. Stanier and W. Willcox (*illus.*) ... 161
The Development and Application of Searchlights ... 163
New Patents Applied For, 1915 ... 164
Abstracts of Published Specifications ... 164
Contractors' Column ... Advertisement page xviii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 938; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

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ROME: Loescher & Co., Corso Umberto I 307.

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TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

IN PREPARATION.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

ENGLISH AND AMERICAN WIRING RULES AND REGULATIONS.

IN a recent issue of the *Electrical Review and Western Electrician*, namely, the issue bearing the date December 5th, 1914, a detailed comparison was made between the "National Electrical Code," which is in use in the United States and Canada, and the German and English rules. The comparison, which is set out in three parallel columns, occupies 10 pages of the journal referred to, although it deals solely with the wiring rules concerned with inside work, which form considerably less than half of the complete code; the latter covers also the wiring of central stations, transformer sub-stations, outside work, marine and miscellaneous work, in addition to comprising a large section devoted to constructional details of fittings, cables, switches, and other wiring accessories.

In our Institution Rules the standards adopted for cables, conduits, &c., are those defined by the Engineering Standards Committee (E.S.C.). The rules make reference to these but do not quote them *in extenso*. It is very doubtful if the average contractor has ever troubled to read them or even to obtain a copy, and the average wireman has probably never heard of them, nor do they greatly concern him. The contractor knows that there is a difference between "Association" and "non-Association" cable, but he knows more about the difference in the price than in the cable, and he must accept the maker's guarantee as an article of faith. As to applying any tests to prove that he is getting what he pays for, we doubt if anything beyond gauging the wire is done, and it would be beyond the practical capabilities of many to measure the resistance of a coil with sufficient accuracy to say whether or not it came within the permissive margin of 2 per cent. variation from the standard. We do not say this in disparagement of the wiring contractor; he does not regard it as his business, nor has he generally the necessary measuring appliances.

Seeing that he is entirely at the mercy of the manufacturer, there is something to be said in favour of the system of testing and issuing certificates of approval which has been adopted by the National Board of Fire Underwriters in the States. We assume that so long as a contractor working under the National Code employs "approved" materials, he accepts no responsibility in connection with them, but this point is not clear.

The National Electrical Code is revised every two years, and the time for revision is now approaching; it is possibly due to this fact that so much attention is at present being devoted to the discussion of wiring matters in the American technical Press. There appears to be a feeling that electric wiring is passing, or about to pass, through a transition period in which the piping or conduit system may have to give place to some of the later systems which have been devised, just as casing has been gradually, but none the less surely, replaced by conduit. There is in this country at the present time a tendency to ask if all the advantages supposed to be possessed by conduit wiring are real or mythical, and many contractors, some consulting engineers, and, we believe, also insurance companies, are disposed to look more favourably upon wood casing installations now that jointing has been largely superseded by looping of connection fittings. Eliminate joints from the conductors actually enclosed by the casing, and there is very little left in the system which can be objected to from the point of view of fire risk when it is used for ordinary residential buildings, and in dry situations. It will be generally agreed by those competent to express an opinion, that a good casing installation is better than a poor conduit job.

The chief objections to the wood casing system were the risk of fire due to bad jointing or connections within the casing, and the unsuitability of casing for sinking flush or burying in plaster when surface work was undesirable.

It is not without interest to note that the special wiring systems which have from time to time been brought out, such as the Stannos system, Henley's wiring system, and cab tire sheathing, owe their inception to cable makers rather than to electrical contractors, as was the case with wood casing and conduit. We do not think that it is claimed by the originators that any one of these systems is capable of universal application, although no doubt each has merits when confined to specialised or particular classes of work.

Conduit wiring is the prevailing practice in the States, and, judging from the tone of the technical Press, we gather that there is a fear among the makers of conduit that the National Code may be revised so as to admit newer methods in which conduit is not used.

The essential difference between our own Institution Rules and those of the National Electrical Code is that ours are of a more general character, specifying the conditions which are to be complied with rather than the actual methods to be adopted and the specific details of fittings and materials to be employed. This is what the National Code purports to do, and is, no doubt, one of the chief reasons which necessitate its frequent revision.

The National Electrical Code is the official code recommended by the National Fire Protection Association, and is drawn up chiefly by men interested in electrical work from the fire insurance point of view. Our rules, on the other hand, are drawn up by a Committee of the Institution of Electrical Engineers representing the various sections of the electrical industry, and including also representatives from the insurance companies. This may account in some measure for the greater stringency of the National Code on some points. We do not think that we should serve any useful purpose to English readers by tabulating in parallel columns the National Code and our Institution Rules, because in many respects, where they cover the same ground, the differences are only verbal. There are, however, notable differences here and there due in part to the different character of the constructional work obtaining in the two countries, but the chief characteristic which distinguishes the Code from our Rules is, as mentioned above, the section in the Code devoted to details of manufacture. Now that our own manufacturers are more fully alive to the export business which may be done, perhaps not with the States, but with the Dominion of Canada, we think it is important that they should appreciate that any fittings designed for use in that Colony will not only have to be in accordance with the National Code Rules, but will have to be officially tested and approved by the laboratories of the National Board of Fire Underwriters.

We understand that the B.E.A.M.A. has the matter under consideration, and that attempts are being made to induce the Revising Committee to modify certain of the regulations in order to bring recognised and approved British fittings within the requirements. There is no doubt a feeling in the States that some of the conditions are unnecessarily stringent, and that they tend to retard the rate of electrical progress. If, therefore, without sacrificing anything which tend to safety and immunity from fire risk, the Revising Committee is of opinion that some of the restrictions may be relaxed somewhat, it is quite probable that some modifications will be made. But such modifications, if any, will be made solely in the interests of electrical work in America, and not for the purpose of making it easier for British manufacturers to compete with American productions in the American and Canadian markets. Too much, therefore, must not be expected from the forthcoming revision, but our manufacturers must rely rather on modifying their designs where necessary so as to comply with the Code. Whilst we do not propose here to enter into a detailed comparison of the American and English rules, we would refer our readers to a critical commentary which is concluded in this issue by Mr. Frank Broadbent, whose paper on wiring rules, read before the Newcastle Section of the Institution in February, 1901, was among the first which showed in tabular form the extraordinary differences then existing between the rules of the Institution and those of various supply authorities and insurance companies in this country. Happily since that date the revised Institution Rules have been adopted as the National Standard, to the advantage of all concerned, and if subsequent revisions on both sides should bring about a greater degree of uniformity between the American and British National Codes, the advantages would, no doubt, be mutual.

NATIONAL TRADE POLICY.

British manufacturers have been so often accused of indifference in connection with export trade development, that we fear that much of the criticism and advice that are vouchsafed through the columns of trade journals, or by the medium of special trade reports, receives but scant attention. It is a thousand pities if that is true, for many of those who take the trouble to express their views have the best interests of British industry at heart, have first-hand and authoritative information upon which they base their criticism, and find no satisfaction in mere depreciation of the doings or misdoings of their own race. There can be no question about our having done ourselves a good deal of injury in past years by wasting so much time in discussing the opinions of people who have seemed to be in the seventh heaven of delight when they have been advancing "proofs" of our decadence as a nation. Physically, scientifically, industrially, and spiritually—according to the particular exponent of the phase and of the time—have we been on the down grade. Somebody was soon to write the "Decline and Fall of the British Empire"! Unfortunately, discussions of this kind cannot proceed within our borders without outside observers, who do not understand the British character, accepting us at our own apparent valuation.

It hardly lies within our province to dwell upon the view held by some students of these days that from the standpoint of national character this terrible war, notwithstanding all its awful loss in blood and treasure, is not only going to stay or prevent any tendency in the direction of decadence which affluence and internal differences might have induced, but is going to re-establish the prestige of the British nation in respect of the high standards for which it has so long stood. All the old qualities of our fathers have reasserted themselves. Who talks of physical degeneration, of spiritual apathy, after five months of war? Bernhardi-Shaws, "Gloomy Deans" and some evening newspapers are not to be seriously regarded.

Yet we shall not be well advised if we allow to pass unheeded those who ask us not to imagine that all is well with our methods when we consider our relation to the world-trade problems.

Communications continue to reach us from all parts of the Empire, to which we are compelled to afford publicity if we are to fulfil faithfully what we regard as our duty as Editors. It is, and always has been, distasteful to refer to British shortcomings in respect of our export trade, but the views recently expressed by some of our correspondents in India and Canada are typical of many such criticisms that reach us, and they should not be ignored; more are before us as we write.

An Indian critic accuses us of "utter slackness"; a Canadian correspondent says that Britain loses trade in Canada "through lack of attention"; an Australian writer gives us statistics showing the attention that Americans have been paying to the Commonwealth, as evidenced by his own correspondence received since the outbreak of war; others hold up for our reproof the courtesy and eagerness of Continental firms. All of these criticisms are so much like what we have heard for many years past, that we are not justified in suspecting them of relating to isolated and exceptional cases, though we recognise that there may be another side to every complaint. If we mention them now it is less with a desire to decry the methods of the British manufacturer—there is no useful purpose to be served by that alone—than to suggest that when we are contemplating more aggressive efforts to meet the electrical and engineering requirements of other countries, we should remember the frame of mind of some of our potential customers and the virtues credited to our competitors.

We have already dwelt at some length upon the need for co-operative action on the part of manufacturers, though we have not yet witnessed any very strong movement in that direction. Probably the lack of it is due to the pre-occupation of our firms with direct or indirect Government orders, to the handicap due to absences on active service, and to the indisposition to make definite movements while our national life continues under a cloud owing to the enforced slowness of military operations in winter. But we must continue in these days to prepare for what is to follow when conditions change, as they must do before long—perhaps sooner than we think. While we are trying to possess our souls in patience concerning the forward movement in France and Belgium, forces and equipment are being prepared which will make victory sure. There is the same call for patience in regard to the Trade War, for the opportunities for actual advance are not facilitated by the financial and shipping difficulties that now prevail; but there is as great need for preparing ourselves as business men, as there is for training and arming Kitchener's Army. There is a strong desire in the Colonies that such an invulnerable line shall be drawn by our trading forces that Germany shall not again be able to break through into markets which by right are ours. How are we going to make that line invulnerable? If there have been weak places, owing to faulty methods in the past, we ought to sit down seriously, not showing ill-will at the strictures of our critics, and weigh up the whole matter and adopt measures to prevent the existence of vulnerable points in the future. We refer now, of course, to that kind of reform that lies within our power as manufacturers or traders—an improvement of our own trading efficiency.

We, of course, recognise that there are other matters of prime importance that lie beyond the power of the individual trader. There is a very strong conviction in some quarters that something in the nature of working co-operation, concentration, or even amalgamation of interests, is required in order to enable British firms to deal with the industrial position effectively, so as to prevent unscrupulous aggression on the part of Germany's consolidated electrical and financial forces both in the Home and Colonial markets in the future. That is a matter essentially for manufacturers who know the difficulties with which they have had to contend, but those who study the position as onlookers cannot forget the advice that has been vouchsafed by experienced minds, nor can they shut their eyes to the results that followed the "bulk" manufacturing operations of Germany and the United States. Without such concentration, there must continue a vast amount of wasted effort and expense always adversely affecting the cost of production. The spectacle of half-a-dozen comparatively small British firms competing against each other in a British colony for a contract, while a powerful German or American organisation carries off the prize, is humiliating to all save the winner. If concentration of interests is not acceptable, let us at least have something in the form of organised British co-operation, and secure the spoils for division among British works.

We fear, however, that some of the most representative spirits in the electrical industry are disinclined to plunge into new ventures or to assume added liabilities and responsibilities because of the failure of the Government to listen to the appeal that has been made to it to formulate some policy in regard to the future fostering of British industry. It has done something through the increased activity of the Board of Trade Commercial Intelligence Department—we have no desire to belittle the importance of that. Still less do we wish to underrate its significance—it must consistently lead the Government on somewhere else—but where?

Although we recognise that the Commercial Intelligence Branch has been doing its best under the circumstances, and that it will make more heroic efforts still in the interests of British trade, we cannot help feeling that it is at present severely handicapped. We may be wrong, but it seems that in at least two important directions it requires strengthening in *personnel*. It has been shown again and again that the ordinary tea and toy salesman cannot expect to succeed in the electrical industry until he has had some more or less specialised experience therein; that the British Consul is hardly the best class of representative to cultivate trade; and we believe it to be equally true that the average civil servant type of official requires, for the work of the Commercial Intelligence Branch, to specialise in certain departments, or else his services should be assisted or supplemented by somebody who is tolerably expert in those departments.

The Advisory Committee cannot be expected to fill the needs that we have in mind.

In another direction, too, strengthening might be introduced. We have felt at different times the benefit of being able to confer in London and in the provinces with national trade representatives returned afresh from the scenes of their labours. They have been able to tell us in conversation in half-an-hour more of the special things that we wanted to know than we could have ascertained in months by correspondence either with them or with the Branch in London. There are capable Commissioners representing this country in different parts of the world who have accumulated a most valuable knowledge of the markets in which they have resided, and it seems to us that their presence in London for the next few years would be of material aid to the Department and to British traders. In this connection we might do well to take a leaf out of the German Consular Service book, for in the Commercial Department in Berlin a strong point is made of having always at hand men with knowledge and experience of the overseas markets, able to explain the local conditions and the standing, &c., of the people doing business in those markets, to the home manufacturers and traders. There may be blame attaching to the latter for not paying frequent and thorough visits to the markets abroad, but the Consular representative could give them guidance which we doubt not would frequently encourage them to travel rather than justify their stay-at-home policy.

As our readers will have noted, there are as many schemes for the reorganisation of the Board of Trade as there are self-appointed reformers in these days. There always have been demands for modernisation in that department, and we have ourselves agitated that way, but we fail to see the wisdom of clamouring just now for a complete upheaval, for we cannot see that it is within the scope of immediately practical politics. Yet some action is required, and the Government ought to assist industry by announcing what, if any, new policy it proposes to introduce. The country is, if we understand its present temper, disinclined to be hampered by the trammels of the past, and it does not want a revival of old controversies; what it does want is to be able to assure its manufacturers who have done so much, and in so many ways, to assist the nation at a time of crisis, that something in the form of safeguards or assurances shall be given that the British markets shall not be the future playground for every German who pleases to come over here to undercut those who make present sacrifices to manufacture the things that we need.

As we have said before, the Government has enormous undertakings in hand, and nobody wishes to unduly hamper it in conducting these concerns efficiently, but it has had some very detailed, trying, overloaded, and fatiguing Sessions before, and present claims upon the Cabinet's attentions may not be greater than in those days. Every member of the Cabinet must have brought his mind to bear upon the question of Germany's future trade position in these islands and in our Colonies; doubtless all the members together have already discussed the subject in some of its bearings. We should be sorry to see them divided at such a time as this, but we do again urgently appeal to them to shake off this attitude of the closed lips, and say something for the guidance of British manufacturers.

It seems to us that it is not only manufacturers that need to revise their methods of dealing with foreign trade, but also the Government.

It will be a matter for something more than regret if, when we write of the electrical industry in five years' time, we have to say that the greatest opportunity we ever had was allowed to slip by with only very small advantage accruing to the British manufacturer, because the Government of the day would not say the word necessary to give the justification for special efforts.

Just as we are writing we observe an important letter in the *Times* from Lord Cromer, who, writing as a Unionist Free Trader on the question of the aniline dye industry, admits that "a Protective tariff, bounties, subsidies, or a guarantee on share capital," though irreconcilable with the Free Trade doctrines "as heretofore accepted in this country," "can be justified on the ground of national emergency." He says other things as well which for our present purpose do not matter, but the above remark, we believe, represents the view of many others who would not have approved of it some months ago. "The ground of national emergency"—that is the crux of the whole matter. In an "Appeal to the Government," published in our issue of October 23rd, 1914, we requested the Cabinet to appoint a Commission to consider the bearing of the war upon the future of industry, and we asked it to consider the advisability of requiring all public money in future to be expended as far as practicable on British-made goods. We are interested to read now, in *Times* dispatches from Paris and Petrograd, that the Chancellor of the Exchequer and the Russian and French Ministers of Finance are to meet in Paris for a conference on financial questions "having special reference to furthering the cause of trade with Russia and the Allied States." This lends support to our suggestion expressed above, that future trade matters have been under discussion in our Cabinet. Though we have not secured the appointment of a Commission yet, it is pleasing to find that the Allies in Arms are about to consider officially the great question of remaining Allies in Trade.

The immensity of the Russian market, and the share in it which Germany has thrown away in the mad rush of militarism, surrounds this conference with a kind of glamour. That Russia will extend a preference of considerable value to us may be regarded as a certainty, but the problems of cheapening the cost of production, and of cutting the claws of tentacular financial control, are not going to be easily settled. The three European Allied Governments will, we trust, see their way to adopt a strong policy in commercial affairs which shall show the enemy that never again will her "will-to-power" policy be allowed to prevail in countries from which she has hitherto derived wealth which has enabled her to drench the soil of Europe with human blood. We credit the Chancellor of the Exchequer with ability to gauge the temper of the people, with a readiness to adjust his political thinking bringing it into subservience to national interests—as witness the Patents Act of 1907—and with a desire to confer with business men before he takes action in regard to matters in which he needs guidance from experts. We hope that before this Conference at Paris he has let down the plumb-line among British business men; or, if not, that he will do so when he is in a position to report upon the suggestions which it may be in the minds of our French and Russian Allies to make.

British Electrical Exports and Imports during 1914.

In accordance with our usual custom in January, we publish in this issue a series of curves which indicate at a glance the general trend of British electrical export and import trade during the past 12 months. The curves bear striking testimony to the effects of the war, which has led to a substantial reduction in the value of our export business, and the rapid replacement of Germany by the United States as the principal importer of electrical goods into this country. German overseas business has, of course, disappeared since the beginning of the war, but our American friends, with characteristic hustle, have more than made up the leeway, so that the imports, as a whole, have almost reached the monthly values prevailing before the war.

The shortage of labour, if not of plant, together with the partial dislocation of shipping and finance, brought about by the war, has tended seriously to handicap the efforts of our own manufacturers in foreign markets, and even internal electrical business, of which we have no record, doubtless gives place to the pressing necessities of the business of war and incidentally leaves an additional opening for the importer. The falling-off in our electrical exports shown by the curves does not necessarily mean any shortage of profitable employment by our firms; indeed, it may be quite the reverse.

Rubber.

The market for rubber has been much affected by a number of difficulties which have had to be faced and overcome, so far as possible, in connection with the export trade, which has been under more or less of a ban in consequence of the export prohibitions in force. Sentiment in this connection was particularly affected by the stoppage of trade with the United States, and this for a time was, indeed, the chief depressing factor. Some relief has, however, been lately experienced in this respect, since a compromise was come to between the Governments of the United States and this country as to a partial resumption of shipments under effective safeguards.

There has been a good deal of business moving during the last few weeks, and the market has shown a tendency towards recovery. American interests have re-entered the market as buyers, and have purchased very considerable quantities in anticipation of the development referred to. This has, of course, tended to stimulate the demand in other directions, and quite large quantities have changed hands. The market has shown a rallying tendency, prices having been advanced to about 2s. 3d. a lb. for No. 1 latex for spot delivery.

The position in the United States was at one time very stringent on account of the stoppage of shipments from this side, which naturally impelled the necessity of arranging for consignments from Brazil direct, which was a somewhat difficult matter. Prices of plantation rubber in New York were at one period run up to figures equal to about 3s. 9d. a lb. for fine grades, but there has since been some reaction. The market conditions were, of course, for a period rather artificial. The stocks in American consumers' hands are now believed to be very much reduced, and there is a continual drain upon the reserves of raw and manufactured material in connection with the pressing demand of the belligerent Powers on the Continent for tires, &c.

As regards the statistical position in Europe, there was last month a very considerable increase in the London stocks, in consequence of accumulated arrivals, but in the course of this month the deliveries have been improving, and it is generally presumed that the present stock will be lessened by slow degrees.

Supplies have been coming forward from the Near East more freely, the total December exports from the Federated Malay States being a record, at 3,361 tons, making a total for the 12 months of 30,697 tons, which compares with 23,463 tons in 1913 and 15.507 tons in 1912.

The state of the manufacturing trades in Russia has been decidedly more encouraging, requirements in that country having assumed much larger proportions, and this may be regarded as an important factor in connection with future developments in crude material. In Germany rubber is very scarce, and manufacturers' operations in many cases have had to be suspended, the State having first claim upon everything available. The fact is considered as being rather significant that the German Government has entirely prohibited the selling of such articles as motor-cars and their tires, except under permits, which sufficiently explains the conditions which are beginning to obtain there.

ELECTRIC LIGHTING AUTHORITIES AND THE LAW OF RATING.

[FROM OUR LEGAL CONTRIBUTOR.]

(*Concluded from page* 103.)

THE application of the principle of this case was illustrated in the assessment of the property of the Charing Cross Electricity Supply Co. (see Konstam's Rating Appeals, page 22). The company had a generating station and mains in the parish of Lambeth, but they did not supply electricity in that parish. They supplied electricity in all the parishes of the City of Westminster, in respect of which there was an appeal, and elsewhere. The greater part of the electricity supplied by the company in Westminster was brought by them from the generating station in Lambeth, but a part was brought from another generating station at Bow. The company had a sub-station situated partly in the parish of St. Martin-in-the-Fields, and another sub-station wholly in the parish of St. Martin-in-the-Fields, besides sub-stations elsewhere. The property in Lambeth, therefore, consisted entirely of indirectly productive works, and that in Westminster partly of directly and partly of indirectly productive works. The capital value of the indirectly productive portion was estimated at £543,666, and of the directly productive portion at £314,696. In the event, the generating station and mains in Lambeth were estimated at £16,106, with a rateable value of £8,053, while the other properties in the Westminster parishes were estimated at £35,559 gross and £19,000 rateable.

Unfortunately for those whose duty it may be to ascertain the rateable value of electric light works in the future, the report of this case gives but a vague idea of the method adopted in arriving at the figures. Nevertheless, the following conflicting figures with regard to repairs and renewals are of interest. Mr. Patchell stated that, in his opinion, the proper amounts to be set apart annually for renewals were, in the case of—

Mains, 3 per cent. on the capital value.
Buildings, 1½ per cent. ,, ,,
Accumulators, 10 per cent. ,, ,,
Other plant, 5 per cent. ,, ,,

Major Cardew, however, who gave evidence for the rating authorities, said that the proper allowance for repairs and renewals of accumulators was 8½ per cent. of their value. The mains had, in his opinion, an average life of 40 years, and would be worth 12 per cent. of their prime cost at the end of that time. The sinking fund necessary to replace them would be 1·14 per cent. of their value, and not more than 2 per cent. would be necessary for the annual repair of the mains. Unfortunately, the report of the case to which we have been referring does not state which of these two sets of figures was acted on by the rating authority.

Rating of Works in Excess of Existing Requirements.—It often happens that electrical undertakers have extra space, and sometimes spare plant, which is in excess of their existing requirements, and is laid down for the purpose of meeting extensions in future years. The question whether this part of the property is to be brought into rating has been considered in a number of cases, but not electric supply cases. In R. *v.* South Stafford Waterworks, 1885, 16 Q B D. 359, the indirectly productive works were largely in excess of the then existing requirements of the company, and had been constructed for use in future years. The rateable value of the whole system was agreed, the point in dispute being the proper amount of deduction to be made therefrom. It was found that if only so much of the permanent works as was required for the purposes of the present supply was brought into rating, the rateable value of the whole would be materially diminished. The following passage from Lord Esher's judgment in the Court of Appeal serves to show the attitude taken up by the Court :—

"There might be works of the undertaking which had not become part of the actual system, as, for instance, a reservoir, or a second lot of engines not yet used at all, but constructed with the view of becoming part of the works in the future. Such could be no part of the existing system of works, but would be intended for another system, and would, of course, be rejected in making the calculation. But that is not the case, for here every part of the works is in actual use, though they are too large for the supply of water at present required. . . . But as the works in use are in excess of the present requirement, a tenant taking the whole or part of the property in a particular parish ought not in justice to be asked to pay the same rate of rent as he would if all the works were earning profit. Therefore, if the 3¼ per cent. mentioned by the arbitrator is the ordinary percentage upon the value of the capital laid out, one would think that the percentage in this case should be reduced to 3 per cent. or less." It would seem from this case that it would be perfectly proper for a rating authority to make a reduction on account of the spare space inside a generating station. The question whether there could be a reduction for a spare "set" is rather different, because prudent people would not run a large station and undertake to give a continuous supply without making provision for breakdown.

Where a Local Authority are the Undertakers.—It was at one time thought that if a municipal corporation or other similar body occupied land, and the whole of the profits of the corporation were by statute devoted to public purposes, the corporation had no beneficial occupation and were not rateable. This, however, is an erroneous view, and all such property now comes into rating, although, as the local authority has to spend the rates, or a greater part of them, the money is to a large extent taken out of one pocket only to be put into another.

Should anything occur to render the undertaking of an electric lighting company less profitable, it is conceived that a reduction may be obtained, but it is clear that the cause must be of a permanent nature. In R. *v.* Islington Assessment Committee 30 T.L.R. 149, it appears that by Sec. 47 of the Valuation (Metropolis) Act, 1869, where in the metropolis a requisition is made to the overseers to send to the Assessment Committee a provisional list showing a reduction, from any cause, in the course of any year, of the rateable value of a hereditament, and the overseers make default, the Assessment Committee must appoint a person to make such provisional list. The London County Council were the owners and occupiers of tramways in the Borough of Islington. In 1912 and 1913, owing to the competition of motor-omnibuses, the gross receipts from the tramways had fallen from 11·42d. per car-mile to 9·05d., and on April 4th, 1913, a requisition by the London County Council was served on the Islington Borough Council, as overseers of the parish, requiring them to send to the Assessment Committee a provisional valuation list showing the reduction in the rateable value of the tramways, on the ground that they had been reduced in value within the meaning of the section. The Borough Council declined to accede to the requisition, and on an application by the London County Council to the Assessment Committee that body came to the conclusion that there was "no *primâ facie* evidence of such a reduction as is contemplated by the section," and they, therefore, declined to appoint a valuer. It was held by the Court of Appeal (Vaughan Williams, L.J., dissenting), that the Council had failed to make out a *primâ facie* case of a reduction in value resulting from a cause of a permanent nature, that the comparison ought to be with the circumstances which established the value of the hereditament at the time of the quinquennial valuation, and that, therefore, a mandamus ought not to issue to the Assessment Committee to appoint a valuer.

The importance of being fully prepared to dispute the right of the Committee to raise the rateable value is illustrated by the case London County Council *v.* Shoreditch Borough Council (105 L.T. 515). It is apparent that in some circumstances the decision of the Assessment Committee is final, and cannot be appealed to Quarter Sessions. In the case in question the appellants, as owners of tramways in a borough, had constructed a new curve for relieving congestion of traffic, and reconstructed certain lines for electric traction. In consequence of this alteration the respondents, as overseers, raised the rateable value of the tramway lines by a provisional list to the extent of a £1,000. The appellants appealed to the Quarter Sessions for the County of London against a general rate based upon the provisional list. It was held that as there was evidence before the Assessment Committee of alterations in the hereditament, the question whether they had rightly come to the conclusion that such alterations had resulted in an increase of value, was not one which could properly be raised on appeal to the Quarter Sessions.

THE NATIONAL ELECTRICAL CODE AND BRITISH WIRING RULES COMPARED.

By FRANK BROADBENT.

(*Concluded from page* 122.)

"Snap" switches are not manufactured in this country in sufficient quantities to justify extended reference to the National Code regulations concerning them. On general points the rules follow the lines laid down for knife switches. The leakage surface is to be not less than 3/64 in. between supporting screws and live parts; conducting covers must be lined with an insulating material not less than 1/32 in. thick. The test is 50 per cent. current overload for switches rated below 10 amps., and 25 per cent. overload for larger sizes. A duration test is also specified, viz., 6,000 "makes" and "breaks" at a rate not exceeding 10 times a minute.

The rules for circuit breakers are generally similar to those for knife switches in so far as they are applicable.

It is not quite clear what is the overload test for breakers, the rule reading as follows:—"must successfully operate three times with two minutes intervals intervening without incapacitating the breaker, the conditions of testing current to be as given in the following table:—

Current rating of breakers.	Percentage of voltage drop in test circuit with rated current flowing.	Minimum available capacity of supply system, not including overload capacity.
0 to 100	2	1,000
100 „ 300	3	3,000
300 „ 400	4	4,000
400 „ 500	5	5,000

No filing of contacts or other repairing of the breaker to be done during the tests.

This rule leaves something to the imagination, and one may suppose that it means a short circuit test, the resistance of connecting leads representing the cable resistance which might be in circuit under the conditions of actual service. On this basis let us see what the overload current would be in a given case. Take the case of a 500-ampere breaker on a 500-volt circuit. The voltage drop with 500 amperes passing will be 5 per cent of 500, or say 25 volts, hence the resistance in circuit equals 25/500=0.05 ohm. A short circuit would therefore permit of the passage of a current equal to 500/.05 or 10,000 amperes, which is 20 times the capacity of the breaker. But, working on this assumption we arrive at the same value, 10,000 amperes, for every circuit breaker rated above 100 amperes when used on any voltage. It is desirable to have the exact meaning of this test made clear for the benefit of British manufacturers.

On the question of cables and their erection the National Code rules are in some respects more stringent than ours, the following being some of the points of difference. Whilst our Institution rules permit of the use of hard wires having a section equal to that of a No. 18 S.W.G. (.0018 sq. in.) the National Code minimum size is No. 14 B. & S. (.0032 sq. in.) or about the equivalent of our No. 16 S.W.G. Hard stranded wires must be soldered before fastening under clamps or binding screws. Where cables pass through walls, timber, or partitions, a *conducting* bush, such as an iron pipe, long enough to pass through the hole in one continuous piece is to be used, the ends to be bushed with an insulator.

We have no exceptional rules relating to the quality of cable insulation to be used for open wiring, but the National Code prescribes wires having an approved rubber, slow-burning weatherproof, or slow burning insulation.

On wood casing or conduit installations the National Code does not permit joints or taps except in approved fittings, and the wire is to be in continuous lengths from fitting to fitting. Threading is not allowed, the complete conduit system must be first erected and the cables drawn in afterwards. Not more than four two-wire or three three-wire circuits to be drawn into one conduit. Our Institution Rules do not impose any limit, but the Edinburgh Corporation rules specify that not more than four wires are to be drawn into one tube. This is a very sensible regulation and is more stringent than the National Code which as shown above allows eight or nine wires.

As in hard wires, so in flexible and fitting wires the National Code is more stringent than our rules, the minimum section allowed by the former being the equivalent of a No. 18 B. & S. (.00127 sq. in.) against the equivalent of a No. 22 S.W.G. (.0008 sq. in.) allowed by the Institution for flexibles, and 3/25 (.0009 sq. in.) for fittings. Such differences as exist in the rules regarding erection are largely accounted for by the differences in the character of the constructional work of buildings, *e.g.*, "frame" buildings, typical of American constructional methods, are practically unknown in this country. A very important rule in the National Code is that which insists on the bushing of all pipe outlets where they enter junction boxes, distribution boxes and the like. Our rules only ask for the bushing of "free ends" of conduit and it is unfortunately not the practice to bush the pipe ends where they enter boxes and fittings. If this were the common practice it would remove one of the two weak points in conduit work, the other being internal condensation. Whilst "sharp bends and elbows" are prohibited by our rules there is no limit as to the number of bends which may be used in one pipe circuit, or say between draw-in boxes. The National Code imposes as a limit the equivalent of four quarter bends not counting the bends at the outlet, and specifies that radius of any elbow shall not be less than 3½ in. It is no doubt owing to the extraordinary height reached by American buildings that a limit is set to the unsupported vertical length of cables run in conduit, the length ranging from 35 ft. in large sizes to 100 ft. in small sizes. The method of support may be a right-angle turn in the conduit system or by insulating supports in junction boxes. As regards the earthing of conduit the National Code does not differ materially from the Institution rules, but it allows earthing to gas pipes on the street side of the meter, a practice distinctly prohibited by the Institution rules.

Concerning cables, the Institution rules, whilst of a more or less general character, laying down the conditions to be fulfilled rather than a detailed manufacturing specification, are more detailed than in the case of switches and other accessories. This is quite understandable when we consider the important functions of the cable and the fact that it is generally concealed and practically inaccessible when once erected. The National Code on the other hand, besides being much more specific and comprehensive in regard to the installation of cables, devotes considerable space, almost 20 pages, to details of construction and the tests to be applied.

According to our Institution rules all covered copper conductors having a greater section than No. 14 S.W.G. (.005 sq. in.) must be stranded, but there appears to be no limit imposed by the National Code nor is there a standard given for conductivity corresponding with our E.S.C. standard which is the standard adopted in our rules.

According to the American Code the copper for insulated solid conductors of No. 4 B. & S. (.2043 in. diameter) and smaller must not vary in diameter more than .002 in., and larger solid wires must not vary more than 1 per cent. from the standard, whilst the E.S.C. standard permits a variation of 2 per cent. from the standard conductivity, an allowance of 1 per cent. for tinning and an allowance of 2 per cent. for the lay of the wires in stranded cables (excepting the centre wire). The National Code stipulates that solid wires shall have a conductivity of not less than 97 per cent. of that of pure copper, and that the conductivity of the individual tinned wires of a stranded cable shall be not less than the values given in the table. The table starts at No. 14 B. & S. (.0641 in. dia.) with 97 per cent. conductivity which decreases by .2 per cent. for each successive reduction in gauge until No. 30 (.01 in. dia.) is reached when the conductivity is 93.8 per cent. There is an allowance of 1½ per cent. permitted between the nominal circular mils. of the strand and the sum of the individual circular mils. of the wires.

The labels on the coils must indicate the maximum voltage for which the cables are to be used, the name of the manufacturer, the month and year when manufactured, the class or grade, and the words "National Electrical Code Standard."

There are 8 grades or classes referred to, each to comply with definite specification and to pass prescribed tests.

The classes are: (1) rubber covered, (2) slow-burning weatherproof, (3) slow-burning, (4) weatherproof, (5) flexible cord, (6) fixture wire, (7) conduit wire, and (8) armoured cable. The requirements are much too long to give in full and are too detailed to permit of condensing satisfactorily. The pressure tests for rubber cables differ materially from ours which prescribe the application of 1,000 volts for half-a-hour after 24 hours immersion. The National Code tests vary with the thickness of insulation thus for thicknesses up to 3 sixty-fourths of an inch the test pressures are 3,000 volts a.c. per 64th. But for greater thicknesses the pressure per sixty-fourth gradually decreases as the thickness increases until a thickness of sixteen 64ths is reached for which the pressure is 28,000, or 1750 volts per 64th. The test is to be made on 1 ft. of cable after 72 hours immersion, and is to start with 3,000 volts a.c. for 5 minutes, to be increased by 3,000 volts at 5 minutes intervals until rupture of the insulation occurs. In addition to this, every complete length is to be tested after 12 hours immersion by the application for one minute of an a.c. voltage varying from 1,500 volts for a thickness of insulation of three 64ths up to 3,500 volts for a thickness of ⅛ in. The insulation test follows this, the test pressures ranging from 4,000 volts to 17,000 volts being approximately 2½ times the maximum working pressure, the insulation ranging from 100 to 600 megohms, in the 1,500-volt cable and from 200 to 1,200 in 7,000-volt cable. These figures are much lower than is the recognised practice in this country for V.I.R. cable, where the 600 megohm *grade* ranging from 600 to 1,250 megohms is required on voltages up to 250 and the 2,500 megohm *grade* ranging from 2,500 to 4,500 megohms on higher voltages within the limits of medium pressure, viz., 650 volts.

In addition to the foregoing test any completed length may be tested at any time during 30 days immersion in water and must show not less than 50 per cent. of the I.R. registered—after the 12 hours immersion. All tests are based upon a temperature of 60 degrees F. and a multiplier is given for temperatures ranging from 50 degrees to 85 degrees.

A stretching test is also prescribed which is interesting, and something of this nature would form a useful addition to our own rules. For thickness of insulation less than five 64th in. a test piece is to be stretched to 2½ times its normal length at the rate of 12 in. a minute and immediately released, when it must return to not more than 125 per cent. of its original length. It must also stand stretching to 3 times its normal length before rupturing. For test pieces from thicker insulation the limits are 2 and 2½ respectively instead of 2½ and 3 as specified for the thinner insulation. The tensile strength is to be 400 lb. per sq, in. It would surely be a very poor sample of new cable which failed to pass the stretching tests imposed. Cable tested at any time within one year of the date of manufacture must pass a less severe stretching test than the foregoing namely about, twice instead of 2½, and 1¾ instead of 2.

We have still not finished with the tests, for five chemical tests are specified, viz., acetone extract, alcoholic potash extract, chloroform extract, ash and and total sulphur, and the sum total of the results shall not exceed 80 per cent. by weight of the total compound. This synopsis covers only the first of the eight classes of cable enumerated, but sufficient has been said to indicate generally the kind of conditions and tests to which cables are subjected, and those who are sufficiently interested in the other sections are referred to the Code itself.

The requirements as to steel conduit, in addition to those referring to erection, cover standard sizes and thickness, finish, bending tests, etc., and also interior lined conduits which notwithstanding the late Mr. F. Bathurst's strenuous advocacy, have never gained a secure foothold in this country. The National Code does not recognise slip socket at all, and their conduit appears to be much thicker and heavier than ours. As the American sizes are denoted by their internal and British sizes by the external diameters, comparison is somewhat difficult. The smallest American size is rated as ½ in. conduit, although the internal diameter is .62 in., whilst the smallest British standard is ⅝ in. conduit this being the outside diameter. The minimum American thickness is .1 in. for ½ in. conduit, and the British is .064 in. for the ⅝ in. size; and for a 2 in. which is the largest standard British size the thickness is .092 against the American .15 in. In order to arrive at the internal diameter of British standard conduit (E.S.C.) this being the really important dimension, it is necessary to deduct twice the thickness from the outside diameter,, and as the diameters are given in fractions and the thicknesses in decimals this cannot be done without a preliminary conversion.

The following tabular comparison shows the wide divergences in the practice of the two countries, and serves to explain another of the causes of the high cost of wiring in the States. In the table the letter "B" means British and "A" American standards. Owing to the fact that the British standard is based on the external, and the American on the internal diameter it is impossible to compare two pipes of the same nominal size, moreover neither the internal nor external diameters of the American conduits

Comparison of American and British Conduit

Nominal size in inches.		Internal diameter in inches		Thickness in inches		Outside diameter in inches		Minimum weight per 100 ft. lb.	
B	A	B	A	B	A	B	A	B	A
⅝	—	·497	—	·064	—	·625	—	37·4	—
¾	—	·606	—	·072	—	·75	—	51·0	—
—	½	—	·62	—	·100	—	·82	—	75
1	¾	·856	·82	·072	·105	1·00	1·03	69·8	104
1¼	1	1·106	1·04	·072	·125	1·25	1·29	88·[illegible]	152
1½	1¼	1·34	1·38	·080	·135	1·50	1·6[illegible]	119·0	209
2	1½	1·816	1·61	·098	·140	2·00	1·89	184·0	250
—	2	—	2·06	—	·1[illegible]0	—	2·36	—	350

[illegible] the nominal rating, thus what is called a ½in. conduit measures .62 in. internally and .82 in. externally and so forth.

Many more interesting comparison might be made between the respective practices of the two countries, particularly in the matter of wiring accessories, but sufficient has been said to indicate that whilst in some respects the National Code is more stringent than the British, the differences do not give any greater security; and further, that considerable modifications in details will have to be made in certain British manufactures if it is hoped to obtain a greater share of the Canadian trade. There is little doubt that in some respects the regulations will be modified during the forthcoming revision, but it is doubtful if any modifications which may be made will have for their object the bringing about of a closer degree of uniformity with British practice; they will be made more with a view to cheapening the cost of conduit wiring lest perchance some new and cheaper system should threaten it.

A MERCURY RECTIFIER LOCOMOTIVE.

[illegible] the Westinghouse [illegible] motor car provided with the Westinghouse [illegible] mercury arc rectifier locomotive equipment. This consists of a stepped-down transformer, [illegible] 11,000/1,200 volts, with [illegible] taps for varying the pressure, two six-phase rectifiers, one being reserve; four D.C. motors of 1,000 H.P. total capacity, and the necessary control apparatus, rectifier-exciter, etc.

The equipment is installed in a car belonging to the Pennsylvania [illegible] and was first tried on the Westinghouse test track at Pittsburgh. Later to obtain service conditions it was transferred to the electrical zone of the New Haven Railroad and [illegible] on the New Canaan branch of that company. After preliminary trials it was put into revenue service, hauling [illegible] to date has been operated more than 20,000 miles. Its present schedule calls for a daily mileage of 240. [illegible] the reliability of the equipment under general service conditions, such as sustained high voltage, voltage fluctuations, as well as mechanical shocks and vibrations.

The fundamental parts of the equipment and the circuit connections are shown in the accompanying diagram. Current is drawn from the 11,000-volt overhead contact wire through the standard pantograph of the New Haven Railroad. It flows through a line switch and the primary winding of a lowering transformer to the rail return. The transformer secondary is provided with a centre tap and with a number of others equally spaced two by two from the centre on both sides to permit the varying of the A.C. voltage from zero to the maximum. The centre tap connects with the terminal of a group of four motors connected permanently in series-parallel. These motors are standard Westinghouse No. 308, wound for 600 volts. The group is grounded at the centre to limit the D.C. voltage between any point in the equipment and ground to 600. The outside secondary transformer terminals connect to the two positive electrodes at the top of the rectifier. The remaining connection is from the mercury or negative terminal of the rectifier to the other terminal of the motor group.

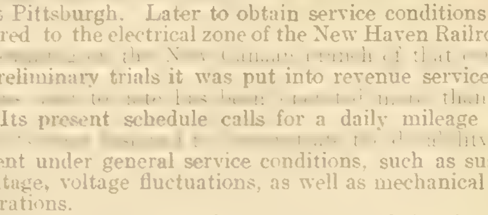


DIAGRAM SHOWING LOCOMOTIVE RECTIFIER ARRANGEMENT.

The rectifier consists of a light steel cylinder container approximately of 20-in. diameter and 36-in. in height. The electrodes enter at the top of the container through airtight insulating bushings, projecting a short distance into the cylinder. The arc is started by means of a small motor-generator exciter. No external reactance is needed on the D.C. side, as the motors furnish ample reactance for the purpose of steadying the current. That they do so is indicated by the fact that they operate as well on the rectified current as on that supplied from a rotating machine. The voltage drop in the rectifier is about 25 volts, practically regardless of the magnitude of the current, so that at say 750 D.C. amp., which is about full load for the motors, the power loss is 18¾ KW. and the efficiency, at 1,200 volts, is very high.

Details of the cooling system, electrodes, exciter connections, etc., are not yet available.

The rectifier weighs but a few hundred pounds, and the motor car complete weighs 72 tons. The rectifier equipment is mounted in the baggage compartment and occupies, with the switch groups and transformer, not more than one-half the floor area.

WAR ITEMS.

Manufacturing Works in Germany.—The general meetings of the leading manufacturing companies in Germany have now taken place, but beyond the extraordinary speech which was delivered by Dr. Walter Rathenau, and to which attention was recently drawn, very little information of importance has been allowed to transpire. In the case of the Siemens-Schuckert Works Co., which is a private company owned by the two firms indicated in its title, no annual assembly is necessary or is held in public, but Dr. von Petri, general director of the Schuckert Co. of Nuremberg, informed the shareholders in the latter company at the recent meeting that the works of the Siemens-Schuckert Co. in Berlin and Nuremberg had rapidly accommodated themselves to the conditions of war and were sufficiently well employed, activity in the war departments in particular being considerable. At the assembly of the A.E.G. it was mentioned that the turnover in the year ended last June amounted to £26,000,000, as compared with £22,000,000 in the preceding year, and that the trade with hostile countries represented £4,750,000 of the former total. The orders invoiced to domestic consumers and neutral countries by October 31st, 1914, amounted to £6,250,000, whilst the value of the orders then on hand reached £15,500,000, exclusive of £6,500,000 held by subsidiary companies in hostile countries on June 30th, the outstanding debts in the countries being £1,000,000. As to the degree of employment in the first four months of the new financial year, it was explained that, reckoned in working hours, this bore the relation of 2 to 3 as compared with the equivalent term in 1913. The Siemens and Halske Company, although acknowledging a material reduction in the orders on hand for articles of peace, stated that the works were sufficiently occupied as a result of the abundance of orders allocated by the military and naval authorities. Speaking generally, it was submitted that as one-third of the workers in trade, industry and agriculture had been called to the colours—that is by the first week in January—it might be expected that a general reduction in the output of one-third would take place, and that the profits would be curtailed to a similar extent. Apart from the manufacturing companies, the electricity supply works are also suffering from a diminution in the consumption of energy for lighting and power purposes, except in those cases where firms are engaged on the production of war materials; and with the increasing scarcity of raw materials, especially metals, it is probable that the degree of activity in manufacturing and in the supply branch will tend to decline further, particularly when it is taken into consideration that small pecuniary payments are being offered in certain districts for the recovery of spent and live cartridges, shells, etc., which may be found in the field.

Prospects in China.—Dealing with the war's effect on trade in South China, the United States Consul at Hong Kong calls to mind that for some time past all railway and industrial undertakings of magnitude in China have depended upon foreign loans for realisation. Loans for such purposes in China in the near future will be out of the question, and there is, therefore, little likelihood of any railway work of magnitude being carried on perhaps for years to come, other than that already arranged for. A similar prospect is ahead for all important public works. In founding industrial establishments, such as electric lighting plants, there will be a similar restriction, although it is hoped that enough Chinese capital may be enlisted in certain directions to lead to some development of the most promising undertakings. It is likely that one result of the war will be a marked change in the course of railway and similar concessions in China. The general machinery of trade, of course, has been interfered with greatly. While German and Austrian firms continue to do business in the open ports of China, the restrictions placed upon dealings between them and British, French and allied firms are such as to make trade almost out of the question. In Hong Kong German houses have been allowed to continue business by special licence of the Government to the extent of liquidating contracts made previous to the opening of the war, but they are not allowed to enter upon any new contracts. The result is that their business organisations are being destroyed, their employés are idle, and in many cases have of necessity been discharged, their Chinese connections are being broken up, and in general the whole machinery of trade is being badly crippled. Many of these German and Austrian firms are important factors in the trade with the United States, and their embarrassment is materially affecting American interests concerned in Hong Kong trade. Not only is an unusual opportunity for building up new business afforded by the collapse of trade machinery under the war, but, as stated, this same collapse has thrown out of employment many men of long experience and established connections in various lines of import and export business whose services would be of the greatest value to new concerns attempting to establish connections in the trade. The services of such men might be had at the present time far more reasonably than under other circumstances, while their knowledge of the field of trade here and in other countries, of buying and selling connections,, and of the trade generally, is something that can be acquired only by years of service.

The War and German Cables.—The fact that the German submarine cables were cut by the British navy at the beginning of the war is keenly felt in interested circles on the other side of the North Sea, the two cables connecting with the United States having been severed off the Azores as early as August 5th. Professor Meister, of the Munster University, Westphalia, who recently delivered a lecture on the "English Cable War," stated that owing to the English policy of destruction Germany has been isolated from all ex-European telegraphic traffic in a way that would not have been regarded as possible prior to the war. It will therefore be necessary, in his opinion, for that country to protect itself in the future by the adoption of a systematic policy for the prevention of such isolation. For this purpose he declares that all that is required is a single direct American cable from the United States to Germany without any intermediate landing place, which would belong to the United States and which Great Britain would guard herself against cutting. The Professor thinks, however, that a safer scheme would be for the establishment of an American-owned cable between the United States and a neutral country, as, for instance, Denmark or Sweden, and thence onwards to Germany. At any rate, it is considered that a solution must be reached as soon as possible by the creation of a German world's cable system which would be independent of that of Great Britain. As to the objection that submarine cables could be replaced by wireless stations, Professor Meister remarks that it is also possible to destroy the latter in time of war, as in the case of the stations at Togo, the Cameroons and in East Africa, whilst the wireless system in the present stage of science is unable to afford a complete substitute for submarine cables, which now, as in the future, must act as a complement of the former.

The Position in Austria.—A little light on the situation of affairs in Austria is thrown by the report of the United Electricity Co., of Vienna, for the year 1913-14. Although solely occupied as an industrial company since its supply works were acquired by the Vienna municipal council a year or so ago, the company is yet interested both in supply and manufacturing undertakings in Austria-Hungary, and it is to the statements made in regard to these that attention might be directed. In the first place, it is mentioned that the activity of the supply companies in question is being detrimentally affected by the effects of the war, inasmuch as the sale of energy for lighting and power purposes has taken a downward course, while on the other hand a large decline has occurred in the traffic on the electric tramways and railways served by some of the companies. The question as it applies to the manufacturing companies, however, is of greater importance. The report states in this connection that with the exception of certain contractors for the delivery of war materials, the degree of employment of the electrical firms has greatly diminished in consequence of the extraordinary limitation in the orders placed by public authorities and private undertakings, as well as through the total cessation of the export trade.

Trade War Exhibition.—A concerted effort on the part of representative business men to further the campaign for the capture and retention of enemy trade, was inaugurated at the Mansion House on January 21st, when Sir William Bull, M.P., presided over the first meeting of the General Advisory Committee of the National "Trade War" Exhibition. The exhibition, which it is proposed to hold in London at an early date, will include a display of goods manufactured in Germany and Austria, and exhibits of British goods by which they can be superseded. There will also be lectures and discussions dealing with subjects of interest to manufacturers and traders. An executive committee has been elected, and Mr. F. H. Payne was appointed Organising Commissioner. All communications should be addressed to the Organising Commissioner, National "Trade War" Exhibition, Central Hall, Westminster, S.W. A public appeal is to be issued for a £10,000 guarantee fund.

Recruiting Tramcar at Rochdale.—An illuminated tramcar, gaily set out with patriotic devices and coloured lights, arranged by the Tramways Committee of the Rochdale Corporation in conjunction with the Parliamentary Recruiting Committee of Rochdale, to assist in the work of securing men for the army, has been out for service on various routes for a week and has been well patronised. The additional receipts have almost paid for the cost of the decorations and illuminations The car is to be kept in service for another fortnight at the least.

A Rochdale Problem Reconsidered.—The Rochdale Tramways Committee has reversed a decision which had been arrived at respecting an application from a man who, before the war, was training for service as a conductor, and who, since war was declared, has joined the colours. By a majority of one vote, as reported in our columns two or three weeks ago, the Committee had decided that the man in question was entitled to the half-pay which the Committee had granted to men who were on the staff before war was declared and who have since joined the colours. At a meeting of the Committee on January 20th, it was legally ruled that the man was not an employé when war broke out, and the previous decision to grant him the half-pay was rescinded.

Electric "Fall In."—At the request of the Chief Recruiting Officer for London (Captain Passingham) metropolitan borough councils which own electricity works are to have illuminated electric recruiting signs for night use affixed to the standards of street lamps in their districts, intimating to men of military age the nearest recruiting stations in the various localities in the metropolis.—"Standard."

Telegraphists at the Front.—On Friday last Colonel A. M. Ogilvie, Second Secretary of the Post Office and Director of Home Signals, unveiled a handsome scroll containing the names of 447 telegraphists who had left the Central Telegraph Office for active service. The Controller of the Central Telegraph Office (Mr. J. Newlands) presided, and stated that the scroll was a gift of the girls of the department. Over 500 telegraphists have left the office, and more are to follow. The total number of men serving with the colours is now over 30,000, of whom 4,000 are from the telegraph force.

Bradford Employés and the Relief Fund.—The complete list, to date, of employés' contributions to the Bradford Lord Mayor's War Relief Fund includes those of the employés of the Corporation Electricity Department, eighteen contributions, £167 6s. 8d.; of the tramways workers, sixteen contributions, £759 10s. 10d.; and of Messrs. C. Pratt & Sons, Ltd., electrical contractors, twenty contributions, £12 15s. The total contributions of Bradford Corporation employés to the fund have amounted to over £5,000.

Edinburgh Tramwaymen.—Since the commencement of the war 300 men of the Edinburgh and District Tramway Company's service have joined the different units of the army. In the case of married men who have joined the forces the company have made up the difference between Government allowance and full wages, and in the case of single men the company are allowing each man 10s. per week. Up to date their allowances have cost the company nearly £2,000.

L.C.C. and Alien Firms.—The Stores and Contracts Committee of the London County Council reports that, as the result of inquiries with regard to firms controlled wholly or largely by enemy aliens, whose tenders or quotations had been accepted by the Council, it has decided to have no further dealings with 28 such firms, and their names have been removed from any lists of firms to be invited to tender for the supply of stores, etc.—"Times."

Australia and Enemy Trading.—The "Times" states that the High Commissioner for Australia has received advice from the Commonwealth Government that Consular certificates of origin will be required in respect of all goods shipped to Australia from places situated in Norway, Sweden, Denmark, Holland, Switzerland, and Italy, on and after February 1, 1915.

German Trade.—Referring to the Board of Trade Exchange meeting recently noticed in this column, the Stonebridge Electrical Co., Ltd., of Willesden, write to say that they supply small milliampere-meters and pocket voltmeters such as were exhibited, but of much better finish than the latter.

Stockport Tramwaymen.—Some slight curtailment of the tramway services has had to be made at Stockport owing to the fact that 71 employés in the department have left to join the colours, and that it has not been possible to fill up their places.

Siemens' Employés' Contributions.—The employés of Siemens Bros. Dynamo Works, Ltd., Stafford, have sent £62 7s. 11d. to the Mayor's National War Relief Fund, the sum being five weeks' contributions.

Personal.—Owing to the exigencies of the work of the Woolwich Electricity Department, the B.C. has not granted Mr. E. Mawdesley, assistant engineer, permission to enlist in a combatant capacity in the Army.

Mr. W. J. Leeming, electrical engineer to the Buxton U.D.C., has had his services accepted by the Government, and will be attached to the Royal Engineers.

Professor Alfred Schwartz, of Redcliffe, Orpington, Kent, informs us that by deed poll dated 20th January, 1915, he formally renounced his surname of Schwartz and assumed the surname of Barnes (the maiden name of his great-great-grandmother on the paternal side—Elizabeth Barnes, b. 1731), and adopted the name of Schwartz as a forename and addition to his Christian name of Alfred, and intends henceforth to describe himself on all occasions and for all purposes as Alfred Schwartz Barnes.

Roll of Honour.—Private William Millan, of the Highland Light Infantry, who was employed in the office of the Scottish Central Electric Power Co., Falkirk, has died from enteric fever while in training at Troon.

Sergt. Alec. Evans, of the Cheshire Regiment who was formerly with the Potteries Electric Traction Co., was killed in action near Chapell on October 27th.

Private Fred Ashcroft, up till recently an employé at the Westinghouse Works, Trafford Park, has been killed in action.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until* [illegible]. *Correspondents should forward their communications* [illegible] *moment. No letter can be published* [illegible] *writer's name and address in our possession.*

Advertising and Character.

With reference to Mr. Turner's letter in your issue of 22nd inst., I must congratulate that gentleman (an American by "instinct"—whatever that means) on his subtlety in extracting a personal compliment from what was intended to be a statement of a difference in temperament, but, logic, surely, should prevent him saying, as he does in effect, that because A is fat and B is thin therefore A is a wise man.

To appreciate the distinction I tried to draw, not offensively, I can only suggest that your correspondent should compare the selling methods of a West End tradesman with those of a New Cut coster. It may be quite true that Bill Sykes of the New Cut, who is a monogamist by "instinct" and a temperance advocate, is far superior to William Sykes, Esq., of Oxford Street, who is neither, but Bill has an unfortunate habit of screaming his wares.

I do not like "screams."

"Mr. Contractor! If you're alive, get busy! right now!" Yah!

E. J. Reed.

London, S.W., *January 22nd*, 1915.

Evidently I did not make myself clear in my former letter, as Mr. Herbert Berry has missed my meaning. I stated that "an advertisement should reflect the character of the firm issuing the announcement." What I intended to convey was that the "style" of the advertisement, that is, its appearance, should be in harmony with the advertiser's business. The same applies to a great extent to the text.

For instance, methods of advertising which would be applicable to a turbine maker might be ineffective if adopted by a manufacturer of electrical accessories, such as fittings, ceiling roses, etc. In other words, the advertisement should be designed to appeal to the buyer of the goods advertised. Mr. Herbert Berry says the two are opposed. I would like to know in what way? It seems to me that the two are identical.

By no means is it impossible to appeal to the various sections of buyers in turn—to "ring the changes," as Br. Berry calls it—and to retain the same general "style" throughout the entire series of advertisements.

To keep changing from one type of display to another means the risk of losing one of the most valuable advantages of advertising, viz., cumulative effect, which really means "goodwill." In a manner, you may liken this to a firm which changes its name frequently. With the adoption of the new title they have to inform all concerned of their action, and this frequently leads to mistakes and invariably means that a certain number of customers are lost. The analogy may be a poor one, but I think Mr. Berry will see my meaning.

Of course, there are lots of men who read their technical papers away from office when they are free from the distractions of the day. It is at such times that the advertiser stands the best change of securing attention for his proposition. Now if you put in a cartoon which is really and truly funny, you may get the reader to laugh until his sides ache, but the point is, is he amused with the joke, or is he interested in the goods? After all, the idea back of the advertiser's mind is to interest the prospective buyer in what he has to sell, not to amuse him. The latter can be left to *Punch* and other papers catering for the reader's entertainment. Granted that the cartoon is looked at and appreciated, is there not a great danger that the richness of the jest will overshadow the message the advertiser wishes to convey and *drive home?* I think so. Surely, it is better to attract attention by more serious methods, and, having gained the reader's eye, and, shall we say, sympathies, endeavour to interest him in what we have for sale; our steam engine, dynamo, switchgear, fuses, or whatever it happens to be. Is not this a more logical, and far less risky way of proceeding?

Of the postcards, etc., to which Mr. Berry refers, I can offer no opinion as I have not seen them, but as I take it that most of this matter is sent through the post, and addressed to firms and individuals, it seems to me that these hardly come within the scope of the present discussion which, up to the present, has been confined to technical paper publicity.

Circularising in any form is quite different to Press advertising. Both are but links in the selling chain which connects the seller with the buyer. When the two are used with discrimination, and in conjunction, then are the best results obtained.

And now for a word with Mr. A. M. Turner. It is essential for the writer of technical advertisements to have an acquaintance with technical phraseology and the customs of the engineering trade. At the same time it is not a *sine qua non* for the advertising man to be a past expert in the goods or apparatus he is advertising. There is a vast difference between the commercial man who knows his subject and the technical expert in the works, or test room. As a rule, the latter men know infinitely more about their subject than the individuals who sell it.

The advertising expert designs his announcement with the object of creating a bias in the mind of the reader, or of getting him to put himself in touch with the advertiser. A maker of expensive plant, such as steam sets, or complete electrical equipment, would draft his advertisements with the object of increasing his reputation. Such a one could not expect to receive a big bunch of enquiries, for the simple reason that there are but few buyers in the market at any one time for apparatus such as I have mentioned. Orders are not placed every day for plant or equipment which may run into several thousands of pounds. On the other hand, the advertiser of wiring accessories, electric light fittings, and such like, would be well advised to frame his advertisements with the object of getting direct enquiries. And there are advertising service agents who are able to give this specialised service to engineers and other technical advertisers. The advertising trade is very much the same as any other. Some firms give good service, others ——. Many agents devote themselves to a speciality: motor-cars, patent medicines, foods, garments, etc. And it is the specialist who is able to give the best service because of his accumulated experience.

With apologies for the length of this epistle,

Ernest Ingram Hill.

London, S.W., *January 22nd*, 1915.

Contracts with Alien Enemies.

It may interest your commercial readers to know that the Chamber of Commerce have seriously taken in hand this question.

The legislation required would roughly cover the determination or suspension of executory contracts with an enemy by way of a written order by the Secretary of State or the Board of Trade. The portion of the contract which has already been performed, of course, would be unaffected. When the matter has duly gone through the Chamber of Commerce Parliamentary Committee, and the other necessary steps have been taken, the practical step will be a deputation to place before the Government the commercial view of this matter, when it is hoped the Attorney-General will, in accordance with his promise, give the matter immediate attention, and, one trusts, incorporate the same in the Bill for next session.

T. W. Cole.

London, S.W., *January 22nd*, 1915.

Garage Heating.

I should like to record my appreciation of the Editors' footnote to my correspondence published in your issue of Jan. 8th under the above heading, and also for the reply of your correspondent "P. 6817." I must confess it appears that I have somewhat over-estimated the risk existing with petrol vapour, but I always understood that petrol vapour under certain conditions in air formed a mixture ignitable at a very low temperature. The lamp arrangement suggested by your correspondent I have utilised myself for temporary conditions, but always felt that it was not a safe method, owing to ignition risks.

By "garage," I had in mind the usual single brickwork building with wooden doors, such as is usually adopted by private car-owners, and I fully appreciate that such buildings are somewhat expensive to keep heated owing to the bad heat insulating qualities of the roof and walls, and the generally bad fitting doors, etc.

I am afraid, even though every precaution were taken to felt the interior and protect against draughts, that it would be a somewhat expensive matter, even with current at 1d. per unit, to heat the whole garage sufficiently to prevent damage to the upholstery, etc., and that it would be difficult to compete with slow-combustion stoves or externally-heated hot-water apparatus.

I have received several makers' catalogues illustrating heaters which they claim to be satisfactory for "garage" heating, but it would appear that they have not been carefully designed for the sole purpose they are intended for, and seldom is provision made for earthing, which is surely necessary where 200 volts and above is only available, and this from a public supply.

I must apologise for taking up so much of your valuable space, but I am confident it is a subject that interests a good many, and reliable data and information must be useful to others besides—

Interested Inquirer.

Salaries of Junior Engineers.

Having read the remarkable effusion by "Experienced" in last week's Electrical Review, I am filled with mingled feelings of amusement and disgust. It is quite apparent to the average shift engineer that the writer cannot be experienced in the working of a public supply station with a capacity exceeding 100-kw.

He states in his letter that the station superintendent and his assistants are responsible for the efficient working of the station. Now what I would like to ask "Experienced" is: Who are the station superintendent's assistants but the shift engineers? Of course, by that statement he absolutely gives himself away.

As for his remarks re card playing, if he had ever had charge of a shift in a modern power station he would know that frequently, if he managed to find time to eat a meal in comfort during his shift, he would be lucky, especially during the winter months.

The letter is quite clearly absurd to those acquainted with modern station practice. I have only troubled to answer it for the benefit of those not so acquainted who might form mistaken ideas as to the true value of the long-suffering shift engineer.

One of Them.

Judging from his remarks relating to the duties of shift engineers and others in a modern generating station, your correspondent "Experienced" has apparently forgotten the prefix "In" to his *nom de plume.*

Why confine the recreations of the shift engineer and switchboard attendant to card-playing? Surely the introduction of a piano in the engine-room, with a few comic songs by the switchboard attendant accompanied by the shift engineer, would relieve the monotony of "nap" and "cribbage," whilst a gramophone in the boiler-house would be a welcome addition to all the other automatic plant, including mechanical stokers, which require so little (?) attention.

It would perhaps be advisable to remind "Experienced" that a station equipped with the most recent automatic and labour-saving devices requires most careful and skilful operation, and any really good station superintendent will admit that he places far more confidence in the skill and intelligence of his staff than in all the automatic gear in the works.

The remarks of "Experienced" on this subject are far too facetious to be taken seriously, and the remainder of his letter appears to consist of a rather personal attack on Mr. Ebben, who—whatever his views upon the subject under the above heading—is not afraid to append his right name to his correspondence.

A few years spent in the running of a well-equipped electricity works would probably induce "Experienced" to modify his views, and he would then be in a better position to choose what appears at present a most unsuitable pseudonym.

W. E. Plowman.

London, *January 23rd*, 1915.

Referring to your correspondence column of the 22nd inst. regarding salaries of junior engineers, your reader who signs himself "Experienced" appears to be very rude. Some of his remarks, however, should not be allowed to go unchallenged.

Take the gist of his statement, that very little skill is required by shift engineers, switchboard attendants, and others to run central station plant. I think this remark is most ridiculous and unworthy of the publicity of your valuable columns. He states also in language very annoying to all station men, that it is chiefly by "rule of thumb" methods that the running of station plant is conducted.

Perhaps he could instance the rule of thumb methods of procedure for the following:—A fracture on a "live" steam main, a hot bearing, or an "earth" on the field circuit of a loaded alternator?

I could enumerate many like instances where that method would be a failure, also, I am as well assured that he would never take the responsibility of his "steady, experienced driver" in these cases, as I am assured that Mr. Ebben is no Hyde Park orator.

And, speaking of Mr. Ebben, whom I have the pleasure of knowing personally, I can inform "Experienced" that Mr. Ebben is one of the best of good fellows and knows very well how to treat cheap abuse, which I consider the other remarks made by "Experienced" are.

The A.E.S.E. has now a very large membership, mainly due, I think, to the untiring efforts of Mr. Ebben, who must get through an immense amount of work, and this, mark you, as an honorary secretary.

Wm. Cooper.

London, W., *January 23rd*, 1915.

Your correspondent under the doubtful *nom de plume* of "Experienced" is undoubtedly one of the engineer managers referred to in the very excellent letter of Mr. W. J. Ebben which you published in your columns a week or two ago. Of course, it is not for me to guess as to whether "Experienced" in his young days was one of those "with brains and liked work," and so obtained his promotion, or whether he had capital and influential friends behind him to boost him up, but the fact remains obvious that "Experienced" has much to learn respecting the running of electricity stations.

His statement in comparing the abilities of the engineer-in-charge and the engine-driver is more than sufficient to condemn his own capability to write letters on such a subject. The engine-drivers of my experience hardly know the difference between the dynamo and the switchboard, so that far from practically taking charge in time of trouble, they are more in need of someone to take charge of them. The majority of drivers are nothing more than stokers who have "had brains and who liked work," and have been promoted to the rank of driver. I should very much like to know exactly what can be learnt in the way of dealing with short-circuits, earths, and break-downs, etc., from the boiler-house. "Experienced" had also something to say about the "collar and cuff" engineer's amusements to while away his shift. Charge-engineers of my experience have more than sufficient to do in the way of work to occupy the whole of their time, and at the same time have to take the full responsibility of whatever occurs. It is absurd for your correspondent to state that the "collar and cuff gentleman" takes orders from the driver, more especially in such a case as a fault, either electrical or mechanical; indeed, it is extremely doubtful whether the average station superintendent or engineer-manager could get things in order without "the collar and cuff gentleman," considering that they just casually stroll around during the day it is not expected that they could do otherwise. Moreover, the college-trained man is in close touch with everything in boiler-house, engine-room and on switchboard, and knows exactly where and how things are, and also how they ought to be.

"Experienced" also states that owing to "rule of thumb" methods very little skill is required by shift-engineers, switchboard attendants and others as the regulating is "done by automatic apparatus." If your correspondent's experience has taken him so far as automatic gears he will know that they are far more complicated than the hand regulation methods, whether electrical or mechanical. Can "Experienced" tell us what part the "steady driver" would play in the event of this automatic gear going wrong? And as for the station superintendent and his assistants maintaining and taking the responsibility for the efficiency of this part of the works, I quite fail to see how he can do so if the mishap occurs when he isn't about, and where his responsibility lies. I suppose the "collar and cuff gentleman" awaits his coming before doing anything in the matter. In conclusion, I must say that in my opinion it is such men as "Experienced" who are the stumbling block of many smart juniors "with brains," but without the money and influential friends to find them good positions.

Collar and Cuffs.

I have been requested by the Bradford Branch of the A.E.S.E. to forward the following for insertion in your correspondence columns:—

W. J. Ebben, *Hon. General Secretary, A.E.S.E.*

London, N.E., *January 25th*, 1915.

If "Experienced" will kindly read his Electrical Review for January 15th again, he will see that Mr. Ebben did not write the letter he objects to. Mr. Ebben was asked to forward the opinions of the Yorkshire members of the A.E.S.E., of which the Bradford Branch is the centre, to the Press, and he did so.

The facts and opinions as published are not grievances of the aforesaid members, but were put forward to draw attention to the "Situations Vacant" column of January 8th. Will "Experienced" kindly look out that number and deny the truth of the statements made on January 15th, if he can?

He admits that a few shift engineers and others are badly paid; that is not as it should be, but to say that those with brains who like work will undoubtedly get promotion makes one wonder how he obtained his present berth, and makes one sorry for those unfortunates who occupy subordinate positions under him and have to exist on less than an unskilled labourer's wages.

Further along he tells us that "rule of thumb" methods and very little skill are required by station engineers, etc., etc. Will "Experienced" kindly tell us who are the station superintendent's assistants, and if the shift engineers and switchboard attendants are not usually hoping to hold that exalted position some time in the future?

We thought "rule of thumb" methods had passed away with the Victorian Era; and that all the best practical and scientific means were adopted to obtain the most efficient and economical plant to fill our modern power stations. We think "Experienced" has not read his Electrical Review week by week, or he would know better.

Will he tell us why one-third of the station engineers should be compelled to work for less than a labourer's wage when it usually costs the former rather more for house rent, food, etc., for himself, his wife and family than it costs the labourer?

Take the staff in a 25,000-kw. capacity station we know of, as follows:—One station superintendent, one assistant superintendent, five shift engineers, and 25 switchboard attendants of various grades. How many years will it be before a switchboard attendant of the middle grade becomes the [illegible] station superintendent, and what will become of the other twenty-four?

If "Experienced" can solve that problem he will find a very good argument to work upon when next he takes up his pen.

It is an undoubted fact that [illegible] or managers [illegible] that [illegible] the younger [illegible] is really paid.

"Experienced" [illegible] himself [illegible] he is not an engineer, his "rule of thumb" [illegible] shows he is not a [illegible] if he has ever heard a "Hyde Park orator." It is an interesting study, and he better will not keep the A.E.S.E. members who are well paid from trying to lift up those who are not so fortunate.

I have read with regret your "Experienced" correspondent's abuse of Mr. Ebben and the A.E.S.E. I am not a member of the A.E.S.E., neither do I know Mr. Ebben, but I have followed his good work and observed its progress since its inception. I hope the organisation will continue on its successful way. There are many questions to be considered before one can ascertain the cause of bad working conditions in central stations. They are generally caused by an inexperienced man being placed in authority, by a weak chief, who is easily overcome by a plausible tongue, yet strong enough by surrounding influence to retain his position. One never hears of bad feeling in a well-disciplined station, and the working conditions are always better.

Chief engineers should thoroughly examine their candidates before engaging them, because testimonials are not to be relied on. I have known of men writing their own, signed by the chief, at his request. I have also known of time-expired apprentices receiving testimonials which would do credit to chief assistants, just to get rid of them.

The system of working apprentices and other boy labour on shift work is an abominable system, and yet it is practised by a few of the smaller municipalities—under the nose of the Factory Inspector. Of course, it brings the working costs down to a minimum when there is an experienced man to superintend their working. In some such stations, boys fresh from school are put to work the board and even drive the engine and fire the boilers, and this in stations up to 1,500-KW. capacity. These apprentices blossom forth as electrical engineers, when, as a matter of fact, they are merely qualified to drive an engine or look after a switchboard. And yet this is the type of man we see pushed into supply stations to superintend others at a low wage, which he can increase by the pernicious method of using oil to his superior. The apprentice system requires rooting out. We can never get rid of the "swelled head," "something-out-of-nothing" variety of engineer who holds the reins and glories in being glorified, but by united action we might make things more comfortable.

Anti-Oil.

I am pleased to see that the question of the salaries of junior engineers has cropped up again, and that it is being regarded as a question on its own, apart from any other. I have been disappointed that ere now someone with an able pen has not thanked Sir John Snell for his remark on the subject, which remark really set the ball rolling. Mr. Ebben made a passing reference in his letter, but I think a straight "Thank you, Sir John," would have been more fitting, and was due.

I would like to draw attention to the first six lines in the second paragraph of the letter of "Experienced." He, in a letter which seems to indicate a man somewhat tyrannous, admits there are badly-paid men, in a FEW cases. I would suggest that he is referring to his own particular area, and think that elsewhere he would find another "few," and yet others. He points out that the smarter of these are qualifying for better positions. They are certainly trying to do so; but brains need books and little experimental ventures, too, to develop them, things which cost money, even if the books be second-hand. The money cannot be squeezed out of 30s. a week, and we have not all got fathers with long pockets to find it for us.

He further says that station work is now largely a "rule of thumb" affair, everything being done automatically. Does he realise that each piece of automatic apparatus in a place means something else for the man-in-charge to understand, to watch, and to keep in order? Further, if that automatic, whatever it may be, fails to perform its allotted function, the "mere man" must step in and use his knowledge. *He must know what to do under the circumstances, every bit as well as if no automatic means of doing it were installed.*

Automatic appliances do not relieve a man one whit of his responsibility. Whatever happens, he has to answer for it, even if it be a mistake on the part of his junior, as instanced by J. Kay.

There are many things, trivial perhaps in themselves, but which, taken together, point to a lack of consideration being shown to the men, on whom, perhaps above all others, depends the continuity of supply. Especially so when it is remembered they are at it seven days a week, fifty weeks per year, including all Bank and special holidays. I wonder whether managers recollect such times. Perhaps they were more fortunate.

I fear I mustn't trespass further on your space just now. I should like to see letters from other men who know what they say, and abstain from any inclination towards abuse or ridicule, which seem to me to be against our interests, even if indulged in by writers on the other side.

A Senior Assistant.

A.C. v. D.C. for Lighting.

In my opinion as a practical electrician who has installed and handled both alternate and direct lighting jobs, chiefly in factories and works where the conditions were anything but favourable, owing to heavy vibration, dampness or excessive heat, and often in very close positions, I have no hesitation in recommending direct current at about 240 to 250 volts in preference to alternating at 110 volts or any other pressure.

The chief trouble with the A.C. supply is that you have always two live wires to contend with at the point of entry into a room, the fixing of the usual single-pole tumbler switch to control a light or number of lights always leaves one terminal of the lamp-holder fully alive. In the case of a tubing job, where perhaps tube-end lamp-holders and bracket fittings are oftener used than pendant drops, the replacing of a lamp-holder means that several more branch circuits must be cut off to enable the repair to be carried out with safety after drawing the necessary fuses.

Also, the lower voltage would exactly double the cost of installation, as it becomes necessary to double the size of cable if the voltage is reduced by one-half. The increased fragility of the 250 or 240-volt lamp as compared with the 110-volt is all bunkum; any metal filament lamp will give out if roughly handled. I have found no difference whatever between the 240 and the 110-volt lamp. In fact, in my opinion the more universally used 230 to 250-volt lamp is the best lamp, and will last longer and stand more vibration and knocking about than the 110-volt lamp. In any case, it must be remembered that lamps are manufactured specially for very vibratory positions or traction work; these lamps are known as traction lamps. The 230 to 250-volt direct-current supply has become so universal that lamp manufacturers have devoted particular attention to the manufacture of lamps of both carbon and metallic filaments for this popular pressure.

One other little point must not be overlooked, for it is very often met with, and that is, that you cannot charge accumulators from an A.C. supply without installing an expensive apparatus known as an interrupter, or by using a motor generator. A.C. supply is also useless for electroplating and electrochemical or medical purposes. A single-pole switch only is necessary when placed on the live side of a D.C. circuit to render the circuit quite dead and harmless, and this practice is universally adopted for factory and works lighting.

Henry Fowler,
Electrician-in-Charge.

Liverpool, *January 23rd*, 1915.

[If the voltage is halved, the section of copper must be quadrupled, for the same load and percentage drop.—Eds. Elec. Rev.]

Commercial Relations with Germany.

At the conference of this Association, held in Edinburgh in 1911, we were favoured with the presence of the representatives of many Foreign and Colonial Commercial Travellers' Associations, including the powerful organisation in Germany. To mark the occasion the honorary membership of this Association was conferred on each oversea delegate present.

I have received through the post a copy of an announcement recently published in *Die Post*, the organ of the German Association, a translation of which I enclose herewith.

I think this document most interesting, showing, as it does, the ignorance of the real position amongst a class of the German people who should be acquainted, if anyone outside the ruling class is acquainted, with the real facts regarding the present deplorable strife and Britain's action and part therein, and showing the intense bitterness of feeling against this country of the commercial community in Germany.

I shall be glad if you will give publicity to this pronouncement, so that your readers may have first-hand evidence of the real mind of commercial Germany with regard to Britain. Confident as we are in the justice and right of the action we have taken, we can regard such action with the contempt it deserves, and it will be as well in future to be on our guard against resuming the business relations which have hitherto subsisted and to give to all things German, including her commercial travellers, a very wide berth.

Fred. Coysh,
Secretary, U.K. Commercial Travellers' Association.

London, W.C., *January 19th*, 1915.

Notice.

The undersigned have decided to resign our hon. membership of the United Kingdom Commercial Travellers' Association and to return our official badges at the first opportunity. The reason that this has not been done before is that the undersigned had the opinion that after the declaration of peace commercial relations between Germany and Great Britain would be resumed, and it would thus be out of place to break off good relations with old colleagues, but the action of England against Germany in business matters has reached such a degree of hatred and low action as has never before been known under any conditions of warfare amongst cultured nations; it is evident that the idea is not only to destroy German commerce but the German nation entirely. Further, the robbing of German property and the bad treatment of German prisoners in England, show England to be on such a low grade of civilisation that it will be many years before friendly relations can be resumed. It is therefore beneath our dignity and honour to wear an English badge.

(Signed) George Haase, *Chairman Central Board.*
W. Bauer, *Vice-Chairman Central Board.*
Felix Ebel, *Chairman Berlin Section.*
Ludwig Ullmann.
A. H. I. Ioka.
Emil Berstorff.

War on German Trade.

We hear a good deal on the above subject, but one side that has not been given great prominence is the question of the employment of Britishers lately connected with German firms.

Some few weeks ago a firm advertised in your columns for an engineer for the sale of cable, and added this significant sentence : "Those previously employed by German firms need not apply." I ask, is this fair? To my mind it is most unjust.

In support of my view of the matter I would point out :—

1. If all firms acted in this way, then the Britisher who for patriotic reasons desired to join a British firm would be "kept at bay," and after the war would be more or less driven to rejoin the old firm.

2. If British manufacturers will only take into their employ men previously employed by German concerns and give them salaries which will induce them to stay, the war on German trade will be considerably furthered.

3. Face the facts! German organisation has always been excellent, and largely responsible for their extensive trade. Britishers employed by German firms have a knowledge of these methods, and could undoubtedly in many cases introduce them to great advantage into some of our firms and further strengthen our position in the future.

I speak from experience obtained in the employ of leading British and German firms, but as my views are evidently not shared by the firm who inserted the advertisement referred to above, I shall be very interested to know their reason for so wording the advertisement.

Britisher.

German Trade with Belgium.

After a stay of three months in England, I find that of the various points touched upon by the Belgian Press, in connection with the banishment of German products, one of the most important has been overlooked. I refer to electrical machinery and apparatus. As this especially concerns the readers of your esteemed Review, and affects their interests only, you will oblige me by according to these lines the hospitality of your journal.

As many journalists and men of standing and justice have already pointed out, when we have driven from our devastated Belgium the usurping and criminal power, it will be our task to restore our country to a position at least as important as it occupied before the war, whilst casting out goods made in Germany or in other countries under the auspices of German capitalists. It goes without saying that this will not be accomplished without a struggle, especially in the latter connection, in view of the duplicity of which that country is a past master.

Two important points, however, will ensure to us this commercial victory, which, in my opinion, is no more uncertain than that of our allied armies on the vast field of battle :—

1. Belgian patriotism, mingled with hatred for the criminals.

2. The assistance that our English friends will continue to accord to us.

None of your readers, makers of electrical material, is unaware, I suppose, that Germany predominates in the export of this material to all countries. This is the case with regard to Belgium, thanks to low prices, in accordance moreover with the quality of the goods, as is well enough known, and to a system which has been widely adopted for the past fifteen years.

Now, having taken a firm resolve to banish this material from our country, how shall we accomplish it, seeing that a first necessity will be to re-establish installations in many industries at present ruined, to restore networks, and to replace gas undertakings with the latter, if the rival products are not known there or are inadequately appreciated?

I repeat that British aid will be a great asset towards victory, provided it takes shape in good time and with the necessary energy. Let your industrial leaders immediately issue an appeal to the many Belgian electricians and manufacturers at present in London, in order that in proportion as Belgium is freed your products may be brought within their reach under the most advantageous conditions.

As much in this relation as in that which concerns the system employed by Germany for the past 15 or 20 years, I place myself at the disposal of your readers, to smoothe the way that they would wish to follow.

As regards Belgian patriotism, I shall not dwell at length on this point; first, because, through modesty, I do not wish to magnify the wreath of glory won by our people at this time; and, secondly, because this quality has been proved ever since the commencement of the war.

Just as our brave soldiers, then, have been able to hold in check the first fierce onset of the German horde, so our commercial world, conscious of its duty and filled with gratitude, will be able to defeat the rapacity of the German capitalists and show them, with a gesture of defiance, that their fine but deceitful words will in future have to seek other fields.

I entrust you, Sirs, with my London address, at the disposal of your readers, with compliments and thanks in anticipation.

Jos. Barrea.

London, N.W. *January 23rd*, 1915.

[Several letters are held over.—Eds. Elec. Rev.]

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

E.A.C. Inching Starter.

The Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, S.W., have placed on the market a heavy duty d.c. inching starter, which we illustrate in fig. 1. It consists of an automatic circuit-breaker (contactor), interconnected with an otherwise plain rheostat in such a way that the circuit is always broken by the contactor, no matter how carelessly the starter is handled.

There is no hold-on coil or spring return, and by dispensing with the latter it has been possible to increase the brush pressure to give satisfactory contact and to obtain finer resistance graduation with more steps.

The rheostat movement consists of a plain lever with a superposed separate operating handle, the forward movement of which latter, relatively to the lever, makes a plunger contact, energising the contactor coil and causing the contactor to close the main circuit to the motor.

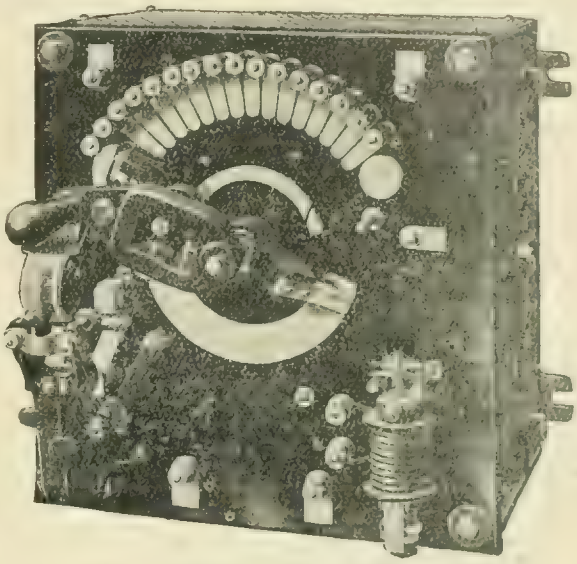


Fig. 1.—Heavy Duty Inching Starter.

If the handle is released or drawn back, the energising circuit to the contactor is broken and the contactor opens, stopping the motor.

When all the resistance is cut out, the handle can be released, as an alternative circuit to the contactor is provided in that position.

It should be noted that the contactor opens the circuit before the rheostat lever can be moved, and that a breaking arc on the starting segments is impossible.

The contactor can only pull up when the main lever is on the first contact, with all starting resistance in circuit ; by automatically cutting in economy resistance with the closing of the contactor, the operating coil is only subjected to full voltage for a fraction of a second, and cannot be burnt out ; also the inductive spark is broken by a properly-designed switch.

These inching starters are made in sizes from 5 h.p. to 200 h.p., and in the open, totally enclosed and back-of-board types.

An Electrically-Driven Rolling Mill.

A large firm of Birmingham steel workers recently decided to lay down a new 10-in. mill for rolling steel ingots down to various small sections, such as bicycle rims, &c. In fig. 2 will be seen a general view of the rolling mill, together with the driving motor.

Fig. 2.—Rolling Mill with 350-h.p. Witton Motor Drive.

The motor is rated at 350 H.P., and is of the "Witton" three-phase induction slip-ring type, and is started through a G.E.C. dust-tight liquid starter. Power for driving the motor, supplied by the Birmingham Corporation at 5,500 volts, three-phase, passes to a G.E.C. mistake-proof, boiler-plate motor-control panel. In addition to the usual gear this panel contains a set of choking coils to protect the end turns of the induction motor at the instant of switching on.

The drive from the motor is by cotton ropes on to a 7-ton flywheel carried on a shaft running in self-oiling dust-proof bearings. A special feature of the installation is that provision is made fo the easy adjustment of every part which can possibly require it and everything is done to facilitate the changing of the rolls when this is required. The mill was built by Thos. Perry & Sons, Ltd., of Bilston, and the whole of the electrical equipment was supplied by the GENERAL ELECTRIC CO., LTD., of Witton. The views were taken at a time when the motor was not housed in.

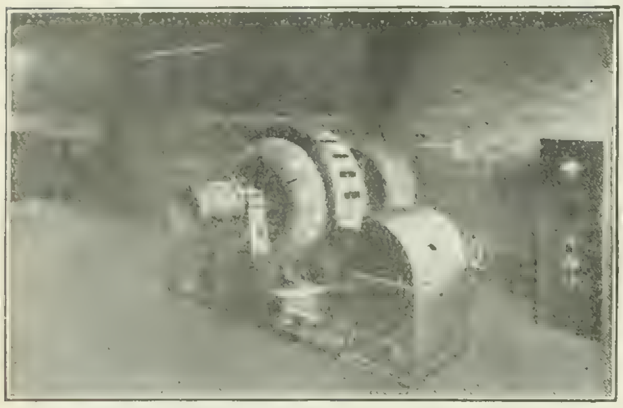
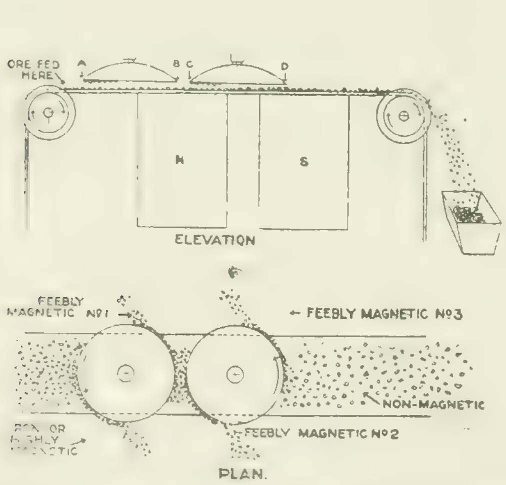


FIG. 3.—WITTON MOTOR WITH STARTER AND CONTROL PANEL.

New Magnetic Separator.

THE RAPID MAGNETTING MACHINE CO., LTD., of 18, Crescent, Birmingham, are introducing a new revolving disk magnetic separator (Type O), patents for which are pending, for the separation of feebly-magnetic ores.

It consists of a travelling feed belt passing successively over the poles of two vertical magnets. Two horizontal revolving domed iron disks are suspended over the belt, one somewhat in advance of the first pole and the other between the pole axes, as in figs. 4 & 5. The rim of the first disk is magnetised sufficiently to attract iron and highly-magnetic material from the ore on the belt, and the disk being of sufficiently large diameter to overhang the edges of the belt, as it revolves carries the ore beyond the magnetic influence, when it falls off by gravity and is there collected.



FIGS. 4 & 5.—REVOLVING DISK MAGNETIC SEPARATOR.

A similar action occurs with the second revolving disk, which, however, is so situated that an intense magnetic field is produced in its rim actually over the poles, thus attracting the feebly-magnetic material which is deposited from the overhanging edge.

By the introduction of extra pole-pieces in tandem with disks of suitable construction, the number of magnetic products can be increased, and by suitable arrangement two distinct products can be obtained from each disk.

The machine is provided with a number of adjustments as regard speeds, spacings, magnetic strength and ore feed, which make for greater efficiency. By setting the disks so that the edges are at graduated distances from the ore, the magnetic field can be varied to give four magnetic products.

"Ediswan" Half-watt Lamp Fittings.

THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., of Ponder's End, Middlesex, have placed on the market two similar half-watt lamp fittings, one of which is shown in fig 6. These are both made in cast-iron, and are suitable alike for interior or exterior use.

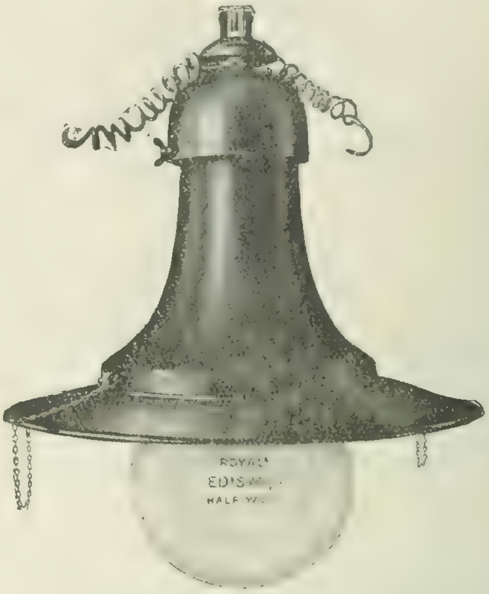


FIG. 6.—"EDISWAN" HALF-WATT LAMP FITTING.

In each case there are two sizes, one accomodating standard 100, 200 or 300-watt bulbs, and the other standard 500, 750 or 1,000-watt bulbs.

A simple form of adjustment to allow for varying length of bulb is provided; the fittings are water-proof and efficiently ventilated; one is provided with a reflector as in fig. 6, the other is without the reflector.

Lektrik Ceiling Roses.

The possibilities of the ceiling rose are admirably illustrated in a new list issued by MESSRS. A. P. LUNDBERG & SONS, of Pioneer Electrical Works, 477-489, Liverpool Road, N., which is devoted entirely to these accessories. Six types are shown, ranging from the "Biflex," with two terminal plates, to the "Multiflex" with six, and plug-connection patterns. In fig. 7 we illustrate the "Triflex," in which each plate has a loop-in terminal and two screw and washer terminals. The shank of the centre terminal provides the means of fixing the plates to the porcelain base. The three plates provide for a variety of uses, amongst which may be

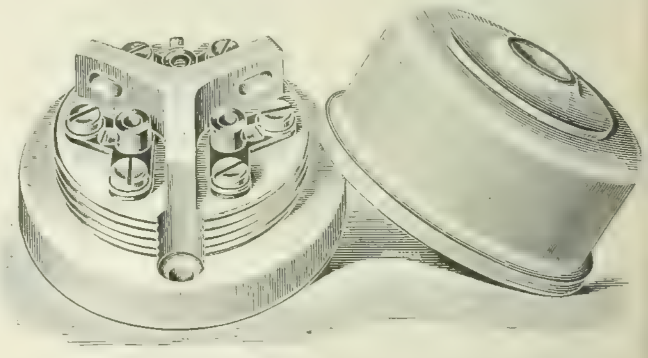


FIG. 7.—"TRIFLEX" ROSE.

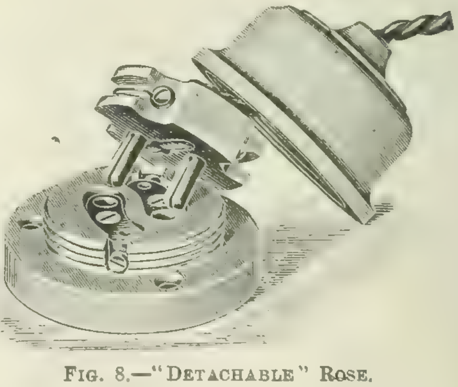


FIG. 8.—"DETACHABLE" ROSE.

noted the connection of a switch to control the whole pendant, or to give three degrees of lighting with three lamps, or a series-parallel-and-off switch to give dim light or full light with two lamps, or an earthing wire.

Fig. 8 shows a device which enables the pendant fitting to be completely removed and replaced whenever desired without detaching any screwed connections; and fig. 9 combines the advantages of a three-plate rose with a side plug connection for a small heater or motor, or other purposes—whence it is called the "Multum-in-Parvo."

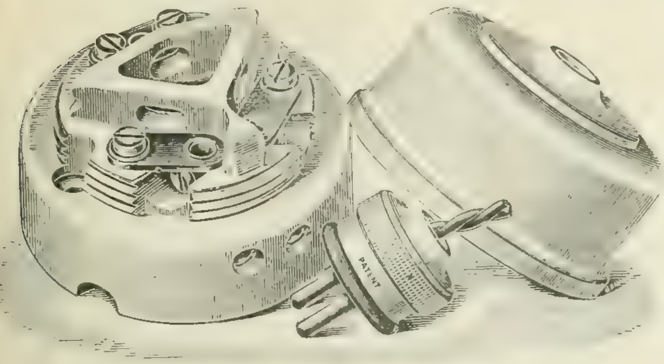


Fig. 9.—"M.I.P." Rose and Plug Connection.

Interlocking Switch Plug.

Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., have just introduced an interlocking switch plug mounted in a c.i. box for use on conduit installations. When the plug is inserted in the socket and the switch placed "on," the dolley lies over the extended flange of the plug, so that the latter cannot be withdrawn without switching off. It is also impossible to insert the plug with the switch on. We illustrate in fig. 10 a 5-ampere flush pattern switch plug, with plain polished brass cover.

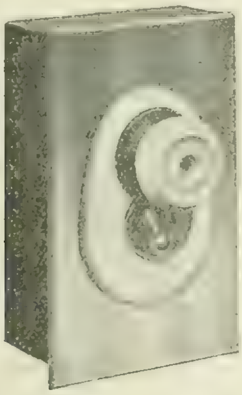


Fig. 10.—Interlocking Switch Plug.

Firing in the Dark.

A quick-sight electric flashlight rifle has been invented by a famous Australian explorer. The flashlight is fitted close to the muzzle of the firearm by a simple device, and the battery is carried in the butt. The light throws a T-shaped mark, which gives an automatic aim, the bullet striking practically at the intersection of the two lines. The device can be fitted to any arm, and should be useful to the big game shooter in the dark, or as a protection against thieves in the night. The flashlight can also be used for signalling.

Copper.—Returns for the half-month are now to hand, and we see from Messrs. H. R. Merton & Co.'s statistical circular that the total European visible supply is well maintained. Quantities at Havre are given as before the war, and the same course is followed with those at Hamburg and Bremen (if any). As these quantities remain fixed in the figures given, they do not affect the aspect of the increase or decrease, *i.e.*, the increase of 876 tons during the fortnight ending January 15th is a true increase at English ports, or afloat thereto.

Detailed supplies show a large quantity from Spain, equal to a month's supply previous to the war, as might have been expected after three months of short supplies from that country. Chile shipments are well over the average, Australian, so far, below it, but, from the quantity afloat, likely to exceed its pre-war average on the whole month's figures. Total deliveries are higher than half those of August, October, or November, but not up to the half of last month's. This may, of course, be considerably altered by antities received during the ensuing fortnight.

LEGAL.

Tramcar Accident Claim.

A verdict in favour of pursuer, with an award of £150 damages, was given in the Court of Session last Friday in a case in which a woman sued the Corporation of Glasgow for £250 damages for injuries she received on one of the Corporation cars. Pursuer stated that she was proceeding along the passage on top of the car when it stopped with a violent jerk. She was thrown forward and her head went through a glass panel. She attributed fault to defenders in respect that the car was being driven at an excessive rate of speed and was not under proper control. The Corporation denied fault, and stated that the driver brought the car to a standstill in order to avoid running over a dog. The car was going at a moderate speed, and, they said, was under proper control.

A Sydney Customs Duty Dispute.

In November, 1913, Ralph Sadlier Falkiner (trading as the Falkiner Electric Co.) imported a motor train, consisting of an engine, car, and 10 wagons. A dispute arose between the importer and the Customs Department as to the Customs classification for revenue purposes. The importer claimed that the duty should be £673, while the Customs Department claimed £4,590. Falkiner paid the duty claimed under protest, and claimed in a case heard before Mr. Justice Hood, a refund of £3,917, the difference between the duty collected and that which he held should have been paid.

Mr. Justice Hood, in giving judgment at Melbourne in December, said plaintiff was entitled to judgment for the amount of duty paid in excess (about which, he understood, the parties would agree), and costs including discovery.—*Sydney Morning Herald.*

Workmen's Compensation Claim.

At Wolverhampton County Court, on Monday, before his Honour Judge Howard Smith, and Dr H. L. Brown (West Bromwich), who sat as Medical Assessor, Hannah Simcox, widow, applied for an arbitration under the Workmen's Compensation Act on behalf of herself and her three children, the sole dependants of her husband, Thomas Henry Simcox, who, it was alleged, was killed by an accident on the Wolverhampton tramways during his employment as a motorman by the Corporation. Applicant claimed £245.

The case for the applicant was that at 10.15 p.m., on November 18th, Simcox was driving a tramcar from Wolverhampton, in the direction of Willenhall. When near Hayward's works the car left the rails. Shortly afterwards a car from Willenhall came up, and by means of a cable power was transmitted to the derailed car. While this was in progress, Simcox took up his place on the front of the car. One attempt was unsuccessful, but at the second the lights on the derailed car came on. It was seen that Simcox had assumed a stooping position, and when it was realised that he had collapsed, the current was disconnected. Simcox was moaning, and after artificial respiration had been tried without success, he was taken to the General Hospital, where he was found to be dead. A post-mortem examination was made, and the conditions pointed to the fact that the man had been killed by shock.

Dr. T. Black, formerly house surgeon at the General Hospital, said he made a post-mortem examination. He did not form any definite opinion as to the cause of death, but it was quite possible it resulted from the effect of an electric shock. He could not account for it in any other way. He discovered certain conditions which were present in cases of death from electric shock.

Dr. Bankier said he attended Simcox from October 30th to November 11th, the complaint being influenza and colic. There was no disease of the heart serious enough to cause death. Witness was present at the post-mortem examination. The dark and unclotted condition of the blood was a condition which he understood, pointed to electric shock.

For the defence, Mr. Henry Lea, of the firm of Lea & Son, consulting engineers, Birmingham, was called. He said that he tested the car after the accident, and if the insulation had not been perfect it might have caused shock. The insulatior, however, was perfect.

Dr. Cholmeley, who examined the body, said there was sufficient disease of the heart to cause death at any moment.

The Judge and Dr. Brown retired, and on returning the former said it was really a hopeless case on the applicant's part. He was advised by the medical assessor, and he agreed with him, that Simcox died as the result of the condition of the heart. Electric shock might have determined the cause, but Dr. Brown agreed with him that there was no evidence to show there was an electric shock at all. The verdict would be for the respondents, with costs.

Mr. E. W. Cave, barrister, pointed out that the Corporation had made an offer which, in his opinion, would have been handsome.

Osram Lamp Works, Ltd. v. The Corona Lamp Works, Ltd.

In the Chancery Division, on Wednesday, January 27th, this cas was down for hearing before Mr. Justice Warrington

Mr. A. J. Walter, K.C., who, with Mr. Colefax, K.C., Mr. J. Hunter Gray and Mr. Lunge, represented the plaintiff company, informed his Lordship that the action had been settled. Judgment by consent would be taken with his Lordship's approval, the plaintiffs being granted an Injunction as asked, and the defendants having paid £1,000 to cover damages and costs.

His Lordship gave judgment in accordance with the terms of settlement.

BUSINESS NOTES.

Smoking Concert.—On Friday, January 22nd, the staff and foremen of the Edison & Swan United Electric Light Co., Ltd., held a smoking concert at the Staff Café Ponder's End. Mr. J. W. Elliott presided, and Mr. J. S. Child occupied the vice-chair. Mr. Sydney Warwick acted as accompanist. We understand that Mr. C. F. Warren's vocal solos were greatly appreciated, and that the humorous songs of "Little Jack," the firm's telephone exchange operator, were equally enjoyed.

Pocket Lamp Inquiry.—Inquiry has been received for the names of United Kingdom manufacturers of cases and bulbs for electric pocket lamps, also for small polished steel reflectors. Communications should be addressed to the Secretary, British Chamber of Commerce, 9. Rue des Pyramides, Paris (Ref. G.W. 1,116).—*Board of Trade Journal.*

Trade Announcement.—Messrs. Fyfe, Wilson and Co., of Glasgow, have opened a London office at Broad Sanctuary Chambers, 11, Tothill Street, Westminster, S.W., for the sale of their Kelvin petrol and paraffin engines and electric generating sets, "Quartowatt" heaters, &c. Mr. A. G. Tucker, who has been with the firm in Glasgow for a considerable time, will be in charge of the new office, and his telephone number will shortly be "6921 Victoria"

Liquidations.—The Altheat Co., Ltd.—This company is winding up voluntarily, with Mr. A. Slatter, 62, Oxford Street, W., as liquidator. A meeting of creditors is called for February 1st.

The Universal Radio Syndicate, Ltd. — This company is winding up voluntarily, with Mr. F. A. Walrond, of 38 to 41, Queen Anne's Chambers, Westminster, S.W., as liquidator. A meeting of creditors is called for February 4th.

The Uitenhage Electric Light & Power Co.—A meeting will be held at 71a, Queen Victoria Street, E.C., on February 22nd, to hear an account of the winding up from the liquidator, Mr. E. West.

The Electrical Stores, of Nottingham, write to point out that they have no connection with the Electrical Stores, Ltd., of Wolverhampton, which was referred to in our last issue. The former concern is a private partnership, not a limited company.

The Sandwich, Deal and Walmer Electricity Supply Co., Ltd.—A meeting will be held at 36, Castle Street, Dover, on February 27th, to hear an account of the winding up from the liquidator, Mr. R Mowll.

British Prometheus Co., Ltd., Salop Street, Birmingham.—A Receiver for the debenture-holders has been appointed.

Book Notices.—Our valued contemporary *La Revue Electrique*, which published its issue for October 16th, 1914, on January 15th, states that it hopes to be able to appear regularly henceforth, and remarks on the distinct revival in scientific and industrial activity that coincided with the end of 1914. The contents consist of articles prepared for use in September, and include one by M. J. Blondin on telephotography and telephoty, in which recent apparatus are described. We welcome the return of the *Revue* to more normal conditions, and confidently hope that its career will never again be interrupted from such a cause.

"B.E.A.M.A. Journal." Vol. I, No. 1. January, 1915. London: The Association. Price 1s.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV, No. 1. January, 1915. New York: The Institute. Price 1$.

"Papers set in the Qualifying Examinations for the Mechanical Sciences Tripos, 1906-1913." Cambridge University Press. Price 2s. net.

"Annuaire pour l'an 1915 publié par le Bureau des Longitudes." Paris: Gauthier-Villars. Price 1 fr. 50 c.

"Graphical Determination of Sags and Stresses for Overhead Line Construction." By G. and M. Semenza. London: Hill Publishing Co. Price 12s. 6d. net.

"*Proceedings* of the South Wales Institute of Engineers." Vol. XXX No 6 Cardiff: The Institute. Price 5s.

"Electricity in Gases." By J. S. Townshend. Oxford: Clarendon Press. Price 14s net.

"Lockwood's Builders and Contractors' Price Book, 1915." By F. T. W. Miller. London: Crosby Lockwood & Son. Price 4s.

German Cable Manufacturing.—A fresh development is in contemplation by the conversion into a joint stock company of the Norddeutsche Kabelwerke—an undertaking which was formed by the Mix & Genest Telephone Co. about four years ago, with a capital of £15,000. The share capital of the reconstituted company, which bears practically the same title, amounts to £75,000, of which the Municipal Council of Neukölln, where a new factory is in course of erection, is reported to have subscribed £15,000. It is proposed to extend the scope of the company's manufactures, including the production of rubber core cables, and when the factory is finished it will be possible to turn out all the manufactures of a modern cable works.

Catalogues Wanted for India.—Messrs. Greaves, Cotton & Co., who are opening a branch of their electrical department in Karachi, invite our firms to send catalogues addressed to them at Karachi, India.

Patent Application.—Mr. L. Brennan, C.B., has applied for restoration of Patent No. 26,034 of 1909, for "Improvements in means for imparting stability to unstable bodies."

Bankruptcy Proceedings.—W. Walker (D. Smith and Co.), dealer in electric lamps, 2 and 3, Red Lion Court, Fleet Street, E.C.—Last day for proofs for dividend February 6th. Mr. E. S. Grey, Official Receiver, trustee, Bankruptcy Buildings, W.C.

W. R. Wedge, Albion Place, Northampton, lately carrying on business as electrical engineer in the Arcade, Northampton.—At the Northampton Bankruptcy Court, on Tuesday, the examination was adjourned *sine die.*

A. Whiteley, electrical and mechanical engineer, Llandudno.—First meeting, February 5th, at Crypt Chambers, Chester. Public examination, May 4th, at Bangor.

Calendars and Diaries.—Messrs. Hayward-Tyler and Co., Ltd., of 99, Queen Victoria Street, London, E.C., have sent us one of their usual pocket diaries for 1915. In addition to daily diary space there are some pages of engineering memoranda relating to water supply matters, and illustrated particulars of the firm's pumping machinery.

From the Hyatt roller-bearing department of Messrs. Broom and Wade, Ltd., High Wycombe, Bucks., we have received a scrap of card illustrating their bearings. When opened it turns out to contain a tiny calendar for 1915.

Messrs. Toy & Winslow, of 58, Stockwell Road, Brixton, S.W., have sent us a desk calendar with monthly slips.

Catalogues and Lists.—Messrs. Landis & Gyr, Ltd., Elgee Works, Stonebridge Park, Willesden, N.W.—Leaflet illustrating and giving connection diagrams of double tariff meters, with clock and hand control.

Messrs. Lacy-Hulbert & Co., Ltd., 51, Victoria Street, Westminster, S.W.—Four new leaflets briefly describing, illustrating and giving prices of "Boreas" air compressors, electric air compressors, electric blowers and rotary blowers.

The Benjamin Electric, Ltd., 1a, Rosebery Avenue, London E.C.—Four new sectional publications in attractive and serviceable form. No. 500 gives particulars and prices of "Marbella" opal reflectors of the distributing and concentrating types; No. 501 (24 pp.) details numerous Benjamin lighting specialities, such as wireless clusters, Edison screw devices, lampholders, &c.; No. 503 (16 pp.) is devoted to a number of reflectors and fittings for shop window, show-case, and cornice lighting; No. 502 is a 40-page pamphlet entitled "Economical Industrial Lighting," and it gives full information concerning the Benjamin steel line of reflectors and reflector fittings designed for this class of illumination service. All of the publications are fully illustrated, and have the prices set out very clearly.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—16-page electric heating list containing illustrations and prices of a range of Plexsim luminous radiators, from one to six lights, Murray's patent radiators, the Plexsim electric heat projector, and various designs of convectors operating upon the Simplex strip system.

Messrs. Crompton & Co., Ltd., Chelmsford.—Leaflet describing their "D" pattern portable moving coil instruments, ammeters, voltmeters and combined volt-ammeters, and giving prices of same.

Messrs. Pass & Seymour, Inc., Syracuse, U.S.A.—Price leaflet in three languages giving particulars of "Shurlock" electric sockets.

Messrs. Thomas Mitchell & Sons, Ltd., Derby Street, Bolton.—100-page catalogue of the stock of second-hand machinery, boilers, engines, electrical plant, &c., that they have available.

Messrs. Julius Sax & Co., Ltd., 24a, High Street, New Oxford Street, London, W.C.—16-page catalogue of electric bell and lighting accessories, Holophane glassware and fittings.

Norway.—The Tinfos Electrical Iron Works, which are the only exporters of electric pig-iron in Norway, have lately had a number of inquiries from abroad for the material, and, in fact, for more than the works are able to produce. To Danish motor manufactories and foundries the company has lately sold 1,700 tons of electric pig-iron, and 350 tons to other countries. The company has also practically secured an order for 500 tons for Italy.

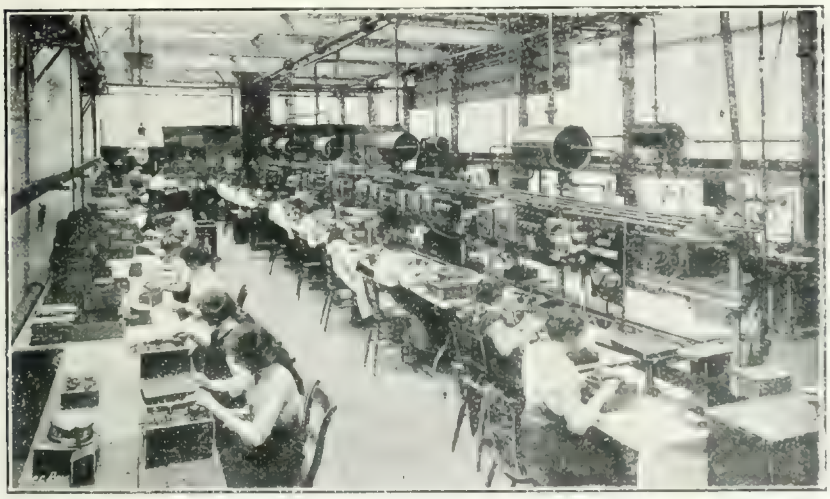
Private Arrangements.—Spagnoletti, Ltd., electrical engineers, Goldhawk Road, Shepherd's Bush.—The creditors of the above were called together last week at the offices of the liquidator, when it was stated that the meeting had been held in pursuance of the provisions of the Companies' (Consolidation) Act, the shareholders having passed a resolution for the voluntary liquidation. The liquidator stated that the company was registered in August, 1907, with a capital of £20.000, there being no public issue. In October, 1907, there was a debenture to the extent of £10.500 issued, and a further issue of £2,000 general charge, including the freehold land and buildings at Goldhawk Road. Another debenture was issued in December, 1913, in favour of the London County and Westminster Bank. The real object of the company going into voluntary liquidation was to get rid of the present name of Spagnoletti and reconstruct the company. The sale of the whole of the assets had been concluded, and the business had been taken over by the Park Royal Engineering Works, Ltd., who would continue the business. The trade liabilities would be paid in full and the creditors would probably each receive a cheque in settlement before the end of the present month. No resolution was passed, and the voluntary liquidation will, therefore, remain in the hands of the present liquidator.

(*Continued on page* 149.)

THE EDISON & SWAN ELECTRIC LAMP WORKS.

Mounting Carbon Filaments for "Ediswan" Lamps.

Firms may come and firms may go—but few of us can remember when the Edison & Swan Co. came into existence, for from the earliest days of electric lighting the name of this firm has been a household word, and none of us is likely to see it go, if we may judge by its present activity; long may it flourish, and worthily may it continue to bear testimony to the splendid work accomplished by the two great pioneers whose names it proudly bears! Ill fortune has dogged the steps of many of the old firms which laid the foundations of the electrical industry, and not a few of them have succumbed to the assaults of competition or the canker of internal disorders; the "Ediswan" company itself has not escaped the trials of adversity, but it has survived all perils, and now, with undiminished energy and renewed vitality, it appears to have entered upon an era of prosperity unsurpassed in its previous career.



Flashing and Checking Carbon Filaments.

Exhausting Tungsten Lamps.

Sealing Drawn-Wire and Carbon Lamps.

Photometer Room.

The firm was established in 1883, with a capital of one million sterling, when the interests of the two inventors, J. W. Swan and T. A. Edison, in this country were amalgamated, and the manufacture of incandescent electric lamps was commenced under their joint patents. During the reign of the carbon filament, the "Royal Ediswan" lamp acquired and maintained a reputation second to none, and the firm established branches in many provincial towns, as well as in the British Colonies and South America. On the introduction of the tungsten filament a few years ago, the firm took up the manufacture of the new type of lamp, first with the pressed or squirted filament, and later with the drawn-wire filament, and achieved equally satisfactory results.

It is a remarkable fact that, in spite of the high efficiency of the tungsten lamp, the demand for the carbon-filament lamp has suffered but little diminution, and consequently on a recent visit to the works at Ponder's End, we found the carbon lamp department busily employed, the output from this branch amounting nearly to half the total output of Ediswan lamps. The question has often been asked—who uses carbon lamps nowadays? The reply is that wherever lamps are exposed to rough usage, shocks, and vibration, the carbon lamp, which can be turned out at one-quarter the cost of the tungsten type, is still the most economical; the filaments are able to withstand an extraordinary amount of hard knocks, and the cost of renewals is comparatively trifling. Thus, carbon lamps are still employed on warships, at collieries, and on some railways, and for portable lanterns on ships, in workshops, &c.

Winding and Mounting Metal Filaments.

The processes involved in the manufacture of incandescent lamps are now so familiar to our readers that we need not describe them in detail. In the Ediswan works we saw great quantities of cellulose filaments being squirted, hardened and dried, passed through dies to render them uniform in diameter, and carbonised: bearing in mind the length of filament in a lamp, and even allowing for a large percentage of waste, the amount of filament material prepared affords some idea of the enormous output of the works. The filaments are sorted, mounted and flashed in the customary way, and the construction of the lamps otherwise calls for no comment, but the production of the bulbs is a different matter, for the Ediswan works is unique in that it is provided with a glass-blowing department on the premises, in which the whole of the bulbs are manufactured. The company is fortunately situated in this respect, as the supplies of foreign bulbs used in this country were cut off on the outbreak of war. In addition to two large glass furnaces which have been in use for many years, a new and still larger one, with 12 pots, has recently been built and put in operation; the original small furnace with which the company commenced its glass-blowing operations—more than a quarter of a century ago—has also been brought into use again after a long period of idleness. The process of making a bulb is perhaps the most interesting of all the operations connected with lamp-making; yet it is exceedingly simple—to the spectator. The workman dips an iron tube into the pot of molten glass, which we believe is called "metal," and withdraws it with a glowing lump of plastic glass on the end; after blowing it out a little, swinging and spinning it, he inserts it between the halves of a mould which is quickly closed by a boy helper, and blows it out in the mould whilst rotating it, so that the joint of the mould leaves no mark on the bulb. The latter is withdrawn in a few seconds, ready for use. The workman displays remarkable skill and judgment in taking exactly the right quantity of glass and manipulating it so that the thickness of the walls is uniform. The largest bulbs for high-C.P. lamps are made in a similar manner, but the operation is longer and more difficult, requiring two heats.

Exterior and Interior of "Ediswan" Glass Works.

The whole of the process of glass-making is carried on in the works, from the raw materials—chiefly sand and red lead—of which an abundant supply is available; the output of bulbs, already numbering some millions per annum, will be greatly increased by the addition of the new large furnace, but we understand that the whole of it will be absorbed by the Edison and Swan works. The construction of the glass furnaces—which somewhat resemble pottery kilns in shape—and the mode of setting and heating the "pots" in which the glass is melted and refined, are exceptionally interesting features of the works: the pots, for which a special quality of fire-clay is used, are made and set by the expert staff of the company. The pots as well as the furnace have to be heated to a high temperature before the setting takes place, and the operations carried on under such arduous conditions make heavy demands upon the skill and endurance of the manager of the department and his assistants.

Returning to the lamp-making works, we watched with interest the drawing of tungsten wire through diamond dies to the smallest sizes, and the subsequent processes of shaping, winding and mounting the filaments, which follow the usual lines. Besides the ordinary standard lamps, a variety of special types are manufactured by the company, from the tiny lamps for telephone switchboards to lamps of the highest candle-power. Various improvements have been introduced by the staff, whose prolonged and unique experience must be of the greatest value to the company, many of the experts having been associated with the firm almost from the commencement of its operations. The lamps are tested at various stages of manufacture, and the photometer rooms are exceptionally well equipped, the pentane lamp being used as the ultimate standard of reference.

Even where the bulbs have been of British manufacture, it has been a common practice to import the vitrite and brass caps; this company, however, has made itself independent of foreign aid in this respect also, by installing machinery for the manufacture of the caps, so that every part of an Ediswan lamp is entirely British made. The accompanying illustrations show some of the departments of the lamp works; but the company, in addition to lamps, makes a variety of instruments, switchgear, heating apparatus, &c., and its other departments are working at high pressure in the execution of important contracts. Owing to the needs of the Government, which have absorbed a large proportion of the company's products, the effect of the war has been not to reduce, but to redouble the activity of the works, and every effort has been and is being put forward to cope with the extraordinary demand for Ediswan manufactures; the buildings are being extended and additional machines installed for this purpose. The employés number about 2,500.

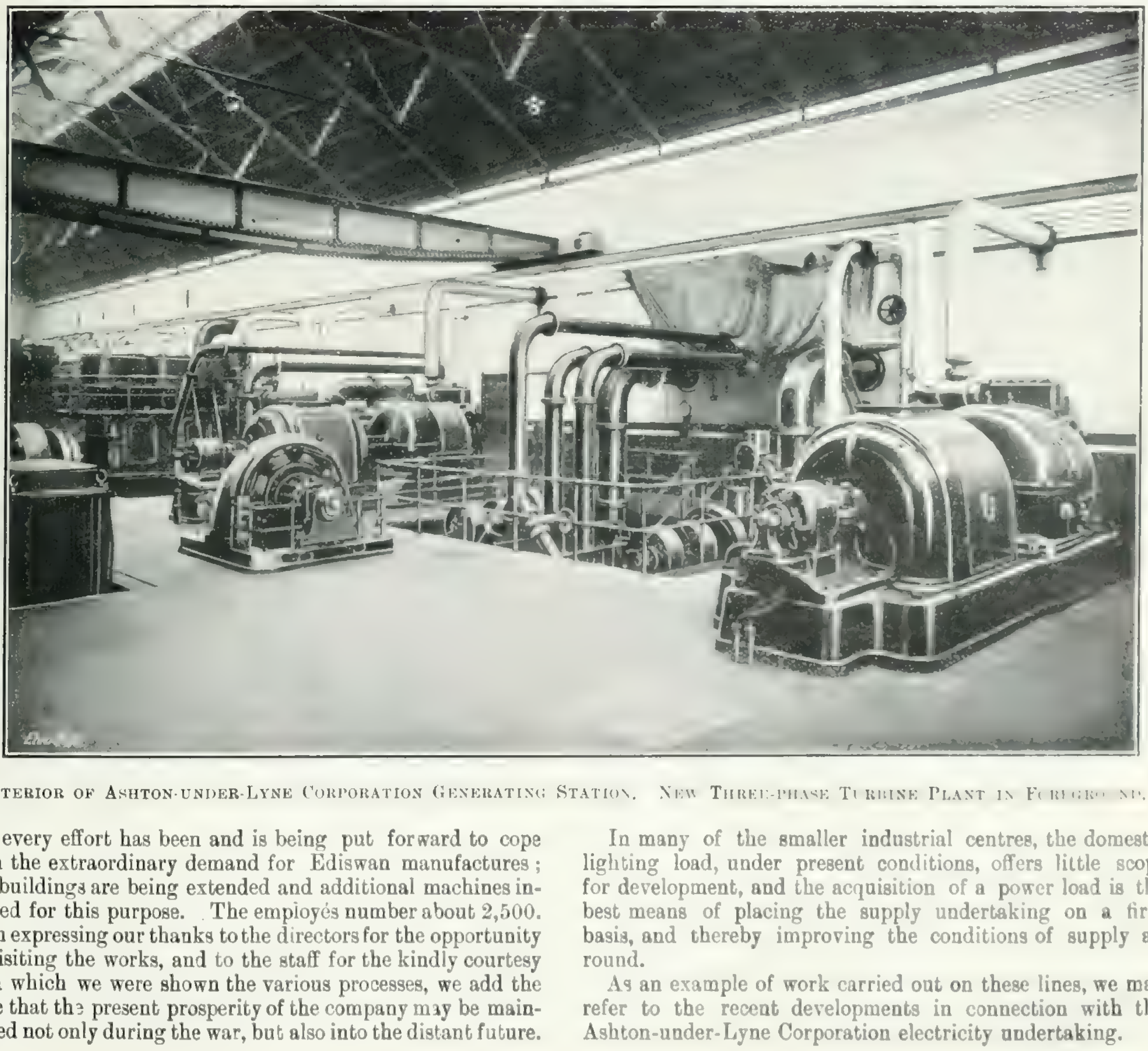
Finishing Department and Stock Room at "Ediswan" Works.

In expressing our thanks to the directors for the opportunity of visiting the works, and to the staff for the kindly courtesy with which we were shown the various processes, we add the hope that the present prosperity of the company may be maintained not only during the war, but also into the distant future.

THREE-PHASE PLANT AT ASHTON-UNDER-LYNE.

During the last few years electricity supply has made great headway in the industrial and manufacturing areas of this country. This is particularly true of the Lancashire cotton manufacturing districts, in which the demand for greater facilities in the matter of electric driving in mills and factories has led to a very general adoption of three-phase generation and distribution on the part of the municipal electricity suppliers in the vicinity of such works.

New three-phase power stations are springing up and others are projected, while the same type of plant is making its appearance, even in small areas where a power load is in prospect.

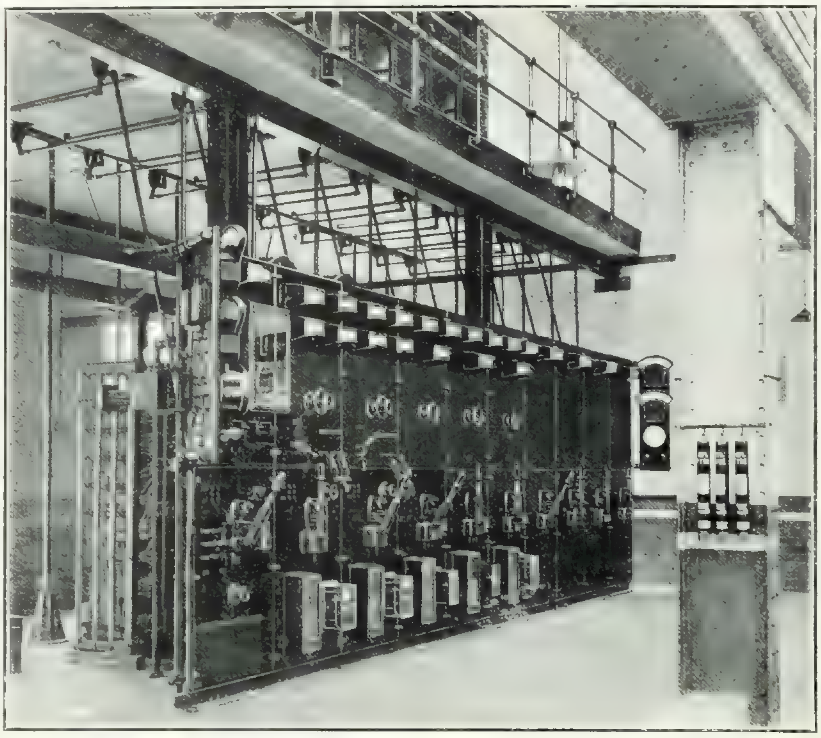


Interior of Ashton-under-Lyne Corporation Generating Station. New Three-phase Turbine Plant in Foreground.

In many of the smaller industrial centres, the domestic lighting load, under present conditions, offers little scope for development, and the acquisition of a power load is the best means of placing the supply undertaking on a firm basis, and thereby improving the conditions of supply all round.

As an example of work carried out on these lines, we may refer to the recent developments in connection with the Ashton-under-Lyne Corporation electricity undertaking.

In 1910 when the question of extensions was being considered, it was decided to start a three-phase alternating-current supply, and for this purpose a Willans exhaust steam turbine coupled to a 400-KW. Peebles alternator, and a 400-KW. Peebles motor-alternator were installed.



Three-Phase H.T. Control Board, Ashton-under-Lyne.

The area up to that time had been supplied on the three-wire direct-current system and the Willans turbine operates on the exhaust steam from three Browett-Lindley direct-current sets, and in conjunction with an Allen counter-current jet condenser, with a capacity of 25,000 lb. of steam per hour. The condensing water is passed through a Blasberg cooling tower of 125,000 gallons per hour capacity.

The installation of this plant took all the available space in the then existing buildings, and, further plant being required, a large extension scheme was put in hand, and has been in use for some months.

This comprised a boiler house to hold five 9-ft. diameter Lancashire boilers, with Goodbrand economisers and a chimney to deal with the gases from ten boilers; the boilers are equipped with Sugden superheaters and Triumph machine stokers, the hoppers of which are supplied with coal by small Bennis elevators—one to each boiler. The elevators are fed from a 1,000-ton coal bunker facing the boilers, and pass up over the firing floor to spouts leading to the stoker hoppers, this arrangement being similar to that adopted in the original boiler plant.

Three-Phase Oil Switch Cubicles on Gallery.

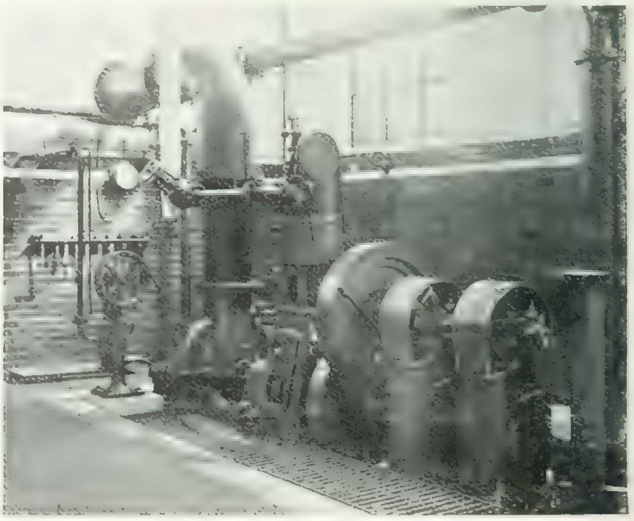
The coal elevating and conveying plant for filling the bunkers was supplied by Messrs. R. Dempster & Sons.

As there is no natural source of water on the site, all the water for condensing and boiler feed purposes is pumped from a borehole, some 500-600 ft. deep, being subsequently treated in a Kennicott water softener of 5,000 gallons per hour capacity, and passed to the cooling-tower plant. The feed water is drawn from the jet condenser discharge on its way to the cooling towers, and passed through a feed heater — into which the pump exhausts are turned —prior to passing through the economisers.

Two 6,000-gallon Nichols steam feed pumps form part of the new extension.

An addition was also made to the engine-room building, in which two 1,500-KW. B.T.H. three-stage Curtis turbines running at 3,000 R.P.M. on steam at 145-lb. pressure are installed, each driving a three-phase alternator for supplying 3,300-volt, 50-cycle current and a direct-coupled 16-KW. exciter. The cooling air for the alternators is passed through Balcke dry air filters in the basement.

The condensing plant is installed in an open well between the two turbine sets, each of which exhausts into an Allen counter-current jet condenser, the steam-driven pump set in connection with which consists of a 65-H.P. Allen tandem compound engine driving a centrifugal extraction pump and a geared two-throw air pump.



One of Three Similar Allen Condensing Plants at Ashton under Lyne.

To economise space in the engine room, the condensers have been erected in the boiler house, into which the main exhaust pipes are led.

The condenser bodies are cylindrical in shape, of riveted steel, and provided with internal perforated steel trays to insure intimate mixing of the steam and water. Each condenser is supplied with a butterfly valve and float for controlling the quantity of injection water and to safeguard against flooding of the condenser and turbine should the water extraction pump fail.

The air pumps are of the single-acting Allen-Edwards type, speed 150 R.P.M., driven through a cast-iron spur wheel and paper pinion on the engine shaft, which runs at 500 R.P.M. The centrifugal water extraction pumps are arranged to deliver over the top of cooling towers.

These condensing plants are similar to the earlier one provided for the exhaust turbine set, and will deal with 25,000 lb. steam per hour, giving a 27½-in. vacuum with condensing water at 80° F. The centrifugal pumps are each rated at 115,000 gallons per hour, and to meet the further requirements of this plant a Davenport cooling tower was installed, of similar size to that previously mentioned.

As an additional link between the alternating and direct-current plant, a 500-KW. Westinghouse six-phase rotary converter is installed, speed 750 R.P.M., together with a 550-KW. transformer, the whole of the three-phase plant being controlled by B.T.H. oil switchgear installed in a recess on one side of the engine room.

This H.T. switchgear consists of an operating board standing slightly above engine room floor level, with the oil switches, two sets of bus-bars, &c., in cubicles mounted on a gallery above. The oil switches are designed to break 10,000 KW. safely, and are mechanically operated. The operating board of the usual B.T.H. type includes panels for the three turbine sets and four feeders; an interconnector panel for the bus-bars fitted with a Tirril regulator; and panels for the motor-alternator and rotary converter.

Our views give a good idea of the new three-phase plant, and some indication of the original engine-room, with a modern 500-KW. Belliss direct-current set conspicuous in the background. Amongst the consumers on three-phase supply are cotton mills, rubber works, cake factories, a colliery, &c., which are supplied both by underground and overhead mains, the contracts for which have been carried out by the British Insulated & Helsby Cables, Ltd., and the Mackintosh Cable Co.

At the present time the three-phase load is increasing rapidly, as the following figures indicate :—

One week. December.	General supply.	Tramway supply.	Three-phase supply.	One week. Total.
1913	44,315	34,850	18,537	97,702
1914	44,698	32,329	83,478	160,505

As to the effect of the new plant on the operation of the station, it is worth noting that the coal consumption per unit delivered to the mains has fallen from 5½ – 6 lb. to 3·70 lb., the latter figure representing a cost of ·198d. per unit (with coal at about 10s. per ton); the generating costs as a whole are about ·43d. per unit.

The full load steam consumption of the new turbine sets on test was 16·3 lb. per unit, and erected on site under normal working conditions on two-thirds load, including steam range and auxiliary engine losses, amounted to 18·05 lb. per unit.

The extensions as a whole, buildings and plant, have cost some £37,000, equivalent to £10·1 per KW. of generating plant installed.

For the particulars and figures which we quote, we are indebted to Mr. Neville Appelbee, the electrical engineer to the Corporation, on whose advice the introduction of three-phase supply has been carried out.

That his anticipations have been amply realised, may be gathered from the fact that the growing demand on the station points to the necessity of installing another turbine set almost immediately, which will have a larger output than the existing ones, and will take the place of some of the earlier reciprocating plant.

In conclusion, our thanks are due to Mr. Appelbee for so readily assisting us in the preparation of this short article.

Fire.—A Reuter dispatch from Trenton, New Jersey, states that damage to the tune of £200,000 was done by a fire which broke out on January 19th at the plant of John A. Roebling, Sons & Co. The company was making insulated wire for telegraph and telephone field service and trace chains for artillery. Incendiarism is suspected.

BUSINESS NOTES.

(*Continued from page* 144.)

Catalogues Wanted in Spain.—Firms dealing in electric railway material and accessories for tramways, are invited to send catalogues and particulars of export prices to Mr. B. Abraldes, Carral No. 9—1°, Vigo, Spain.

For Sale.—Halifax Corporation Electricity Committee has for disposal by tender one 30 ft. by 9 ft. Lancashire boiler, with sprinkler stokers and superheater. Particulars are given in our advertisement pages to-day.

LIGHTING and POWER NOTES.

Aberdeen. — RESTRICTED LIGHTING. — The Lighting Committee of the T.C. reports that owing to the curtailment of the public lighting there was a saving of £968 on the electricity account up to the end of December. The total amount saved in both electricity and gas since August last amounted to £2,000.

Barnet.—INFIRMARY LIGHTING.—The B. of G. has considered the offer of the North Metropolitan Electric Power Co. to supply energy in bulk to the new infirmary, at 1d. per unit, with an additional fixed charge of £50 per annum, the company undertaking to lay cabling in duplicate, free of cost, and has finally decided to adhere to the original intention to supply its own energy. The question of an agreement for an emergency supply of current in case of necessity was referred to a committee.

Belleek.—E.L. SCHEME.—The Fermanagh C.C. has granted permission to the Belleek R.C. to erect the necessary poles for the proposed electric lighting of the town; the power will be supplied by the Belleek Pottery.

Blackpool.—A temporary failure of the electric light on January 20th was caused by the bursting of a water main, which had the effect of flooding an electric light chamber near the central station. The motor fire engine very speedily cleared away the water.

Boston.—PROV. ORDER.—The R.D.C., having been asked to consent to the application of the Boston and District Electric Supply Co. for a prov. order for E.L., has decided to see what is done in the matter by the Boston Corporation.

Bury.—OVERHEAD MAINS.—Application is to be made to the B. of T. for permission to erect an overhead electrical line for the purpose of a bulk supply to Heywood.

Chapel-en-le-Frith. — WORKHOUSE LIGHTING. — The B. of G. has decided to obtain an estimate for an E.L. installation at the workhouse.

Chertsey.—The R.D.C. has been informed that the B. of T. intends granting an order to the Woking Electricity Supply Co. Ltd., permitting it to supply electricity in bulk to the Ascot and District Electricity Supply Co. The Council has decided to inquire from the Woking Co. what its proposed charges for current are.

Chipstead.—The Surrey County Council is advised by the Parliamentary Committee that, for its own protection, it should have Clause 14 of the Electric Lighting (Clauses) Act, 1899, inserted in the Chipstead and District E.L. Prov. Order, applied for by Mr. G. Allom.

Cleethorpes.—PROPOSED LOAN.—The D.C. has decided to apply to the Public Works Loan Commissioners for a loan for electricity purposes as follows:—Mains, £7,870; services, £965; cut-outs, £148; switchboards, &c., £198; meters, £819.

Colwyn Bay.—PUBLIC LIGHTING.—The U.D.C. has decided to utilise high-power electric lamps instead of gas for lighting the portion of Abergele Road containing business premises, and the business part of Old Colwyn from Church Walks to the Ship Hotel.

Continental.—SPAIN. — A Royal Order, under date December 14th, authorises the Sociedad La Riverena, of Duero to extend its distribution network to include the towns of Arauza Jumael de Hizan, La Aguilera Vilalba, and other localities in the Spanish Province of Burgos. Similar authorisation is accorded to the Sociedad Anonima El Porvenir to the towns of Quintanilla, Sobre-ierra, Masa and Sedano, in the same province, through the medium of a sub-station to be erected.

The Sociedad Anonima Union Industria is the style of a company formed at Villanueva and Geltru, Spain, for the erection of works for the supply of gas and electricity.

A concession has been secured to supply electric light and power to the towns of Carino, Mera San Claudio, Ortigueira and Cedeira, in the Spanish Province of Coruna.

Crayford.—The P.C. has received amended terms for lighting by electricity from the West Kent Electric Co., which is supplying houses on the estate at Barnes Cray with current. The new terms have been referred to the Lighting Committee for consideration.

Coventry.—The Sub-Committee of the E.L. Committee, having inspected the dust-catching arrangement installed in connection with the dust destructor at Poplar, recommends that a similar arrangement be installed in connection with the forthcoming extensions at the electricity works.

The Electricity Committee has approved of the amended terms for the use of water from the Coventry Canal Co. for condensing purposes. The payment by the Corporation is to be £325 per annum for the present plant plus £20 per annum for each additional 3,000 KW. of plant installed. A Sub-Committee was appointed to consider as to the terms upon which electricity could be supplied to the workmen's cottages at Stoke in connection with the Leicester Street re-housing scheme.

Dover.—The T.C. has decided to have the drainage works lighted by electricity.

Durham.—SCHOOL LIGHTING.—The C.C. has decided to have the E.L. installed at the County Industrial Schools.

Earlstown (Lancs.).—E.L. SCHEME.—The D.C. has appointed Mr. E. M. Lacey consulting engineer in connection with the electric lighting scheme.

Edinburgh. — HIRING CLAUSES, &c. — The T.C., by 20 votes to 13, decided to delete clauses 66 and 67 in the Corporation's prov. order, which proposed to give power to let on hire electrical appliances and to open showrooms in the city for this purpose.

Epping.—The U.D.C. has decided to oppose the London Electricity Bill.

Grimsby.—PROPOSED LOANS.—The T.C. is recommended to apply to the L.G.B. for sanction to borrow £5,000 for a new battery, £4,000 for mains, and £2,000 for services.

India.—The Ahmedabad electricity generating station is now almost completed, and it was expected to commence the supply this month.—*Times of India.*

Leek.—The Electricity Committee recommends, as an alternative to the existing scale, that current for power purposes, be offered at a payment of £1 17s. 6d. per quarter per KW. of maximum demand, plus one-third of a 1d. per unit for all current used. The maximum price per unit under this scale not to exceed the price under the original scale; and that the flat rate of 2d. per unit for heating and other domestic purposes (other than lighting) be reduced to 1½d. per unit.

London.—WOOLWICH.—On account of restricted lighting the electricity department has allowed £180 off the Corporation's lighting account. Petitions are to be lodged against the two London Electric Supply Bills. The Finance Committee has considered a report from the borough treasurer on the question of the accelerated loan repayments in respect of the loans outstanding on plant at Plumstead electricity works, which under Sir John Snell's first report, in which he proposed the closing down of the Plumstead station, was to be replaced and become obsolete. The borough treasurer points out that Sir John Snell in his final report advised that the Plumstead station should not now be shut down entirely, but continued in use by the destructor steam only, and to otherwise hold the plant as for reserve purposes. The Council has decided to ask the L.C.C. to accept the ordinary reyayments on the original loans in respect of the plant at Plumstead works, and to suspend the operation of the deed entered into on April 7th, 1913, for the acceleration of repayments within the next three years, having regard to the altered circumstances in connection with the Council's proposals in which the plant at Plumstead works will be kept in use.

BATTERSEA.—The Electricity Committee recommends that during the time restrictions on outside lighting are in force, a reduction of 75 per cent. be made in the contract charges in respect of hire and maintenance, &c., of lamps installed outside premises, subject to the condition that the period of the agreement be extended by the period during which the restrictions are in force.

The B.C. is recommended to present petitions against the London and District Electricity Supply Bill and the London Electric Supply Bill.

The L.C.C., as a result of its inquiry whether the B.C.s were in favour of the unification of electric supply in and near London and the terms on which they would be prepared to endorse the Council's scheme, finds four Councils opposed, 10 asking for postponement, and that five gave indefinite replies.

SOUTHWARK.—The B.C. has been recommended, in order to obtain a *locus standi*, to oppose the two London Electric Supply Bills.

HACKNEY.—The Finance Committee recommends the B.C. to accept the offer of the L.C.C. to advance £10,000 on account of the loan applied for in respect of expenditure on mains, and that application be made to the L C.C. for sanction in writing to the borrowing of the sum of £22,652, being the balance of the amount sanctioned.

Masham.—E.L. SCHEME.—The U.D.C. has concluded an agreement with the promoters of a scheme for supplying the district with the electric light.

Nantwich.—PROV. ORDER.—The Crewe Corporation has asked the B.O.T. for [illegible] to the granting of an order by the B. [illegible] Corporation to supply Wistaston Manor and other places in the township with electricity, which would also be available for street lighting.

New Zealand.—The Timaru Borough Council has been offered a supply of power from Lake Coleridge at £6 per H.P. per annum. It is not stated whether this is on the maximum installed power or on the average power used.—*New Zealand Shipping and Commerce.*

Plymouth.—RECEIPTS AND ESTIMATES.—The return for the three months ended December 31st of the Prince Rock section of the Corporation electricity undertaking shows receipts £9,298, compared with £9,518 in 1914; 888,996 units were sold as against 901,843 units in the corresponding period of last year. The Electricity Committee anticipates an expenditure in the next financial year on public lighting in the Plymouth area of £7,763, Devonport area £5,010, and Stonehouse area £965, a total of £13,738. The estimates for the electricity undertaking were for the Princes Rock section an income of £32,140, as against £32,750; and a net profit of £2 066, out of which it was proposed to spend £1,800 on meters, mains, service transformers, &c, carrying £286 to the reserve. For the Ker Street section, the estimated income was £23,164, as against £22,599, and a net balance of £1,759. On capital account on the Ker Street section it was decided to provide an expenditure of £4,500.

South Africa.—The Durban Corporation has decided to appropriate a sum of £350 000 from the £960,000 loan for public works, for the extension of the water supply, electric lighting, tramways, telephone system, and other municipal enterprises —*Board of Trade Journal.*

Street.—E.L. SCHEME.—A limited company is to be formed at once for the purpose of carrying out the electric lighting scheme. Messrs. Christy Bros. are to take over the public lighting on an agreement for 10 years at £2 per lamp per annum.

Walthamstow.—NEW TURBINE PLANT.—The Lighting Committee has decided to enter into a contract with the Brush Co. for the supply of a 1,500-KW. Ljungstrom turbine, at £6,996, the contractors to agree to open out the turbine for inspection at the end of 12 months, it being understood that the turbine will not be taken over if the blading shows any appreciable signs of wear, the contract to further provide that the set will be replaced by a 1,500-KW. disk and drum turbine in accordance with the tender for that type of plant, should the Ljungstrom set fail to comply with requirements.

West Ham.—LINKING-UP PROPOSAL.—The electrical engineer has been instructed to report on the possibility of linking-up with the Poplar electricity undertaking for mutual supply purposes.

Willesden.—Owing to the shortage of carbons, the Electricity Committee proposes to convert as many as possible of the existing arc lamps to metal-filament lamps. The engineer was instructed to obtain quotations for insurance against loss by fire of apparatus which had been loaned out to consumers. The Council has been recommended to petition against the London Electric Supply Bills. As the Council's agreement with the North Metropolitan Electric Power Supply Co. expires on March 31st, 1918, the Electricity Committee is of opinion that the electrical engineer should be instructed to report generally upon what terms the agreement may be renewed for a further period of seven years, and also alternatively to submit preliminary plans and estimates for the erection of a new generating station, either on the site acquired by the Council for the purpose, or any other suitable site.

Worksop.—The Traders' Association has forwarded to the U.D.C. a resolution of protest against the suggestion of the Lighting Committee to embark upon municipal trading, on the ground that it would be detrimental to the interests of the individual traders of the town. The matter has reference to the decision of the Council to support the Bill of the I.M.E.A.

Yorkshire Electric Power Bill.—The Birkenshaw Council has decided to recommend the West Riding C.C. to safeguard the interests of the local authority by reserving to it the right at any time to supply power in the district; the Bingley Council has decided to lodge a petition against the Bill in respect of East Morton, and the Brighouse Corporation has resolved to oppose the Bill.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. CARS.—Some time ago, residents in Mannofield and district petitioned the T.C. urging the discontinuance of the P.A.Y E. cars, but the Corporation Tramways Committee recommended that as the new plan had only been in operation for a few months no action be taken. The matter is not ended, however, as the Town Council is to receive a deputation at its next meeting, and notice of motion has been given that the system be abolished on all Corporation cars.

Argentina.—The Buenos Aires City Council has conceded to the Anglo-Argentine Tramway Co. a period of one year in which to commence the work on the subterranean line from Retiro to Constitucion; this period to commence when peace has been officially stipulated between the various nations. The prorogue is granted under the express condition that the construction of the line will terminate within a period of two years after commencement, failing which the fines provided for in the concession will be applied.—*Review of River Plate.*

Blackpool.—Parcels System.—The Corporation is introducing a tramway parcels system, to come into force on February 8th. It was hoped the system would extend to all the Fylde tramways, but as arrangements have not been made with the Fleetwood Co. the service will only apply to Blackpool Corporation and Lytham and St. Anne's tramways.

Continental.—Italy.—By a supplementary agreement, the company which secured the concession in December, 1910, to construct the steam railway from Umbertide to Todi and Terni, has been empowered to substitute electric for steam traction. The company proposes to adopt the single-phase system at 1,000 volts and 25 periods. The estimated cost of the installation is 21,220,000 lire. The Government contributes a subsidy of 9,600 lire per km. for 50 years.

Spain.—Application has recently been made to the Spanish Government for a concession for the construction and working of an electric tramway between Madrid and the Escorial, which is largely visited by tourists during the summer season.

Croydon.—The B.C. has sanctioned tramway improvements at an estimated cost of £2,957—a new loop each for the Addiscombe and Norwood routes, and the provision of an auxiliary feeder for the latter.

Dewsbury.—Tramway Extensions.—The ratepayers have approved the clauses in the Corporation's Parliamentary Bill relative to the spending of £8,190 for the purpose of proposed tramway extensions; £7,535 for the purchase of land and the provision of a depôt for tramcars and omnibuses, and £200 for the electrical equipment of the tramway.

Elland.—Tramway Extensions.—The U.D.C. has decided to support the Halifax Corporation's proposed Tramway Bill, so far as it relates to the extensions to Elland.

Halifax.—Proposed Tramway Extensions.—The statutory meeting of ratepayers held to consider the Corporation Bill sanctioned the extensions to Elland (£22,921) and Stainland (£15,463), but rejected the proposed extensions to Ripponden (£20,293). Approval was also given to the suggestion to double the track from Stump Cross to Shelf (£10,349), which would enable through cars to be run between Halifax and Bradford.

Huddersfield.—Nine Months' Working.—The receipts of the Corporation tramways for the nine months ended December 31st last amounted to £96,654, as against £88,235 for the corresponding period of the previous year. The total working expenditure has been £52 303, compared with £48,957, and the gross surplus is £44,351, compared with £39,278. Interest on capital, redemption of debt, &c., absorb £19,378, and after provision has been made for depreciation at 3 per cent., there is a net surplus of £13,912, compared with £9,995. The reserve or renewals account stands at £20,079, compared with a balance brought forward of £30,973.

The Finance Committee is to be asked to sanction the provision of £60,000 for capital expenditure on the Elland and Marsden tramway extensions.

London.—L.C.C.—The Highways Committee recommends the entering into an arrangement with the London Electric Supply Corporation for a further supply of power up to 3,500 kw. to the tramways, at £3 a kw. a year, plus ·4d. per unit, for a period of at least six months. If after six months the power is required as stand-by, the charge will be £2 a kw. a year. The costs of cables, ducts, &c., for coupling up to the Deptford station will be some £6,850.

Plymouth.—Proposed Loan.—The Tramways Committee has recommended the T.C. to apply to the B. of T. for a loan of £5,000 for the provision of six additional tramway cars.

Rhondda.—Tramway Extension.—The estimated expenditure to be incurred by the U.D.C. in connection with the construction of new tramways and extensions, as proposed in the Council's Bill, is £25,567 and £2,400 for equipment.

Rotherham.—Proposed Tramway Expenditure.—In the proposed Parliamentary Bill provision is made for an expenditure of £9,108 for motor-omnibus services outside the borough, and £55,789 for the construction of over 5½ miles of tramways to Maltby.

Southend-on-Sea.—The Corporation has deferred consideration of tenders received for the supply of three motor-'bus chassis pending the result of inquiries into the use of electrically-propelled vehicles.

U.S.A.—According to the *Electrical World*, the official statement attributes the recent fire in the tunnel of the Interborough Rapid Transit Co., New York City, on January 6th, to a short circuit on certain feeder cables in manholes on either side of the subway in Fifty-third Street. Practically all the cables were short-circuited and destroyed, creating considerable gas and smoke from the insulation; at the same time owing to the tripping of the circuit-breakers, power was cut off the third rail and the trains were stopped. As our readers are aware, many people were held up in standing trains, several hundred being overcome by the fumes from the burning insulation and removed through manholes and gratings in the street. Moreover, 200 people were injured in the panic which occurred, one fatality being reported. The trouble occurred at about 8 a.m., and by 4 p.m. the system was repaired sufficiently to operate local trains, and normal service was restored early next morning.

Electric Vehicle Savings.—As the result of the experience of Messrs. Marshall Field & Co., of Chicago, with a fleet of more than 200 electric trucks and vans, Mr. Stanley Field states that with electric trucks operating at a cost of $8 a day, the firm are able to perform delivery service which cost $13 a day with petrol trucks.

TELEGRAPH and TELEPHONE NOTES.

Canada.—The new automatic telephone exchange at Medicine Hat (Alberta) is now in operation. The exchange equipment is designed for 2,000 subscribers, while the outside cable construction provides for 3,000. In the new building twice as many subscribers can be accommodated.

Censorship of Telegrams.—In the course of a letter from the Secretary of State, Mr. Bryan, to Mr. Stone, Chairman of the Senate Foreign Relations Committee, defending the neutrality of the United States in the European War, the Secretary states that "the reason that wireless messages and cable messages require different treatment by a neutral Government is as follows:—Communications by wireless cannot be interrupted by a belligerent. With a submarine cable it is otherwise. The possibility of cutting a cable exists, and if a belligerent possess a naval superiority a cable is cut, as was the German cable near the Azores by one of Germany's enemies, and as was the British cable near Fanning Island by a German naval force. Since a cable is subject to a hostile attack, the responsibility falls upon a belligerent and not upon a neutral to prevent cable communication.

"A more important reason, however, at least from the point of view of a neutral Government, is that messages sent out from a wireless station in neutral territory may be received by belligerent warships on the high seas. If these messages, whether plain or in cipher, direct movements of warships or convey to them information as to the location of an enemy's public or private vessels, the neutral territory becomes a base of naval operations, to permit which would be essentially unneutral. As a wireless message can be received by all stations and vessels within a given radius, every message in cipher, whatever its intended destination, must be censored. Otherwise military information may be sent to warships off the coast of a neutral country. It is manifest that a submarine cable is incapable of becoming a means of direct communication with a warship on the high seas; hence its use cannot as a rule make a neutral territory a base for the direction of naval operations."—*Times.*

Norway.—The plant for the Stavanger trans-Atlantic wireless station, which had been ordered in England, was ready a long time ago at the manufacturer's works, but when the war broke out the shipment of it was prohibited. The Norwegian Government has, however, succeeded in getting the embargo removed, and recently there arrived in Norway 142 cases of materials, including the receiving apparatus for the main station at Märland, and the bulk of the machinery for the same as well as for the sub-station. The buildings at both places are nearly completed, and the work of installing the machinery will be commenced at once.

In the vicinity of Christiania a large wireless station is also going to be erected for the purpose of communicating with Sweden, Denmark and Russia. In the next Budget the Government will ask the Storthing for a sum of £5,555 for this station as a beginning.

Telegraphic Interruptions.—The great snowstorm of Friday last brought down telegraph and telephone wires in all directions, and caused serious interruptions throughout the Home Counties. The trunk telephone wires were particularly affected. Most of the damage was repaired during the week-end. Many overhead telephone wires were brought down in London by the damp clinging snow, and in some cases roof standards were displaced. Further damage took place on the following days, owing to falls of snow from roofs on telephone wires.

"Wireless" Wire.—It is reported that the Germans have seized £2,000 worth of copper from the Belgian Government's wireless installations in Brussels.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Brisbane.—March 10th. Motor-generator, power board, &c., for Postmaster-General. See "Official Notices" January 15th.

Aylesbury.—February 6th. U.D.C. Supply of electric motors to consumers (hire-purchase agreement) See "Official Notices" January 22nd

Blackburn.—February 13th. Corporation. Twelve months' supply of stores including a number of electrical items, for the Electricity Committee. See "Official Notices" to-day.

Bolton.—February 11th. Corporation. Low-tension sub-station switchgear, for the Electricity Department. See "Official Notices" January 8th.

Bristol.—February 11th. Twelve months' supply of carbons, joint, junction and fuse boxes, wattmeters, ampere-hour meters, boiler castings, globes, &c. See "Official Notices" to-day.

Cardiff.—February 22nd. Installation, 750 points, at New Technical Institute, Cathay's Park, for the City Council. See "Official Notices" January 22nd.

Colchester.—February 6th. Corporation. Twelve months' supply of stores, including lighting fittings, car equipment, overhead equipment, cable, &c. See "Official Notices" January 22nd.

Darlington.—February 2nd. Corporation. Alternative tenders for 2,000-KW. and 3,000 KW. turbo-alternators; separate tenders for condensing plant. See "Official Notices" January 15th.

Dover.—Tram-rails, for the T.C., Deputy Borough Surveyor.

Dundee.—February 1st. Corporation. Supply of 15-ton overhead travelling crane for Walton electric sub-station. Specification from Mr. H. Richardson, Engineer, Electricity Department.

Halifax.—February 15th. Corporation. Twelve months' supply of stores, including lighting fittings and electrical accessories, cables, telephone wire, meters, &c. See "Official Notices" January 22nd.

Helsby.—The Parochial Committee, having heard a report on the electrification of the water and sewage stations, is obtaining tenders for the work from two local firms—the B.I. and Helsby Cables, Ltd., and the Mersey Power Co.

Hong Kong.—February 3rd. No. 5, steel structural work; No. 6, coal-handling plant. Specifications, &c., £1 each (returnable), from Messrs. Preece, Cardew & Snell.

Leeds.—February 20th. Corporation. Twelve months' supply of stores, including cable, mains boxes and fittings, jointing and insulating material, electric lamps, fittings, &c., for Electric Lighting Department. See "Official Notices" January 22nd.

London.—BERMONDSEY.—February 5th. B.C. Twelve months' supply of carbons and brushes, cable and jointing material, stoneware conduits, meters, demand indicators, main fuses, oils, meter boards, street frames, covers and joint-boxes. See "Official Notices" January 22nd.

L.C.C.—February 10th. Installation (184 wiring points, 246 lighting points) at Scawfell Street Elementary School, Hackney. See "Official Notices" to-day.

The L.C.C. is recommended to invite tenders for the supply of tramway fittings, equipment, &c., for 1915-16, and for a ventilating fan, for the Streatham sub-station.

ST. PANCRAS.—February 15th. B.C. Arc lamp carbons, for the Electricity Department. See "Official Notices" to-day.

ST. MARYLEBONE.—February 17th. Stores, including meter-boards, casings, &c., cables, box compound and insulating materials, &c., for Electricity Department. See "Official Notices" to-day.

Manchester.—February 3rd. Education Committee. Complete electric light and bell installation at the Alice Briggs Home, Heaton Mersey. Specification, &c., 21s. (returnable), from the Education Offices, Deansgate, Manchester.

(*a*) Electrically-operated elevator; (*b*) electrically-operated screening plant in connection with Davyhulme Sewage Works extensions. Specifications (£3 3s. each) from Mr. O. J. Wilkinson, Engineer, 196, Deansgate, Manchester.

February 5th. L.P. piping and valves at Stuart Street Station. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

February 16th. Corporation. 12 months' supply of stores for the Tramway Department. See "Official Notices" to-day.

Newcastle-under-Lyme.—February 5th. Three-wire single, L.T. paper, lead-covered cable, armoured feeder and distributor mains, for the Electricity Department. See "Official Notices" January 22nd.

Portsmouth.—February 3rd. Corporation. Twelve months' supply of stoneware pipes, castings, street work, &c., for the Electricity Department. Forms of tender from the Electricity Station, Gun Wharf Road.

Redditch.—U.D.C. Two turbo-alternators, each 1,000 KW., with condensers, cooling tower, &c.; two synchronous motor-alternators of 500 KW. and 150 KW. respectively. See "Official Notices" January 8th.

Rochdale.—February 1st. The Electricity Committee invites tenders for sub-station buildings and sub-station switchboard at the new sub-station, Castleton, near Rochdale. Specifications, &c. (two guineas, returnable), from Mr. C. C. Aitchison, engineer and manager.

Rotherham.—February 22nd. Corporation. Two water-tube boilers, automatic mechanical stokers, economisers, superheaters, foundations, steel chimneys, steam valves, steam pipes, induced-draught plants, and all auxiliaries. See "Official Notices" to-day.

Spain.—February 5th. The Spanish Post and Telegraph Authorities in Madrid are inviting tenders for the concession for the working of the telephone system in the town of Valls (Province of Tarragona) during a period of twenty years.

Woodstock.—February 4th. Generating plant, switchboard, battery, wiring, lamps and fittings (120 points), for the Union Workhouse. See "Official Notices" January 15th.

CLOSED.

Coventry.—The Corporation has placed an order with Messrs. Edward Bennis & Co., Ltd., of Little Hulton, for the following:—

> Complete coal and ash handling and storage plant, consisting of wharf conveyor, cross conveyor, distributing conveyor, ash gathering conveyor, ash-discharging conveyor, and all structural supports and accessories; also the whole of the steelwork contained in the boiler house, overhead bunkers, boiler house roof, economiser floor and boiler-house floor. The order also includes eight "Bennis" patent chain grate stokers, each 7 ft. wide by 13 ft. 6 in. centres, to be fitted to eight B. & W. boilers.

Haslingden.—The Corporation has placed the contract for the electric light and power installation in the new Central Council Schools with Mr. A. M. Cramp, of Haslingden.

Heckmondwike.—The U.D.C. has accepted the tender of Messrs Goodbrand & Co., at £250 (less £20 allowed for old tubes), for a new economiser at the power station.

Helsby.—The Parochial Committee has accepted the tender of the Mersey Power Co. (£36) for provision of a signal wire from the reservoir to the pumping station.

Leicester.—The T.C. has been recommended to seal a contract with Messrs. F. Webb & Son for installing electric light, fittings and bells in the new sanatorium buildings, at £433.

London.—L.C.C.—The Education Committee reports having accepted the following tenders for electric lighting:—

> The Victoria School, Hammersmith, £270; Senior Street School, Paddington, £375; Woolmore Street School, Poplar, £210; Star Lane, Fulham, £285.—Defries & Goldman.

The Stores and Contracts Committee reports the receipt of the undermentioned tenders for the provision of an electric lift (including guides and gear) for passengers and light goods at the stores premises in Clerkenwell Close:—

Titan Lift Co., Ltd.		£450
Smith, Major & Stevens, Ltd.		450
Ditto	Alt. tender (not according to specification)	422
Easton Lift Co., Ltd.		463
Ditto	Alternative tenders, £443, £445, and up to	523
Spagnoletti, Ltd.		463
Waygood-Otis, Ltd.		475
Ditto	Alternative tender	455
Aldous & Campbell, Ltd.		495
Medway's Safety Lift Co.		502

The chief engineer's estimate was £385. The lowest tender in accordance with the specification was that of the Easton Lift Co., Ltd., of £443.

The Committee reports having accepted another tender of the same firm (£445), as that tender embodies certain different arrangements which are desirable. Permission has been given to the company to sublet—(1) to the General Electric Co., Ltd., the supply of the motor, and (2) to Messrs. Latch & Batchelor the supply of the steel ropes.

The Committee has given instructions for 10,000 tons of coal to be obtained from Messrs. Wm. Cory & Sons, Ltd., as a reserve supply for the Greenwich generating station.

The following tenders were accepted by the Stores and Contracts Committee during the three months ended December 31st, 1914:—

For electric insulating material (Schedule No. 15):

L. Andrew & Co.—Items 1, 7 and 8.
British Electrical & Manufacturing Co.—Item 5.
British Westinghouse Electric & Manufacturing Co., Ltd.—Item 11.
G. Hattersley & Sons, Ltd.—Item 12.
I.R., G.P. & Telegraph Works Co., Ltd.—Item 2.
G. MacLellan & Co.—Item 3.
A. Terry & Co.—Item 10.
J. Thompson.—Item 9.

Electric cables, wires and flexible cords (Schedule No. 16):

British Insulated & Helsby Cables, Ltd.—Items 1 and 5.
Hooper's Telegraph & I.R. Works, Ltd.—Items 2, 3, 4, (a) and (b) 6, 7 and 8.

Electric lamps (Schedule No. 17):

British Thomson-Houston Co., Ltd.—Items 1 to 7 (carbon-filament lamps).
Cryselco, Ltd.—Items 8 to 27 (metallic-filament lamps with filaments not of "drawn" wire).

The following contracts have been continued during the three months ended December 31st, from January 1st, 1915, to December 31st, 1915:—For bitumen, pitch and green oil, for the Tramways Department (Schedule No. 47):

E. Catchpole & Sons.—Item 3.
Forbes, Abbott & Lennard, Ltd.—Item 2.
Grindlay & Co., Ltd.—Items 2 and 3.
W. H. Keys, Ltd.—Item 1.

BATTERSEA.—The B.C. Electricity Committee recommends that the tender of the Edison & Swan U.E.L. Co., Ltd., be accepted for two additional panels to the switchboard at the electricity generating station, at £151.

HACKNEY.—The B.C. Electricity Committee reports that, as a result of an inquiry by the Borough Electrical Engineer of the various contractors in connection with mains materials, as to whether they would be prepared to renew the existing contracts for a further period of three years without an advance in price, the British Insulated & Helsby Cables, Ltd., is prepared to extend the current contract for cables and boxes for three years at the existing prices, in connection with the contract for cables; the prices are subject to a sliding scale covering market quotations in the cost of copper and lead. The Committee recommends that this offer should be accepted. In regard to the other contracts: Messrs. W. Lucy & Co., Ltd., for boxes; Leeds Fireclay Co., Ltd., for troughing; Messrs. J. Joberns & Co., for blue cover tiles; these firms are not prepared to renew the contracts at current prices. The Committee therefore recommends that such boxes as cannot be supplied under the contract from the British Insulated & Helsby Cables, Ltd., and troughing and blue cover tiles, as may be required, be bought from time to time without a special contract

SOUTHWARK.—The E.L. Committee proposes to purchase two 5-H.P. motors from Mr. H. J. Hawkins at a cost of £25 each.

Reading.—The Borough Education Committee has accepted the tender of Messrs. H. W. Cox & Co., of London, for an X-ray apparatus, worked from the 210-volt D.C. mains, at £136.

Teddington.—The U.D.C. has accepted the tender of Messrs. J. B. Marr & Co. for the electric light plant at the sewage works, at £545 or £556, according to the type of oil engine selected by the Engineer.

Walthamstow.—The Lighting Committee has accepted the tender of Messrs. Hobdell, Way & Co., at £25, for repairing the boiler lagging at the electricity works.

West Ham.—The Town Council has been recommended to extend the contract with Messrs. Mansfield for supplies of stoneware ducts required for one or two years, provided the Electrical Engineer can effect this at the same price.

Wrexham.—The B. of G. has accepted the tender of Messrs. E. O Walker & Co. for electric light wiring and fittings at the new Scattered Homes for Children, at £27 15s.

York.—The Tramways Committee recommends acceptance of the tender of Messrs. James Russell & Co., Ltd., for the supply of poles required in connection with the overhead work for the Hull Road extension, at the sum of £538; and that of Messrs. Tramways Supplies, Ltd., for the remainder of the material required in the work, at £556. Additional cars are required for the Hull Road route, and the tramway manager has been instructed to obtain alternative tenders for the supply of six single or six double-deck cars.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, January 29th. At 8 p.m. At 39, Victoria Street. Debate on "London's Future Electricity Supply," opened by Mr. P. C. Batstone.

(Sheffield and District Branch).—Friday, January 29th. At 8 p.m. At Cutler's Hall, Sheffield. Ordinary Meeting.

(Midland Section).—Saturday, January 30th. Social Evening.

Institution of Electrical Engineers (Birmingham Local Section).—Friday, January 29th. At 7.30 p.m. At University, Edmund Street. Lecture on "Kelvin's Work on Gyrostatics," by Prof. A. Gray, F.R.S.

(Students' Meeting).—Wednesday, February 3rd. At 7.30 p.m. At Victoria Embankment, W.C. Paper on "High Explosives," by Mr. H. Williams.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 29th. At 7.30 p.m. At Bolbec Hall, Newcastle. Ordinary Meeting.

(Graduates' Section).—Saturday, January 30th. At 7.15 p.m. At Bolbec Hall. Paper on "Some Notes on Ship Resistance," by Mr. A. P. Patterson.

Association of Mining Electrical Engineers (Lancashire, Cheshire and North Staffordshire Branch).—Saturday, January 30th. At 6.30 p.m. At Grosvenor Hotel, Deansgate, Manchester. Presidential Address by Mr. B. Shaw, and paper on "Prevention of Electrical Accidents in Mines," by Mr. T. J. Nelson.

Royal Society of Arts.—Monday, February 1st. At 8 p.m. At John Street, Adelphi, W.C. Cantor Lecture (III), on "Oils, their Production and Manufacture," by Dr. F. Mollwo Perkin.

Wednesday, February 3rd. At 8 p.m. "Imperial Industrial Development after the War," by Mr. O. C. Beale.

Society of Engineers.—Monday, February 1st. At 7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Presidential Address by Mr. Norman Scorgie.

Institute of Marine Engineers.—Tuesday, February 2nd. At 8 p.m. At Tower Hill, Minories, E.C. Paper on "Small Screw Propellers," by Mr. D. H. Jackson.

Rontgen Society.—Tuesday, February 2nd. At 8.15 p.m. At Middlesex Hospital, W. Paper on "Measurement of the Radiation from the Coolidge and other X Ray Tubes in Clinical Use," by Dr. S. Russ.

Greenock Electrical Society.—Thursday, February 4th. At 7.45 p.m. At 21, West Stewart Street. Paper on "Illumination," by Mr. F. B. Humphriss.

Royal Institution of Great Britain.—Friday, February 5th. At 9 p.m. At Albemarle Street, W. Paper on "Science and Industrial Problems," by Prof. A. W. Crossley, F.R.S.

Monday, February 1st. At 5 p.m. General meeting.

NOTES.

Cable Manufacturing at Perivale: Correction.—In one of our "War Items" of January 15th we gave a summary of some remarks made by the Surveyor to the Greenford District Council, respecting the firm of Geipel & Co., who are constructing cable manufacturing works at Perivale. We reported him as saying that "the head of the original firm was naturalised in 1848," but we are informed that what he actually did state was "that a Mr. Geipel had been naturalised in 1848, but that he did not know if he was the father of the senior member of the firm," adding that "all the members of the firm were British born, and that there was not any German capital in it." In case the report should have misled any of our readers we wish to remind them of the letter issued by the firm in September last, when so many houses were clearing away misunderstandings as to their constitution, in which it was pointed out that the principal of the firm was British born and bred, and that its capital and employés were entirely British also. Those who know Mr. W. Geipel, as we have done, personally for the past 20 years, will recognise that the 1848 naturalisation reference could not relate to him seeing that he is well on the right side of the age that such a date would give him.

Institution and Lecture Notes.—Institution of Electrical Engineers.—On December 16th, the inaugural meeting of the HONG KONG LOCAL SECTION was held in the R.A. Theatre, Victoria Barracks, Hong-Kong. The meeting was of a semi-public character, and engineers from the various works and companies in the vicinity were invited, in addition to members of the Institution. Members also had the privilege of bringing their lady friends. His Excellency the Governor and Lady May and a party of friends attended, accompanied by the General Officer Commanding the Forces, and also the Commander of the Fleet.

Col. Baker-Brown, M.I.E.E., officer in command of the Royal Engineers, read an interesting paper entitled, "Some Military Uses of Electricity." Owing to the mixed assembly, the author did not treat the subject so much as a technical matter, but more in a descriptive manner maintaining the interest of the non-technical with amusing references to the various difficulties encountered in the field, camp and barracks. It was of great interest to the technical people present to hear that the army can lay some 2½ miles of telephone line on light poles within an hour, also that the wire usually consists of strands of steel as well as copper, to enable it to withstand the rough handling during field operations. The beautifully "flat" load curve and consequently high load factor of the military generating stations was the subject of envious comment by the central station engineers present.

At the conclusion of the paper, Mr. W. L Carter, M.I.E.E., chairman of the Local Section, proposed a vote of thanks to the author, to which Col. Baker-Brown suitably responded.

The following members of the I.E.E. were present:—

Mr. W. L. Carter (chairman), chief engineer, Telephone Co., Hong-Kong.

Col. Baker-Brown (vice-chairman) Officer Commanding R.E.

Professors A. Warren (hon. sec.) and C. A. M. Smith, Hong-Kong University. Messrs. E. T. Williams, chief engineer, Naval Yard, Hong-Kong; R. F. Long, G. R. Archdeacon and C. H. N. M. Hamilton, China Light and Power Co., Kowloon; and F. J. Gellion, W. C. Jack & Co., Ltd., Hong-Kong.

The chairman was to give his address during the course of this month; Prof. C. A. M. Smith is also to give a paper, and the session will be concluded with a paper by Mr. C. H. N. M. Hamilton on "Methods of Harmonic Analysis."

At the meeting of the MANCHESTER LOCAL SECTION on Tuesday last a paper was read by Mr. T. D. Robertson on "Electric Steelmaking Furnaces," and was followed by a discussion.

Salford Technical and Engineering Association.—The Syllabus for 1915 of this Association includes the following items:—

February 13th.—"How Plants Protect Themselves," by Mr. J. E. McDonald.
March 6th.—"The Strength of Iron Castings," by Mr. E. L. Rhead.
April 3rd.—"Lifting Machines," by Mr. D. Riley.
May 5th.—Visit Gresley Iron Works.
June 12th.—Visit Stuart Street Power Station, Manchester.
July 10th.—Visit Barton Hall Engine Works, Patricroft.
August 21st.—Visit Messrs. Pilkington, Tile and Pottery Co., Clifton Junction.
September 4th.—"Ball and Roller Bearings," by Mr. A. H. Hindle.
October 2nd.—"The Wonders of Coal," by Mr. G. R. Kew.
November 6th.—Members' Short Papers.
December 4th.—Visit Salford Corporation Cleansing and Flagmaking Department.
December 27th.—Annual Social.

Wireless Society of London.—Mr. A. A. Campbell Swinton, who delivered his presidential address on Tuesday, gave an interesting series of experiments illustrating how the discovery of "wireless" was led up to.

Electric Lamps in Mines.—The value of the miner's electric lamp was exemplified in an explosion at the Minnie Pit, Halmerend, Staffordshire, recently, which resulted in the death of nine men and injury to 18 others. The survivors were in total darkness, in a foul atmosphere, until an electric lamp was found which enabled them to reach a place of safety.

A dispute has arisen in the South Wales coalfield, one of the points at issue being the introduction of safety lamps into naked light collieries without the customary extra payment; the owners contend that the improvement in oil and electric safety lamps has removed the disadvantage of illuminating power, upon which increased payment was based.

Appointments Vacant.—Shift engineer for A.C. work (30s.) for Neath U.D.C.; overhead lineman (35s.), for Kirkcaldy tramways department; temporary clerk (30s.), for Swindon electricity and tramways department; shift engineer (26s.), for Heywood Corporation electricity works; charge engineer, during the war (37s.), and switchboard attendant, permanent (27s.), for Wakefield electricity department; junior assistant electrical engineers (15s.), for Newcastle-upon-Tyne Electric Supply Co. Particulars are given in our advertisement pages.

The Electric Vehicle Committee.—A meeting was held on January 8th, when the secretary submitted a report as to the issue of the first number of *The Electric Vehicle*, which was considered satisfactory. He also submitted a return as to the sales of the Publicity Mail Cards, which showed that only a comparatively small quantity of these had been ordered so far.

The Committee decided to circularise the various undertakings to find out how many standard charging signs would be required, so that it might make arrangements for their production by one manufacturer.

An intimation was received from the Tungsten Lamp Association stating that they had appointed a Sub-Committee to go into the proposed standardisation of glow lamps with the Electric Vehicle Committee, and it was decided to invite this Sub-Committee to meet the Technical Sub-Committee of the E.V.C. at its next meeting.

The Committee had before it the sizes of wheel rims for solid tires standardised by the Engineering Standards Committee at the instance of the Society of Motor Manufacturers and Traders, and decided to recommend purchasers of electric vehicles to insist upon having these standard rims fitted. The question of charging equipments is being further gone into.

The next meeting is fixed for the 5th proximo.

Fatalities.—At Lye, on January 20th, an inquest was held on the body of Ernest A. Bristow, 15, of Pedmore Road, Lye, who was killed on the 16th inst. The lad was employed in the enamelling department of Messrs. Weson Bros., Ltd. Arnold Baker, ironplate worker, said the boy was helping him to put a new piece of piping on a stove which warmed one of the rooms. The pipe was supported by a piece of wire from a beam along which ran an electric cable, and was also attached to some pieces of sheet-iron which had been fastened up, and which were found to be alive with electricity. They had put the pipe where they wanted it, and just as they were going to loose it there was a flash and a shock, witness going one way and Bristow the other. Bristow cried "Oh!" several times, and groaned. Artificial respiration was tried without success.

Terah Shearer, foreman of the enamelling department, said that a 200-volt current was passing through the electric wire. They had had the cables tested, but could not yet find any leakage. Dr. Hardwick said there was no doubt the electric shock was the cause of death. The jury returned a verdict of "Accidental Death."

An inquest was held at Hednesford on January 21st into the death of Joshua Thomas, 55, who had been employed by the West Cannock Colliery Co., at Hednesford. On January 19th, a 6-in. nail was found driven into an electric cable on the main engine road of the pit, near where his body was found. Dr. A. Gardner said that when he was called to the colliery Thomas was dead. There were burns on his right hand and forearm, and an abrasion on the right side of his face, probably caused by falling. Witness attributed death to cardiac failure, due to electric shock. Percy Hooper, a nipper, said he saw Thomas go to the cable, but did not notice him do anything, as he had his back towards him. A moment later Thomas fell groaning. Witness then noticed a long wire nail sticking in the cable. It was driven in about ½ in. Other evidence showed that the nail had not been seen in the cable previously. It was examined on the morning of the accident because a complaint had been made of a shortage of current. Henry Holcroft, chief electrician at the colliery, said the cable was alive all day and all night. Thomas would receive a 330-volt shock. The normal full voltage of the cable was 650 volts. Witness fetched the nail out of the cable. The shape of the hole in the cable indicated that the nail had not been driven in, but worked up and down by hand and forced in. The Coroner remarked that the deeper they went into the matter the more it appeared that Thomas must have put the nail in the cable himself. Nobody but an ignoramus, or a lunatic, would have done such a thing. The verdict of the jury was that "Death was due to misadventure through coming into contact with the nail in the cable, but that there was not sufficient evidence to show how it came to be there."

Mr. J. T. Arthurs, electrician at Messrs. Starkey, Knight and Ford's Brewery, at Tiverton, was killed on Tuesday last week. His coat was caught by a revolving shaft while he was oiling it, and he was drawn up between the girders, with the result that his arms were pulled from the shoulders.

Metropolitan Association of Electric Tramway Managers.—A meeting of this Association was held on Friday, 15th inst., at the Municipal and County Club, Whitehall, S.W., when the following were present:—Messrs. Ullmann (East Ham), chairman; Schofield (Leyton), vice-chairman; Coveney (Erith), Harvey (Ilford), Moffat (West Ham), Goodyer (Croydon), hon. secretary; Mason (South Metropolitan), Mackinnon (London United), Hammond (Metropolitan Electric), and C. Mittelhausen. Messrs. Murray (Walthamstow) and Stokes (Bexley Heath) were unable to attend. Mr. A. Coveney, formerly engineer and tramway manager at Erith, was entertained to dinner, on his resignation as a member of the Association.

Electricity Committees and Coal Supplies.—A trade correspondent says large consumers of coal and particularly those in control of electricity and gasmaking plant are becoming alarmed by the shortage in the supply of coal. With a view to securing relief in this direction the Manchester and Salford Corporations are convening a conference of various municipal authorities, to pass a resolution requesting the Government to suspend the operation of the Coalmines Regulation Act, 1908, and thus enable colliers to work more than eight hours a day. The conference will be held in Manchester. Similar resolutions have been adopted in Glasgow.

Freemasonry.—The second regular meeting of the Kelvin Lodge, No. 3,736, was held on Friday, January 22nd, at Mark Mason's Hall, where, in spite of the inclement weather, a goodly number of brethren supported the Worshipful Master W. Bro. Delebecque, both in the lodge and at the festive board. The next regular meeting will be held on Friday, March 26th, at 5 p.m., at Mark Mason's Hall.

Educational Note. — NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—A Scholarship will be offered for competition among Graduates of the Institution in September next, tenable for two years, and of the annual value of £50. Particulars may be had from the Secretary.

Radium.—The director of the United States Bureau of Mines announces in his annual report that the technical experts of the Bureau have devised a process for the extraction of radium from ores which can be used on a large scale, and which is more efficient than that used by the largest foreign producers of radium. It is believed that the cost of radium to the consumer will be reduced to one-third of the present price.—*Chemical Journal.*

An American Proposal to Australia.—A proposition has been put before the Australian Premier for the establishment of a co-operative colony of American citizens in New South Wales. A society with 1,000 bondholders, with £100 as the membership fee, would take to its adopted country £100,000. As to 40 per cent. the settlement would consist of mechanics, and both primary and manufacturing industries would be engaged in. The manufacture of paper, electrical enterprises and the manufacture of machinery are mentioned.

Concert.—Messrs. Babcock & Wilcox's annual concert, which will be held at King's Hall, Holborn Restaurant, on February 12th, commencing at 7.30 p.m., will be devoted this year to the purposes of the Red Cross Society, and tickets will be on sale. The company hope that friends who have assembled in the past will strongly support the concert this year.

New Swedish Turbine.—From Gothenburg it is reported that trials have lately been carried out with a new type of steam turbine, which, it is hoped, will effect a saving of something like 30 per cent. in steam consumption, while the space occupied is considerably smaller than in the case of existing types.

Electricity from Saw-Dust.—An electrical power station is about to be erected at Gusne, in Sweden, at which saw-dust from a saw-mill in the neighbourhood will be used as fuel. The saw-dust is directly conveyed from the saw-mill to gas producers specially constructed for this kind of fuel, and transformed into electrical energy in the usual way. It is estimated that the saw-dust available is sufficient to produce 2 200 electrical H.P., though the station to be built in the first instance is only designed for 1,100 H.P. The cost of fuel will scarcely amount to more than 50 per cent. of the cost of production of electrical energy from water-power in Sweden.

An Interesting Table.—In view of recent expressions of opinion on the ethics of advertisement, we may allow ourselves to comment on a novel table which appears in our advertisement pages to-day. The views which it represents may or may not meet with general approval; but that it attracts and holds the attention of the reader, we think, will not be denied. As a basis for discussion at a meeting of practical men it would probably lead to a most interesting debate, if not to blows, and if the Society of Supervising Electricians, for instance, were to adopt it for this purpose we should look forward to the meeting with keen anticipation.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Coventry T.C. Electricity Committee has decided to grant the following increases of salary in the electricity department:—MR. E. V. NEWBOULD, chief clerk, from £4 to £4 10s. per week; MR. A. A. HARRIS, second clerk, from £2 10s. to £2 15s.; MR. A. V. LEESON, collector, from £2 10s. to £2 15s.; MR. P. SNAPE, assistant mains engineer, from £2 15s. to £3 5s.; MR. PETTIPHER, engine-room foreman, from £2 to £2 5s.

MR. J. W. BURR, late of Croydon, the new borough electrical engineer of Swansea, was welcomed to his new sphere of labour at a staff dinner held at the Royal Hotel, Swansea, on Thursday evening last week. Col. Alex. Sinclair (chairman of the Electric Lighting and Tramways Committee) presided, and was supported by Ald. Geo. Colwill (vice-chairman), Ald. David Davies, Messrs. David James (Tramways Co.), A. L. Furneaux (electrician) and others. The guests and staff numbered nearly 70. The Chairman, in introducing Mr. Burr, said he thought they should follow the patriotic motto, "Business as usual." Mr. Burr had come to Swansea with the full intention of "booming the show." Mr. Burr met with a most cordial reception. He appealed to the staff not to be "clock-watchers," but to put their whole energies into their work. He accepted the chairman's challenge, which in effect was to get on or get out. Referring to the discussion at the recent Council meeting, he said that, as a mechanical engineer, he professed to know something about suction gas, but now after hearing that £4 per week could be saved by using it instead of electricity, he came to the conclusion that he knew nothing about it.

MR. HAROLD GRAY, electrical engineer, applied to the Accrington Electricity Committee, on January 21st, for permission to take a commission in the new Artillery Brigade. The requisite permission was given. Mr. Gray was senior lieutenant in the Territorial Artillery. It was understood arrangements would be made for carrying on the work at the electricity station under Mr. Gray's assistant, the Corporation to have the benefit of Mr. Gray's services in a consultative capacity during the time the proposed Artillery Brigade is in Accrington.

Owing to the state of his health, MR. C. ATCHISON, borough electrical engineer of Rochdale, has received permission of the Electricity Committee to be away from duty for some weeks from the beginning of February.

The Aldershot U.D.C. has increased the salary of MR. EBERT, first assistant at the electricity works to £143 per annum, rising by £6 10s. a year to a maximum of £156.

General.—The undernoted changes have taken place this week in the staffs of the following companies: Metropolitan District Railway Co., London Electric Railway Co., City and South London Railway Co., Central London Railway Co.:—MR W. E. MANDELICK, in addition to his office as secretary to the above companies, is appointed business manager. MR. Z. E. KNAPP is appointed manager for maintenance and construction to the above companies. MR. H. E. BLAIN is appointed operating manager to the above companies. MR. W. E. BLAKE, in addition to his position as superintendent of the line to the District Railway, is appointed superintendent of the line to the London Electric, City and South London, and Central London Railways, in place of Mr. J. P. Thomas, who has resigned his position with these companies, to become general superintendent of the London General Omnibus Co., Ltd. In this capacity MR. THOMAS will have charge of all the work of operation, under the general control of the operating manager, Mr. Blain.

At St. Ann's Church, Stanley, on January 21st, the marriage took place of MR. HARRY COOPER, A.I.E.E., of Stoneycroft, and Miss Annie Roose Watkins, youngest daughter of the late Mr. Richard Watkins, Liverpool and St. Helens.

MR. JOHN GILBERT, of Farcet, Peterborough, has secured an appointment as electrical engineer to the Co operative Goldfields, Ltd., West Africa, and sails at the end of this month.

MR. ARTHUR J. FOORD has been appointed first assistant electrical engineer-in-charge at the new Naval Dockyard at Rosyth. He has, for 26 years, been in the electrical engineers' department at Chatham Dockyard.

MR. C. F. D. SUGGATE, A.M.I.E.E., A.M.I.Mech.E., who for the past four years has been engaged as an assistant engineer in the electrical engineer's department of the Great Eastern Railway, has resigned his appointment in order to take up a commission in His Majesty's Army as a temporary lieutenant (Inspector of Ordnance Machinery) in the Army Ordnance Department. His address is now c/o Ordnance College, Red Barracks Woolwich.

The marriage has taken place at Holy Trinity Church, Weymouth, of MR CHRISTOPHER HODGSON, chief electrician of H.M.S. *Commonwealth*, and Miss Ethelind Burt, only daughter of the late Mr. James Burt.

MR. WALTER BIRCHALL, transformer expert in the service of the Riegos y Fuerza del Ebro Co., Barcelona, was married a few days ago at the British Consulate, Barcelona, to Miss A. A. Winstanley, of Leigh.

Obituary.—MR. W. MORTON, formerly Superintendent of Post Office Telegraphs at Southport, died at Southport last Friday, at the age of 76 years. He retired from the telegraph service about 15 years ago.

NEW COMPANIES REGISTERED.

Caerphilly Electric Supply Co., Ltd. (139,086).—This company was registered on January 22nd with a capital of £6,000 in 400 cumulative preference shares of £5 each, 1,500 preferred ordinary shares of £1 each and 2,500 ordinary shares of £1 each, to carry on the business indicated by the title. The subscribers (with 50 shares each) are:—J. H. Edwards, Haresfield, Stonehouse, Gloucester, engineer; A. A. Douglas, Brendon, Colwyn Bay, manufacturer. Private company. The number of directors is not to be more than six: J. Herbert Edwards is first managing director; qualification, 50 shares. Solicitors: Seymour Williams & Co., 38, Parliament Street, S.W.

Cinema Supplies, Ltd. (9,306).—This company was registered in Edinburgh on January 20th, with a capital of £1,000 in £1 shares, to manufacture and trade in cinematograph films, carbons, electrical plant, &c. The subscribers (with one share each) are:—R. Ralston, 113, St. Vincent Street, Glasgow, cashier; N. A. Henderson, 113, St. Vincent Street, Glasgow, law clerk. Private company. The first directors are not named; remuneration, £50 each per annum (chairman, £75).

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Telephone Company of Egypt, Ltd.—A memorandum of satisfaction to the extent of £1,200 on December 8th, 1914, of debenture stock covered by trust deed and deeds of acknowledgment, dated from July 27th, 1904, to October 27th, 1909, securing £200,000, has been filed.

Coatbridge and Airdrie Electric Supply Co., Ltd.—Further charge on the company's undertaking and property, present and future, including uncalled capital and Coatbridge and Airdrie undertakings, dated December 31st, 1914 (supplemental to charge dated October 17th, 1906), to secure £4,500. Holders: County of London Electric Supply Co., Ltd., Moorgate Court, Moorgate Place, E.C.

Spensers, Ltd.—Debenture dated January 5th, 1915, to secure £750 (ranking *pari passu* with £7,000 1st mortgage debentures) charged on the company's undertaking and property, present and future, including uncalled capital. Holders: S. F. Ellis, Unwin Street, Stratford-on-Avon, and S. Titterton, 73, Edmund Street, Birmingham.

Amazon Telegraph Co., Ltd.—Capital, £250,000 in £10 shares. Return dated December 1st, 1914; all shares taken up; £250,000 paid. Mortgages and charges: £477,800.

Spagnoletti, Ltd.—A memorandum of satisfaction in full on December 31st, 1914 (*a*) of trust deed dated October 22nd, 1907, securing £12,500; and (*b*) of second debenture dated April 25th, 1912, securing £3,000, has been filed.

Wadebridge and District Electric Supply Co., Ltd.—Debenture dated January 13th, 1915 to secure £350, charged on company's undertaking and property, present and future. Holder: C. E. Hannaford, York House, Perham Road, West Kensington.

Oriental Telephone and Electric Co., Ltd.—A memorandum of satisfaction to the extent of £300, on December 17th, 1914, of debenture stock, covered by trust deed dated June 28th, 1905, and deed of acknowledgment dated June 12th, 1907, securing £250,000, has been filed.

CITY NOTES.

Company Registrations in 1914.—In an article on this subject appearing in the *Investors' Guardian*, of January 23rd, the writer says:—"The motor and engineering groups shows large decreases, although the war has caused very great activity in certain departments of these trades. The textile group also returns a much smaller capital. The figures for the year show a heavy decline in land and development concerns, which may be traced directly to the slump in Canadian and American development enterprises. Electric companies have mustered only £1,100,000 of capital in the whole year; a remarkably small amount even for an industry which has long been in a depressed condition.

English Registrations.	1912.	1913.	1914.
No. of companies... ...	6,796	6,871	5,701
Coal and fuel	£4,973,845	£6,644,383	£3,482,550
Electric	7,579,780	6,102,[illegible]89	1,130,350
Engineering and hardware	8,885,757	10,774,891	6,792,017
Gas	407,900	281,750	193,275
Motor, cycle and carriage ...	7,253,879	8,934,265	4,453,361
Oil	23,533,182	12,978,959	17,641,090
Plantation and rubber ...	3,209,965	4,338,500	3,004,427
Railways and tramways ...	3,164,200	2,754,007	1,761,000

Norway.—CALCIUM CARBIDE MANUFACTORIES AT ODDA.—According to the annual report of the Alby United Carbide Factories, Ltd., the results from last year's working were not quite so satisfactory as those for the preceding year. This was partly due to the great strike that took place, owing to which the production was reduced by 4,500 tons. During this strike period the company was obliged to pay for the electrical energy not employed, which, of course, involved a great expense.

The North-Western Cyanamide Co., of which the Alby Co. holds half the shares, has now for the first time paid a dividend, which was fixed at 15 per cent. The manufactories of this company are also situated at Odda, and are getting their energy from the Tyssefaldene. As regards the prospects for the year ending on June 30th, 1915, it was stated in the report that the work was shut down altogether when the war broke out, but taken up again soon afterwards to such an extent that about 40 per cent. of the energy at disposal was employed. The output has gradually been extended, and the works will shortly be fully occupied. During the last four months there has been shipped nearly twice as much carbide as in the corresponding period in 1913.

The assets of the Alby Co. amount to about £864,800, of which about £331,700 are represented by shares in the Nitrogen Products and Carbide Co.; the latter concern is financing the large Aura Co., whose plants are now under construction.

East London Railway Co.—The report for the year ended December 31st, 1914, gives the number of passengers carried as follows:—1914, 6,172,121; 1913, 5,149,064. The net income amounted to £35,667, plus £9,711 brought forward.

Stock Exchange Notice.—The Committee has appointed a special settling day as under:—

Thursday, February 11th.—B[illegible] Railways [illegible] Ltd. Further [illegible] paid, [illegible] to 120,000.

and has ordered the securities to be officially quoted.

Blackpool and Fleetwood Tramroad Co.—A dividend of 4½ per cent., making 6½ per cent. for the year, is announced.

Held Over.—Pressure upon our space compels us to hold over several City reports until next week.

Traction and Power Securities Co., Ltd.—The directors recommend a dividend of 4s. 6d. per share, free of income-tax, for the year 1914.

St. James's and Pall Mall Electric Light Co., Ltd.—The directors announce a dividend for the half-year ended December, 1914, of 5s. per share on the ordinary shares, making, with the interim dividend, 10 per cent. for the year. The rate for 1913 was 12 cent., and for 1912—10 per cent.

Liverpool Overhead Railway Co.—The directors recommend a final dividend (for the half-year ended December 31st last) at the rate of 5 per cent. per annum (less income-tax) on the preference shares, and 3½ per cent. per annum (less income-tax) on the ordinary shares, making, for the year, 5 per cent. on the preference and 3 per cent. on the ordinary shares.

Westminster Electric Supply Corporation, Ltd.—For the last half of 1914 a dividend at the rate of 8 per cent. per annum is announced, making 9 per cent. for the year. For 1913 and 1912 the dividend was 10 per cent.

STOCKS AND SHARES.

Tuesday Evening.

The naval victory of last Sunday had a cheering effect upon Stock Exchange markets. Prices did not advance to any appreciable extent, but some of the softening which had previously appeared in certain sections turned into strength, and business on the whole was certainly quickened by the very satisfactory news.

Bit by bit the Treasury restrictions are being relaxed, and brokers find it easier to deal with perfectly *bona-fide* investment orders, to the execution of which no barrier should be placed. The Treasury policy is to prevent money from leaving the country, and, to this end, no modification has yet been granted in the direction of allowing the Stock Exchange to sell securities for anybody—ally, neutral or enemy—outside the confines of the United Kingdom.

The individual cases of hardship which this inflicts upon many French, Belgian and Dutch holders of securities, who have no possible connection with Germany, may well be imagined; and some people object to the Treasury acting not only in an arbitrary manner—this, of course, being reasonable enough in war time—but in a way which may possibly defeat its own ends, while imposing real suffering upon staunch friends. The Belgian refugee with £500 worth of securities which he has managed to take with him in his flight to Holland or to England, may well feel that he is being treated with undue severity in not being allowed by the Treasury to realise money by the sale of his stock in open market.

The broadening of business is noticeable chiefly in the purely investment securities, while in the more speculative issues trade is still largely to seek. It is surprising that there should be so little going on in electric lighting shares, where movements on the week are mostly downwards. This is due more to sentimental reasons than to actual pressure to sell as we have pointed out here on many occasions. The prices which have suffered this week are County of London Ordinary and Preference, City Ordinary and Preference, St. James's and Westminsters. Moreover, the market for the Debenture stocks is not so firm as it was. The principal reaction is in St. James's 3½ per cent. Debenture, the price of which reverted to 80. Metropolitan 3½ per cent. Debenture also came in, and was lowered to the same level as St. James's. The yield at this price is £4 7s. 6d. per cent. on the money.

Subjoined are our usual tables of Stocks and Shares:—

Home Electricity Companies.

	Mean price. July 27.	Jan. 26, 1915.	Rise or fall this week.
Brompton Ordinary	9½	8⅞	—
do. 7 per cent. Pref.	8⅝	8⅝	—
Charing Cross Ordinary	6½	4⅞	—
do. do. do. 4½ Pref.	4¾	4¼	—
do. do. City Pref.	4⅝	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅝	4¾	—
do. 4½ Deb.	96½	92	—
City of London	16	14½	— ⅛
do. do. 6 per cent. Pref.	13½	12¾	— ¼
do. do. 5 Deb.	116½	114	—
do. do 4½ Deb.	100½	98	—
County of London	12	11¼	— ¼
do. do. 6 per cent. Pref.	12	11¼	— ½
do. do. 1st Deb.	102½	99	—
do. do. 2nd Deb.	10 ½	97	—
Kensington Ordinary	7½	7½	— ⅛
London Electric	1⁷⁄₁₆	1¼	—
do. do. 6 per cent. Pref.	5¹⁄₁₆	5	—
do. do. 4 Deb.	92½	89¼	—
Metropolitan	3½	3⅛	—
do. 4½ per cent. Pref.	4¹⁄₁₆	4	—
do. 4½ Deb.	97½	91½	—
do. 3½ Deb.	83	80	—1½
St. James' and Pall Mall	9⅝	9	—
do. do. do. 7 per cent. Pref.	7	6½	— ¼
do. do. do. 3½ Deb.	84½	80	—3¼
South London	3⅛	3	—
South Metropolitan Pref.	1¾	1½	—
Westminster Ordinary	8¾	8¾	— ½
do. 4½ Pref.	5⅛	4⅞	—

Home Rails.

	Mean price. July 27.	Jan. 26, 1915.	Rise or fall this week.
Central London, Ord. Assented	83	79	—
Metropolitan	37½	32	— ½
do. District	21¾	18¼	— ¾
Underground Electric Ordinary	2⅛	1⅞	+ ¹⁄₁₆
do. "A"	7/6	6/-	—
do. Income	88	83	+1½

Telegraphs and Telephones.

	Mean price. July 27.	Jan. 26, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108¼	105	+1
do. Def.	23	22⅝	— ⅛
Chile Telephone	7⅝	7⅛	—
Constantinople Tel.	4¼	3½	—
Cuba Sub. Ord.	8½	8½	—
do. Pf.	16½	15½	—
Eastern Extension	12¾	12½	+ ⅛
do. 4 Deb.	97½	94	—
Eastern Tel. Ord.	130½	127	—1
do. 3½ Pf.	77½	71	—
do. 4 Deb.	96¼	95	—
Globe Tel. and T. Ord.	11¼	10	—
do. Pf.	12⅞	11¾	—
Gt. Northern Tel.	32½	28	—
Indo-European	59	55	—2
Marconi	1¹³⁄₁₆	1⅜	—
New York Tel. 4½	101	97	—
Oriental Telephone Ord.	2⁵⁄₃₂	2	—
do. Pf.	1¹⁄₃₂	1¹⁄₁₆	—
Tel. Egypt Deb.	98	97½	—
United R. Plate Tel.	6⅝	6	—
do. Pf.	5¼	5	—
West India and Pan.	1¼	1⅛	—
Western Telegraph	13⅝	13	—
do. 4 Deb.	96½	95½	—

Foreign Trams, &c.

	Mean price. July 27.	Jan. 26, 1915.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅞	4¾	— ⅛
do. 2nd Pf.	4¼	4	— ¹⁄₁₆
do. 4 Deb.	91	85	—1
do. 4½ Deb.	98½	94	—
do. 5 Deb.	96	88	—1
Brazil Tractions	66	58½	+1
Bombay Electric Pf.	11⅝	10½	—
do. 4½ Deb.	96	93	—2
Mexico Trams	70	40	—
do. 5 per cent. Bonds	84	60	—10
do. 6 per cent. Bonds	76	55	—10
Adelaide Sup. 6 per cent. Pf.	5¼	5⅛	—
do. 5 Deb.	104	101	—

Manufacturing Companies.

	Mean price. July 27.	Jan. 26, 1915.	Rise or fall this week.
British Westinghouse Pref.	1¾	1⅞	— ¹⁄₁₆
do. 4 Deb.	74½	70	—2
do. 6 p. lien	102½	98½	—
Callenders	11⅞	11½	—
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2½	3⅛	+ ¹⁄₁₆
Edison & Swan, £3 pd.	³⁄₃₂	12/-	—6d.
do. do. fully paid	1¼	2½	—
do. do. 4 Deb.	59	60	—
do. do. 2 Deb.	63½	60	—
Electric Construction	¹⁷⁄₃₂	11/6	+6d.
do. do. Pf.	¹⁄₁₆	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	18½	—
do. 4½ Pref.	5	5	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	8½	—
Telegraph Con.	38½	36	—

The Home Railway market is passive, awaiting dividend announcements. The first of these come this week, and the market anticipation seems to be that distributions will be at levels a shade lower than those of a year ago. There is, however, such wide scope for surprise that no one feels anxious to speculate on dividend chances, so the attitude adopted is a waiting one. In years gone by there used to be lively speculation in dividends; and to such an extent did the gambling run that the Committee of the Stock Exchange passed a rule, which still holds, forbidding transactions in dividends. Prices of the Underground group are a little easier on the week, with the exception of the Underground Electric Railways issues, which are rather firmer.

Of Foreign issues, Brazilian Tractions have recovered, in consequence of the declaration of the usual quarterly dividends on the common stock, noted here last week. The Rio exchange moves erratically, and, swinging with it, the prices of all Brazilian securities rise and fall. The Mexican group is very weak. Mexican Tramway bonds have fallen heavily. It looked a few days ago as though the United States were about to intervene, and put a stop to the intolerable state of affairs prevailing in Mexico; but this has not fructified, and affairs in the Southern Republic are as chaotic as ever.

Anglo-Argentine Trams have gone back, in sympathy with most of the other securities connected with the country, which has suffered so severely from floods that every industry—especially that of the railways—must be affected. The embargo laid by our own Treasury upon fresh issues of capital is another factor which may operate to the detriment of such a company as the Anglo-Argentine Tramways, the very hugeness of which implies the necessity for periodical capital outlays.

In the Manufacturing group, interest centres mostly upon Armament shares. Vickers, Armstrongs, B.S.A., and Projectiles make a quartet in the shares of which great activity prevails in the Stock Exchanges of London and the Northern provinces. The prudent holder, noting the sharp advances of the past fortnight, and realising that no small amount of the huge profits being earned by the companies must be applied to erection of new plant and machinery before anything sensational can be expected in the way of dividends, will probably recognise the wisdom of selling part of his shares now, especially if he can take a reasonably good profit. The companies dealing with chemicals, too, are prospering greatly. Castner-Kellners have risen to 3⅛.

The Electrical Manufacturing shares have gone back here and there, though the declines are small; Electric Constructions furnish an exception, with a sixpenny rise to their credit. The Rubber share market is firm, and the strength of the raw material affords justification for the investment purchases that are going on in the Throgmorton Street and Mincing Lane exchanges. The provinces, too, are taking something of a hand in this market; and any sales which might otherwise emanate from Belgium, and so check improving prices, are avoided by the Treasury restrictions, to which reference has been already made.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING DECEMBER, 1914.

WITH the present return, we bring to a close our monthly record of electrical exports and imports for 1914.

Following the prevailing tendency to which we refer elsewhere, the value of the electrical exports shows a further falling-off as compared with the previous month, the total being for December £290,069, as against £349,254 for November. This drop in value occurred in all the principal lines, such as machinery, cables, telegraphic and telephonic material, lamps, &c.; but the returns show an increase under the miscellaneous headings of goods fittings, &c., and for battery exports as compared with the previous month.

The imports of electrical goods, on the other hand, have shown a rapid recovery to normal values, reaching a total of £261,303, as compared with £201,569 in November, and monthly averages in 1914 of £230,600, and in 1913 of £245,500.

The increased imports are fairly well distributed, but particularly marked in the machinery, cable, telegraphic and telephonic sections. As regards the latter, it may be noted that Canada appears as an importer of some £19,000 worth of telegraphic and telephonic apparatus.

The re-exports, at £25,510, compared with £29,447 in November. Our most prominent customer during the month was Argentina, with whom electrical trade has apparently not suffered to the same extent as in other markets. Turning to the importers into this country, the U.S.A. has increased its last month's big total of business, reaching in December a value within a few thousands of the highest ever reached by Germany; Italy also expanded her usual trade value in December, while Dutch lamp imports have more than trebled her usual business during the past few months.

On the following pages we reproduce a series of curves for the whole year, based on these monthly statistics.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,283	3,535	735	181	58	1,386	4,090	30	247	17	596	88	12,276
Germany	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies ...	177	2,682	140	12	37	88	429	791	114	26	269	113	4,878
Belgium	...	178	...	...	7	...	...	...	...	8	...	3	196
France	399	...	133	37	...	...	2,218	14	860	60	628	7,398	11,747
Portugal	100	91	2	55	8	467	777	...	7	13	132	61	1,713
Spain, Canary Isles and Spanish N Africa...	38	156	63	33	24	69	4,414	9	35	371	213	125	5,550
Switzerland, Italy and Austria-Hungary ...	10	7	152	...	...	489	1,151	...	186	123	...	9	2,127
Greece, Roumania, Turkey and Bulgaria ...	6	7	50	14	...	...	117	...	5	...	1,311	971	2,481
Channel Isles, Gibraltar, Malta and Cyprus...	214	...	5	37	...	...	157	...	39	...	1	116	559
U.S.A., Philippines and Cuba	198	302	64	348	25	37	817	6	40	68	...	...	1,905
Canada and Newfoundland	207	1,533	237	1,024	...	943	4,571	150	822	2	340	650	10,479
British West Indies and British Guiana ...	181	7	31	125	15	...	208	...	49	14	43	28	701
Mexico and Central America	20	...	...	44	18	...	447	246	9	7	253	15	1,059
Peru and Uruguay	344	1,511	66	30	6	16	1,653	...	3	221	278	19	4,147
Chile	...	40	145	229	7	11	96	9	5	8	...	74	624
Brazil	111	1,099	137	115	63	...	3,732	757	130	3	7	44	6,198
Argentina	10,702	2,552	15,384	925	189	...	16,365	3,175	292	...	13	4,357	54,076
Colombia, Venezuela, Ecuador and Bolivia...	70	350	...	134	...	57	514	...	8	2	792	45	1,972
Egypt, Tunis and Morocco	181	73	186	30	7	...	2,429	13	14	10	402	16,288	19,633
British West Africa	57	99	61	35	14	32	261	68	33	...	55	212	927
Rhodesia, O.R.C. and Transvaal	1,161	1,543	465	802	...	140	4,355	35	39	...	4	...	8,583
Cape of Good Hope	697	3,141	348	202	2	194	1,609	16	344	6	51	534	7,144
Natal	422	2,330	279	130	2	56	114	...	50	...	67	131	3,581
Zanzibar, Brit. E. Africa, Mauritius & Aden	189	53	9	13	2	...	115	16	8	...	10	87	502
Azores, Madeira and Portuguese Africa ...	34	271	74	9	8	48	373	...	8	22	...	83	930
French African Colonies and Madagascar...	35	22	148	5	...	...	22	...	...	...	8	11	241
China and Siam	376	429	285	17	...	567	1,902	471	61	138	1,042	95	5,583
Japan and Korea	92	8	31	48	...	616	3,273	...	183	63	40	501	4,855
India	1,565	7,542	1,591	960	43	571	14,072	3,981	4,165	42	1,333	110	35,975
Ceylon	186	383	437	...	...	108	102	30	423	177	...	1,736	3,582
Straits Settlements, Fed. Malay States and Sarawak	1,143	266	123	22	18	86	5,401	217	69	104	184	361	8,027
Hong Kong	7	139	373	27	51	74	486	...	8	11	120	...	1,296
West Australia	68	376	9	239	16	45	1,747	40	8	...	...	...	2,548
South Australia	183	246	345	108	51	300	238	835	129	...	150	...	2,585
Victoria	1,911	6,792	984	460	6	535	2,378	261	163	81	3,139	2,696	19,607
New South Wales	962	2,623	848	659	57	27	7,104	1,122	9,446	7	1,349	1,081	25,285
Queensland	222	1,597	218	54	...	475	492	...	151	...	191	...	3,400
Tasmania	28	98	...	...	...	...	519	...	9	...	...	...	654
New Zealand and Fiji Islands	1,033	3,579	1,305	875	...	658	3,188	529	270	...	860	302	12,539
Total, £	24,612	45,661	25,463	8,038	734	8,095	91,919	12,851	18,465	1,634	14,342	48,254	290,069

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic and telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	71	...	...	10	637	22	1,722	163	2,332	...	4,575	9,532
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	26	1,744	...	5,036	1,535	...	187	...	349	...	87	8,964
Belgium	...	...	...	...	...	...	10	...	...	...	...	10
France	68	282	615	...	286	48	...	...	1,681	3,104	890	6,974
Switzerland	173	6,424	...	477	178	1,918	2,188	...	30	1,318	10	13,016
Italy	2,231	6,292	9	...	37	139	26,779	711	590	20	...	36,808
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...	...
United States	9,265	1,187	1,015	931	3,253	440	99,065	34,716	3,678	4,282	6,035	163,867
Total, £	12,134	15,929	1,639	6,454	5,926	2,567	79,951	35,590	8,660	8,724	11,597	239,171

Additional imports: Portugal: Instruments, £10. Spain: Lamp parts, £71; carbons, £2 193. Canada: electrical goods, £831; meters, £28; telephone and telegraph apparatus, £18,999.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic and telegraphic cable and apparatus.	Total.
Various countries, mainly as above... ...	11,503	...	...	101	18	...	6,904	...	49	525	7,407	25,510

TOTAL EXPORTS: £290,069   TOTAL RE-EXPORTS: £25,510   TOTAL IMPORTS: £261,303

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

ELECTRICAL EXPORTS AND IMPORTS DURING 1914 AND PREVIOUS YEARS.

The year 1914 will be indelibly impressed on the memories of most of us because of its unfortunate association with the present European war, which great as it is in extent, in the numbers engaged and interests involved, shows an unmistakable tendency to spread still further. The withdrawal of the wealthiest industrial nations of Europe from their normal occupations, and the interference with, and diversion of, the business of so many adjoining, though neutral countries, has naturally played havoc with the European electrical industry as a whole, though we are glad to think that the British share in particular has not suffered so severely as might have been expected.

It is necessary to emphasise the fact that this is an "engineering" war, and the demands on us for engineering material for the allied armies on a war footing are such that the manufacture of war material has replaced—no doubt profitably—the normal employment of a large percentage of engineering and even electrical firms, and in the case of the latter a considerable proportion of this normal business—particularly for the home market—has passed to such overseas sources of supply in neutral countries as are available, with the result that the imports of electrical material have shown a rapid recovery to last year's level since August, while British electrical exports, though substantial in amount, show a falling off, which will probably become more marked while our firms are situated as at present.

These features are reflected in the curves which—as usual in January—we reproduce as a convenient summary of the past year's business. Thus in our first set of curves, fig. 1, the total electrical exports from this country (heavy curve) show a decided falling off during the early part of the year prior to the war—the tendency in this direction being mentioned in our last annual résumé. Then came the slump—common to all the curves—which occurred soon after the outbreak of war, and was followed by a partial recovery in business.

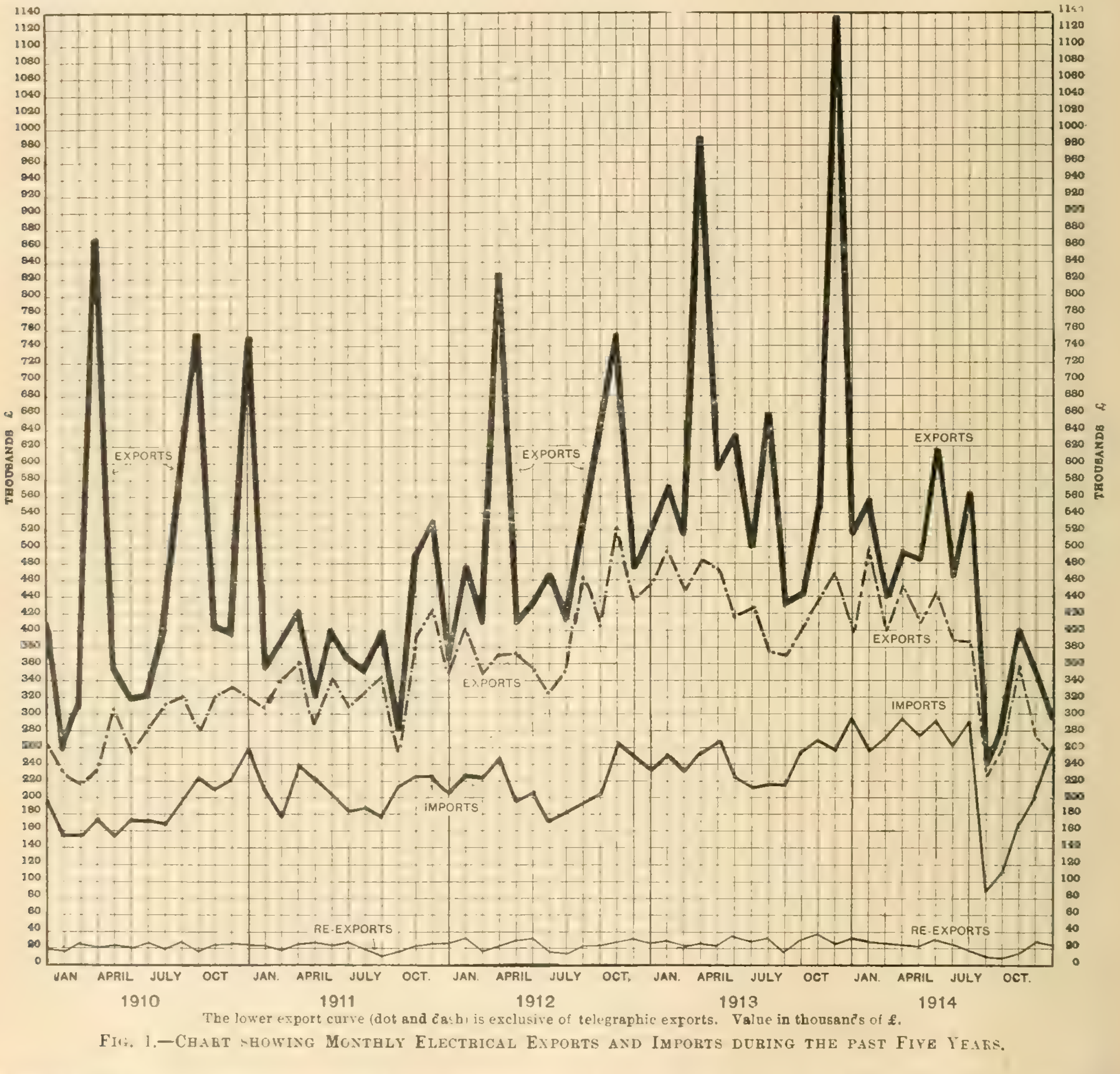
No large telegraphic export occurred during the year, but the general export business (dot and dash curve) remained fairly steady at a reduced level during the first six months of the year. In contrast to this the imports remained steadily at a higher level than they have ever previously reached during the first half of 1914, which reference to our last set of curves, fig. 7, will show to be due to the combined efforts of American and German importers, but more especially the latter.

The re-exports, comparatively small in amount, have returned to something like pre-war level.

The gross values of our electrical exports and of the telegraphic material included therein, for the five years included in the curves, were as follows:—

1910	Gross	£5,700,000	......	Telegraphic	£2,267,500
1911	,,	£4,600,000	......	,,	£560,000
1912	,,	£6,300,000	......	,,	£1,500,000
1913	,,	£7,568,000	......	,,	£2,388,000
1914	,,	£5,189,000	......	,,	£835,800

The monthly average of general business, shown by the dot and dash curve, was, for 1910, £286,000; 1911, £338,000; 1912, £400,000; 1913, £432,000; and 1914, £362,000, but during the first half of the latter year the monthly average was the same as in 1913.



The lower export curve (dot and dash) is exclusive of telegraphic exports. Value in thousands of £.

Fig. 1.—Chart showing Monthly Electrical Exports and Imports during the past Five Years.

As regards the imports of electrical material into this country during 1914, the total value shown by our statistics was £2,767,000, representing a monthly average of roughly £230,000, these figures comparing with £2,946,500 and £245,500 in the previous year (1913). Although the past year, as a whole, naturally shows a falling off in values, it should be noted that the first half of the year showed record imports, viz., a monthly average of £275,000.

The re-exports for 1914 were valued at £265,200, or a monthly average of £22,000, as compared with £341,000 and £28,000 respectively in 1913.

Our second set of curves, fig. 2, shows the trend of machinery and cable exports during the past five years, and it will be seen that during the early part of 1914 machinery export values

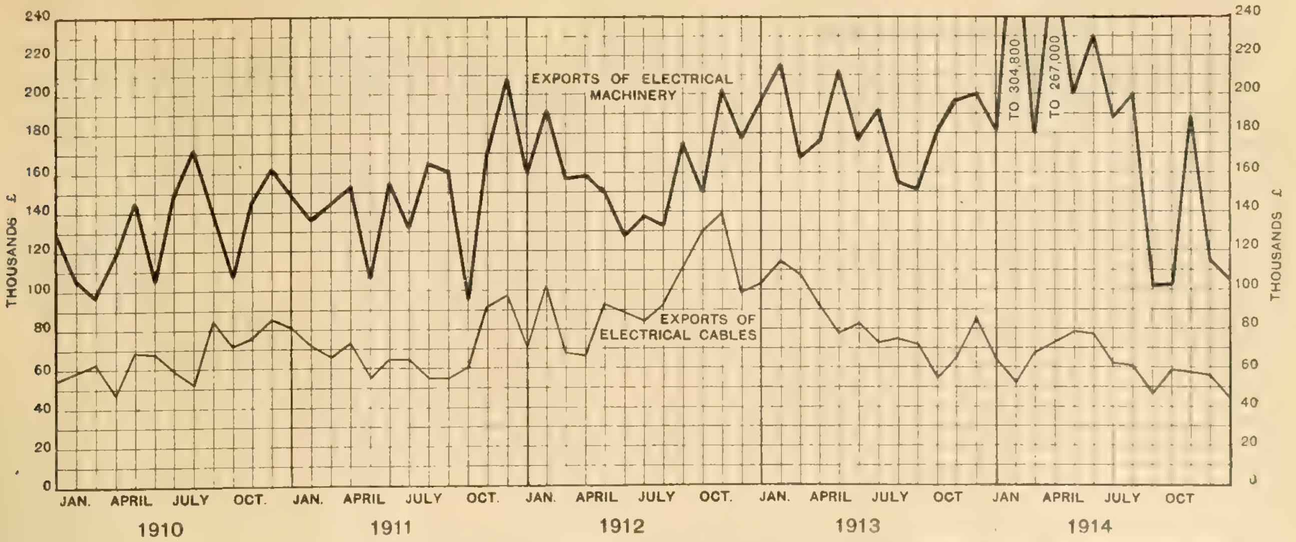


Fig. 2.—Monthly Exports of Electrical Machinery and Electrical Cable—other than Telegraphic and Telephonic Cable—during the past Five Years.

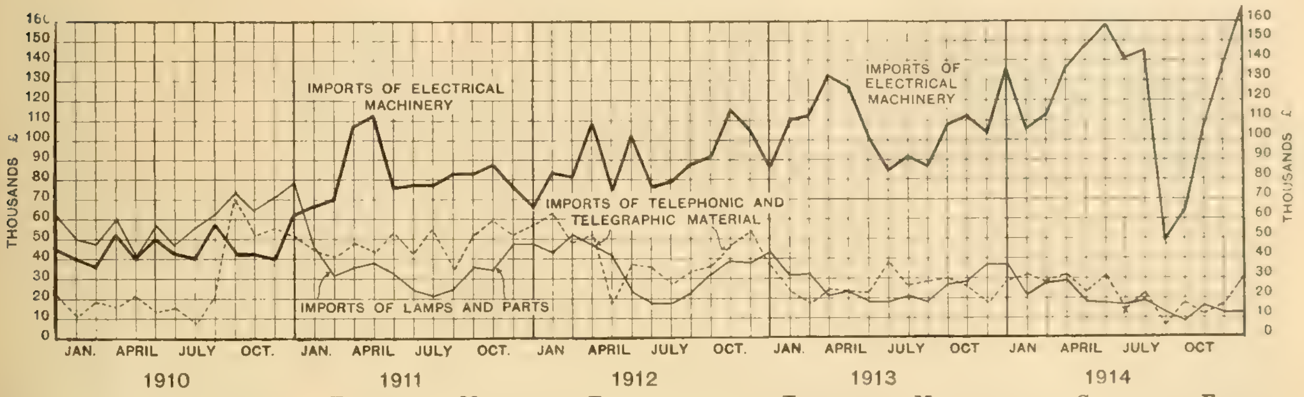


Fig. 3.—Monthly Imports of Electrical Machinery, Telegraphic and Telephonic Material and Cable, and Electric Lamps and Parts during the past Five Years.

attained record proportions, averaging, in fact, during the period January—June, some £224,000 per month, and over the whole year £179,500 per month, the comparative figure for 1913 being £184,000. The total value of the machinery exports for 1914 was £2,154,000, as compared with £2,209,200 for the previous year.

Cable exports, shown in the lower curve, have declined during the past two years and—it may be some consolation—appear to have suffered to a trifling extent in the early days of the war. The cable exports for the year—not including telegraphic or telephonic cables which are included elsewhere—reached a total value of roughly £741,000, as compared with £968,000 in the previous year.

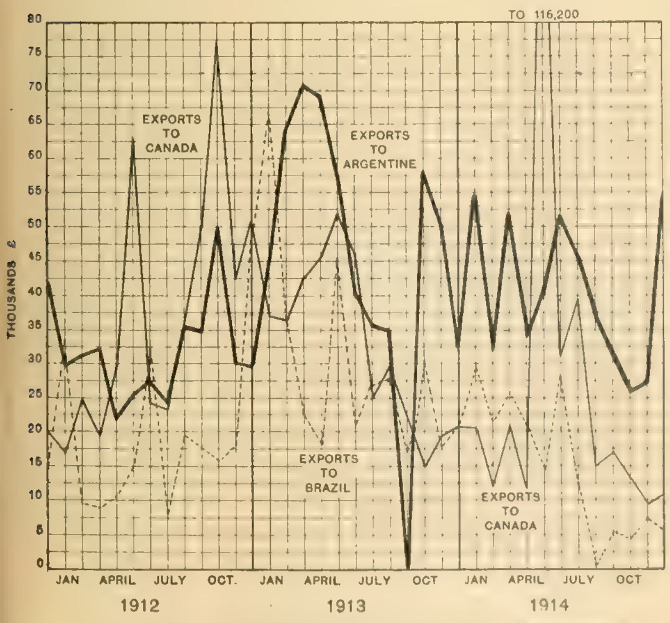
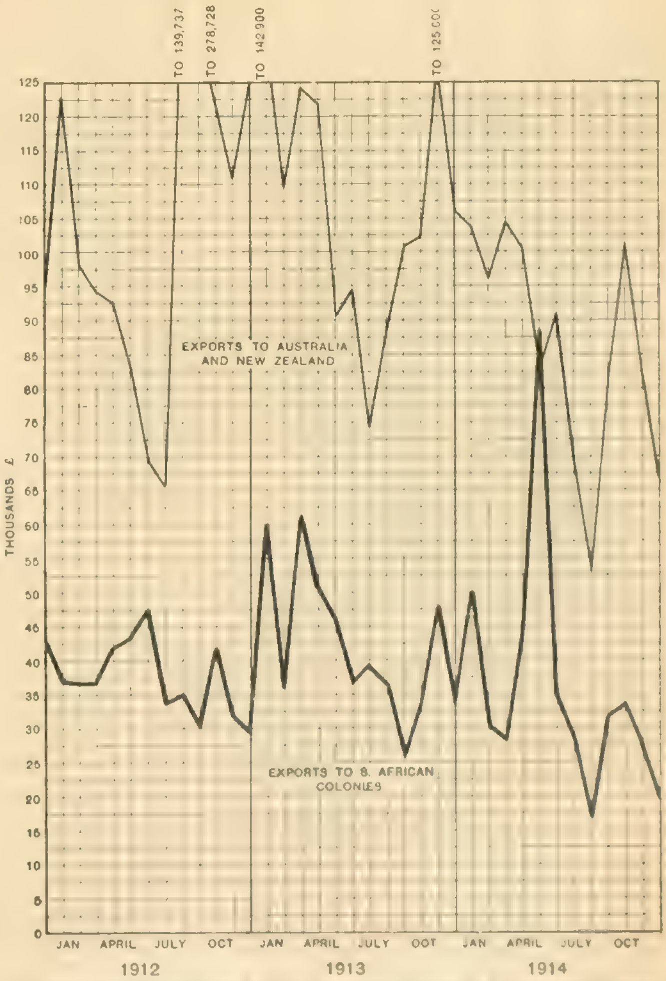


Fig. 4.—Electrical Exports to Canada, Argentina and Brazil, 1912-14.

Curiously enough machinery imports, shown in fig. 3, also attained record values during the first half of 1914, and their rapid recovery in value since the war leaves them in December at the highest level yet reached.



Upper curve includes New Zealand, Australian States, and Tasmania. Lower curve includes Cape, Natal, Transvaal and Orange River Provinces and Rhodesia.

Fig 5.—Electrical Exports to Australasia and South Africa, 1912-14

Other curves in fig. 3 indicate a continuous falling off in [illegible] of lamps and parts, which although no doubt [illegible] this year to the shutting off of German supplies, has been in evidence since 1910, and a similar falling off in telegraphic and telephonic imports.

Electrical machinery imports totalled £1,476,000, imports of telegraphic and telephonic material £267,500, and of lamps and parts, £215,000, during the twelve months. These figures compare with £1,300,000, £314,000 and £313,000 for the same items respectively in 1913.

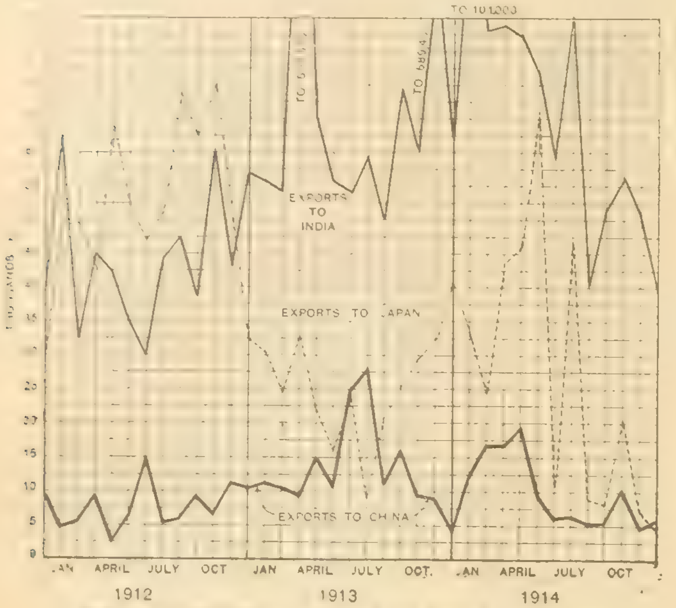


Fig. 6.—Electrical Exports to Japan, India and China, 1912-14.

Purchasing Countries and Importers into the United Kingdom.

The remaining curves, those in figs. 4, 5 and 6 show three years' business with some of our principal customers, with all of whom trade sustained a severe shock on the outbreak of war. Fig. 4 shows that Argentina was our best customer on the American continent, business in that direction being fairly well maintained despite the war. Brazilian trade, which has been declining for the past two years, has dropped off to insignificant proportions since the war, while Canadian trade, with the exception of one or two spasmodic jumps, has been at a lower level than in the previous year.

The curves given in fig. 5 of electrical exports to Australia and New Zealand, and our South African colonies, indicate the same general falling off in values over the year as compared with 1913, with a marked kink at the outbreak of war.

Fig. 6, dealing with Far Eastern trade, shows that with both India and Japan our electrical business was in a really flourishing condition during the early part of the year—especially so in the case of India, with whom trade has been rapidly increasing for some years—and even Chinese trade showed hopeful signs. In all these cases values tumbled down in August, and while we still retain a reduced though substantial Indian business, and the gross value of exports to Japan during the year was actually higher than in 1913, yet at the present time both Japanese and Chinese business appears to be at a very low ebb.

The gross values of our export business to the countries abovementioned for the years 1913 and 1914 were as follows:—India, £1,769,000 and £784,000; Australia and New Zealand, £1,283,000 and £1,032,000; Argentina, £558,000 and £488,000; South Africa, £[illegible] and £[illegible], Canada, £392,000 and £318,000; Japan, £309,000 and £320,000; Brazil, £350,000 and £176,000; and China, £159,000 and £117,000.

The last series of curves, fig. 7, dealing with prominent importers into this country, which have become almost monotonous by reason of the overbearing position of Germany, will be reviewed this year with unusual interest.

Germany did a bumper trade with us during the early part of the year, whether due to accident or design, we can leave to our readers, but following the outbreak of war this naturally fell away to nothing in September, since when there have been no official records of "German" material entering this country. But our American cousins, who in the previous year were showing an increasing interest in our markets, have taken up the running, and are now sending into this country an even greater value of electrical material than Germany did. Under existing conditions this development is not surprising, America being the only really free electrical manufacturing nation at the present time; indeed, her freedom in this respect may be a matter for congratulation to us under the circumstances.

It may be of some interest to record that according to our monthly returns, Germany sold to us magnetos to the value of over £240,000 during the first seven months of the year; the total value of her electrical imports into this country during this period and a few extra days in August amounted to some £1,133,000, or a monthly average—taken over seven months—of £162,000, as compared with £1,632,000 and a monthly average of £136,000 during the previous twelve months. From the States we purchased electrical material to the value of some £911,000, a monthly average of nearly £76,000, as compared with a total of £593,000 and monthly average of over £49,000 in 1913.

Of the other countries, the Belgian curve shows that her trade has also dwindled to nothing, while France still maintains some small business with us. On the other hand our monthly statistics show that Italy, Switzerland and Holland—neutral countries only partly affected by the war, have increased their business with us since August; the Dutch lamp industry, in particular, has found a market in this country, as also have Swiss and Italian cable, etc.

The electrical imports for the last five months of the years 1913 and 1914, for the Scandinavian countries, Holland, Switzerland and Italy were valued as follows:—1913, £83,000; £14,800; £28,000; and £42,000 respectively; 1914, £52,610; £47,000; £34,000 and £50,000 respectively. The Scandinavian total for 1914 shows a decrease, but Russian business, which was included in the 1913 total, has of course disappeared since the war started.

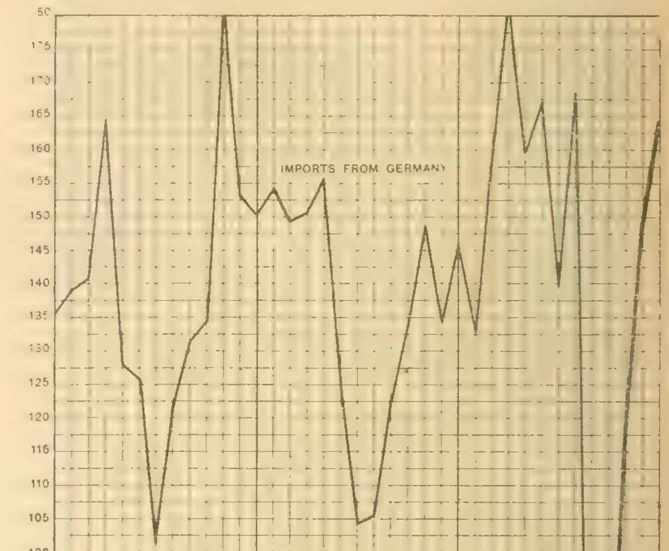


Fig. 7.—Electrical Imports from Germany, U.S.A., Belgium and France, 1912-14.

General.

In concluding these notes, we may point out that the falling off in electrical export business which was indicated in our 1913 curves, continued during the year under review up to the time of the war, and the latter has only been an additional factor in the result. Through the general obscurity in which the future is necessarily veiled, it is not easy to see any improvement in our export business, the indications being that a shortage of both labour and available plant will tend to a further falling off in this direction, as greater numbers of troops become engaged. And for similar reasons it would seem probable that electric imports from America, in particular, which at any rate has ample copper supplies, will show a corresponding increase, for it will be her object to make up for the shortage of European importation into this country as well as any deficiency in the usual supply of material by British firms to the home market, in so far, of course, as these are not curtailed by the war.

It is, in fact, obvious that self preservation may necessitate our concentrating on war requirements to the exclusion, if necessary, of foreign trade, and it is a matter for congratulation that such drastic measures have not up to the present been necessary.

CAB SIGNALS ON BRITISH RAILWAYS.

(*Abstracts of Papers read before the* Institution of Mechanical Engineers, *December* 18*th*, 1914.)

(*Concluded from page* 126.)

G.W.R. Automatic Train Control and Audible Signal System.

By W. A. STANIER, Assistant Manager, G.W.R. Locomotive Works, Swindon.

About the year 1905 some of the Great Western engineers devised an audible signal for the locomotive cab, which, after a certain amount of experimenting, was considered to be simple enough and certain enough to warrant a more extended trial. It was agreed to equip certain branch lines with the apparatus, and as a result the system has had certain improvements, and its use has been considerably extended.

A fixed ramp, in the centre of the track, about 400 yards before the DISTANT signal is reached, is connected to the lever in the signal-box controlling this DISTANT signal by means of an electric wire and switch with a battery in the circuit.

The ramp is laid on the skew so as not to wear a groove in the shoe, and to assist in clearing it, and the shoe which rubs on it, of anything such as frost or snow which tends to insulate them from one another.

In the signal-box is a switch connected to the ramp with a battery of about eighteen Leclanché cells in the circuit, with an earth return. This switch is attached to the lever controlling the DISTANT signal, so that the ramp is electrified when the signal is at PROCEED and dead when the signal is at STOP. The ramp is therefore dead in the event of the battery or connections becoming faulty.

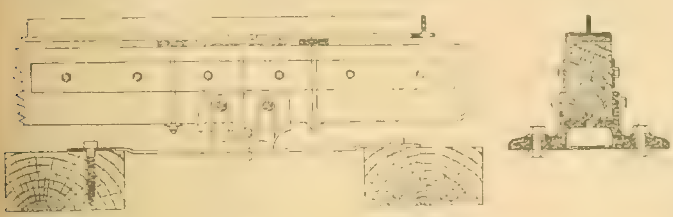


Fig 2.—Central Portion of Ramp.

The apparatus on the engine consists of a siren and brake-valve, and an automatic steam switch. The contact-shoe is fixed in the centre line of the engine, and projects to within 2½ inches above rail level. It is lifted 1½ inches whenever a ramp is passed over, opening a switch attached to the contact-shoe.

The switch is connected with the electrically-controlled brake-valve and siren in such a way that whenever it is opened, except as hereafter described, air is admitted through the siren and brake-valve to the train-pipe, sounding the siren and applying the brakes on the train, figs. 3 and 4. This happens when an engine passes over an unelectrified ramp. The driver can stop the siren sounding, and stop the application of the brakes by raising a handle provided for the purpose, and thus acknowledges the audible STOP or DANGER signal given by the siren. Should the signal be in the PROCEED or ALL-RIGHT position, fig. 5, the switch connected to the lever in the signal-box working this signal is closed, and the ramp is electrified, so that when the engine passes over the ramp, the shoe picks up the current, closing a secondary circuit on the engine which prevents the brake-valve from opening, and at the same time causes the bell on the engine to ring. This audible ALL-RIGHT signal continues until the engineman presses a push-button on the side of the cab apparatus, thus acknowledging the signal, and by breaking the bell circuit stops the bell ringing.

The cab apparatus consists of a box mounted on the side of the cab close to the engineman. It contains an electro-magnet, energised from a small accumulator on the engine, which holds up an armature. The armature is integral with the lever that controls the brake-valve and siren. Close to it is a steam-switch. Its object is to cut out automatically the electric battery on the engine, so that when the engine is not in steam the circuit is open and waste of current is prevented. It is arranged with a diaphragm which is set to move with about 40 lb. steam-pressure, and when it moves it joins up the circuit in the engine. A selective or polarised relay controls the secondary circuit, which circuit is primarily used for ringing the bell mounted at the top of the box, which gives the ALL-RIGHT signal. This relay is also used when the apparatus is installed on single lines. When a train is going in one direction on a single line it is necessary that the ramps controlling signals in the opposite direction should give no signal. This is effected by electrifying these ramps with a current of opposite polarity. The means for doing this is controlled by the electric staff or tablet apparatus, fig. 6.

The apparatus on the engine is always tested as the engine leaves the locomotive shed, as a short ramp is fixed alongside the outgoing signal for the locomotive yard, so that the engineman satisfies himself that the device is all right before he gets to his train. The device has proved so satisfactory that about 180 miles and 90 engines up to the present have been equipped, and its use is rapidly being extended.

Signalling on Railway Trains in Motion.

By W. WILLOX, Engineer, Metropolitan Railway, London.

Twenty-seven miles of the Metropolitan Railway are electrified, and 23½ miles are governed automatically by track circuits. The rest of the Metropolitan Railway has ordinary lock and block signalling, with a number of sections automatically controlled by track circuits.

The system of signalling in use on the electrified portion of the Metropolitan Railway is *all electric* automatic, and this signalling requires no visual indication in the driver's cab. There is, however, a control on the driver by means of "train-stops," which are placed at every STOP signal. The train-stop is a device which is controlled by the track circuit in exactly the same manner as the signals, and consists of a short vertical arm which is held vertically in its normal position, and is lowered to the CLEAR position by means of the track circuit acting through a motor at the same time as the signal goes to CLEAR. There is a trigger fitted on the leading motor coach or electric locomotive which would engage with the train-stop in its normal position and so be deflected backwards. When this occurs, it applies the emergency brake on the train and simultaneously opens the power circuit, thus braking the train and cutting off the current. In this way, if a driver passes a signal at DANGER, his train is automatically brought to a stand and cannot be started again until the trigger is replaced in the vertical position. As showing the effect of these train-stops, it may be mentioned that a train weighing 200 tons running at a speed of 25 miles per hour on the level is brought to a stand in less than its own length.

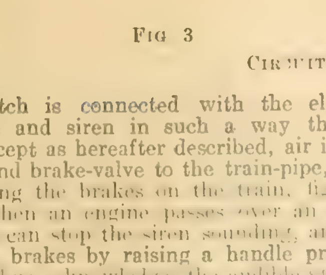


Fig 3

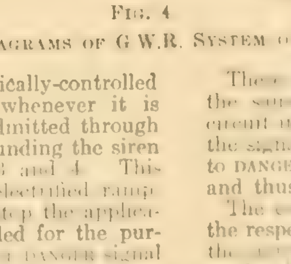


Fig. 4

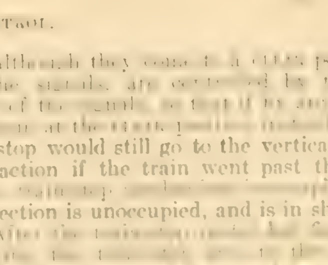


Fig. 5.

Circuit Diagrams of G.W.R. System of Train Control.

These train-stops, although they come to a CLEAR position at the same time as the signals, are controlled by the track circuit independently of the signals, so that if by any accident the signal should remain at the CLEAR position instead of going to DANGER, the train-stop would still go to the vertical position and thus come into action if the train went past the signal.

The control to the train-stop [illegible] when the respective track-section is unoccupied, and is in shunt with the signal control. After the train-stop has finished its work, [illegible] the inoperative position [illegible] by means of the motor control. The train-stop is then held in the CLEAR position electrically, by means of a clutch [illegible] in place. The motor only operates for the actual clearing, and the clutch arrangement reduces the power for holding at CLEAR to an almost negligible quantity, 1-10 amp. When the power circuit is broken, the only moving part of the apparatus is the train-stop arm and shaft, the motor remaining stationary, this being effected by the clutch mechanism. The voltage of operation is 60 and the power required for clearing about 30 watts, the time taken being five to six seconds.

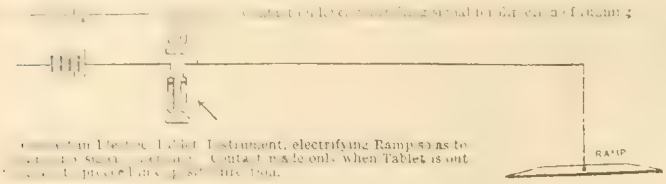


FIG. 6.—WIRING ON SINGLE-LINE RAILWAY.

Fig. 7 shows the general arrangement of the train-stop and controlling motor at rail level, and fig. 8 is a diagram of the wiring between the track circuit and the motor, showing how it is controlled.

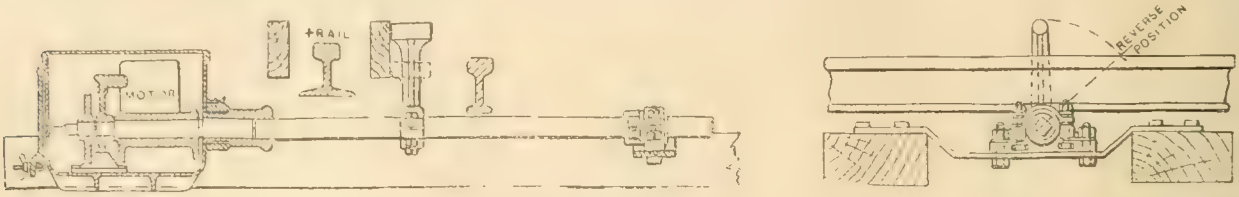


FIG. 7.—TRAIN STOP, METROPOLITAN RAILWAY.

With regard to the reliability of the train-stops described, the results are very satisfactory, as there have been many cases of drivers running past the signal, either through carelessness or some failure of the apparatus, being pulled up by the train-stops.

As to its usefulness, it is relied on to such an extent that fog-signalling in some cases has been dispensed with. Further, it has been possible to shorten the signal sections, and this shortening has only been agreed to by the Board of Trade on condition that train-stops are provided, and the Board of Trade also requires that all STOP signals on the electrified lines shall be fitted with the train-stop apparatus.

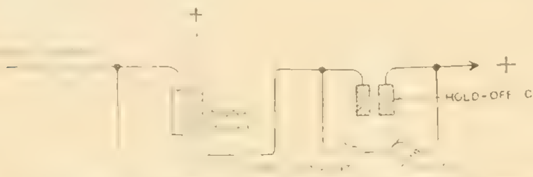


FIG. 8.—DIAGRAM OF TRACK CIRCUIT AND MOTOR CONTROL.

DISCUSSION.

In opening the discussion, the CHAIRMAN (Mr. Michael Longridge) said that the subject of cab signalling was of enormous importance, as the ordinary system of semaphore signalling left much to be desired. He suggested that audible signals were always more reliable, and that the efforts of engineers should be directed to perfecting a system of audible cab-signalling.

Mr. A. T. BLACKALL (Chief Signal Engineer, G.W. Rly.) attached special importance to automatic brake application in the event of the signal being at danger; with this system, there was no need for visual signals. Uniformity of system was of the utmost importance; in particular, an engine belonging to railway A should be able to pick up signals on railway B when running over the latter. He agreed that there should be no moving parts in the track equipment for cab signalling. On high-speed lines in particular, it was unsafe to depend on the train hitting a stop moved from a signal-box say half a mile away.

Mr. S. L. GIBSON (Toronto) outlined a Swiss system of signalling and train dispatching (*i.e.*, control from a central office) with which he had had experience in the States. The system was in regular use on 130 miles of track with extensions in progress to 250 miles. A fixed ramp and shoe were used, visible as well as audible signals being given in the cab. Following usual American practice, a green light, *i.e.*, "safety" signal, was shown normally, a red light appearing only between the distant and home signals when danger was present. The ramps were connected to the control station, and in the latter was a record sheet—showing time horizontally and number of "blocks" vertically—on which every train on the system recorded its position accurately and automatically. Only in exceptional cases were trains stopped automatically. In general, control was restricted to automatic speed limitation within predetermined limits: this speed control could not be overcome by the driver. The automatic apparatus was set in operation at the distant signal, and if the driver did not reduce speed within a certain distance, the automatic apparatus took charge of the train; it did not come into operation if the driver kept within the speed limit applicable to the case. A maximum speed limit was enforced in similar manner, and in the event of a signal being at danger, speed was reduced automatically to say 5 m.p.h. Ramps in and at the entrance to curves secured automatic speed limitation therein. This system had been used satisfactorily for some years; the General Railway Signal Co. (Rochester and New York) was to use it in re-signalling the Metropolitan Railway (New York) and the Pennsylvania Railway was about to use it on 20 miles of four-track way.

Mr. H. RAYNAR WILSON was strongly in favour of cab signalling, but doubted the wisdom of attempting sudden wholesale and radical changes in signalling methods. According to his investigations, cab signals had never been recommended by Board of Trade inspectors. (Mr. Wilsen laid considerable stress on this point, but a later speaker said there were cases in which Board of Trade inspectors had recommended cab signals.) Notable progress had already been made, cab signals being installed on 90 Great Western, 36 North Eastern, and two Midland locomotives, but to avoid unnecessary expense and to reduce the difficulty of securing ultimate uniformity of working, it was desirable to proceed slowly—first repeating distant signals efficiently, then adding stop and route signals later.

Mr. J. SAYERS (Midland Railway) pointed out that, however useful "train stops" might be on low-speed lines, they were of no value for high-speed steam or electric traffic. In his opinion several recent accidents on the Interborough and Third Avenue Railways could only be attributed to failure of train stops. Allowance must be made for the fact that more or less main-line track would ultimately be electrified, and he believed that it would be found there was no room on the track for signalling apparatus. At present single-phase overhead traction utilised running rail return, but the speaker believed that the Board of Trade here and the Public Safety Commission in the States would soon insist on a special return circuit being provided, in which case ramp systems of cab-signalling would have to find another means of transmitting signals to the engine. In co-operation with Mr. Acfield he had tried, on the Midland Railway, a wireless system based on the Railophone and operating, through a tuned relay, an audible indicator and the train brake. He submitted that the continuity of visible signals as now used made them ideal if only one could ensure that they could always be seen.

Mr. A. D. JONES (S.E. and C. Rly.) asked whether risk was not incurred by the normal position of the indicating arm being "clear" in the North Eastern system of cab-signalling; and by the driver being able to re-set the cab semaphore and switch out the bell. Did not cab signals take the driver's attention from the track? The critical period between the beginning of a fog and calling-out fog-men could be tided over by some apparatus enabling signalmen to place detonators mechanically. Cab-signalling was imperfect so long as it left the possibility of errors due to signalmen, for such errors had been responsible for many accidents; also, the system should include automatic train control, though this must not be in the nature of a sudden train stop in the case of high-speed traffic. Apart from other considerations, an attempt to stop suddenly, say, a heavy goods train on a down-grade would cause trucks to mount the tender. Uniformity of system was of the utmost importance—particularly in such cases of military emergency as now existed, when through-running in every direction, all over the country, was desired.

Mr. GARNER SMITH said that in his opinion a mechanical as well as an electrical signal was necessary for safety.

Mr. R. G. BERRY (L. & Y. Rly.) announced that he had been conducting successful experiments with a system of cab-signalling giving both "all right" and "danger" signals, but requiring no battery or accumulator and no delicate contacts on the locomotive.

Mr. A. E. ROBERTS (L. & S.W. Rly.) criticised severely the practice in the North-Eastern system of mounting the brush upon a truck, which had considerable vertical motion.

Mr. R. J. INSELL (G.W. Rly.) pointed out that the G.W. Rly. system of cab-signalling was as efficient as the N.E. Rly. system in warning drivers of their approach to a signalling zone; the G.W. system gave cab signals coinciding with the semaphore signal. Route indications were given only in the case of junctions which could be traversed at 40 m.p.h. or upwards. At most junctions the "danger" signal was given at the distant post in order that speed might be reduced for the junction; route indications were then unnecessary. Train stops were of no use on high-speed steam lines. Modern high-speed, frequent-service conditions would necessitate one system being generally adopted in the near future.

In reply, Mr. ACFIELD said that no mechanically operated moving ramp could be generally satisfactory. Tests on the

Midland Railway showed that train stops could not stand operation by trains running at 60 to 70 m.p.h. The exigencies of modern traffic demanded that the driver should be able to release himself from automatic braking directly such release became safe, and without waiting for the guard's services. Visual signals, though not necessary where distant signal control was alone practised, were advisable where the home signal was given also.

Mr. Pigg (speaking in the absence of Mr. V. L. Raven) said that an important feature of the N.E. system was the showing of one signal till the next was given. The driver was not required to remember what was the last signal. The normal position of the indicating arm was "danger," but the normal running position was "safe" so long as all circuits and contacts were in order. The cut-off switch was used only to save current while locomotives were in sheds; special ramps outside the latter demonstrated the correct working of the apparatus on leaving the sheds. The bell switch was for use in shunting; even with the bell switched out, a complete "off" signal was not given because the route indicator remained central. The complete canalisation of the system was very important, and Mr. Raven's system did not lose control of the driver at the distant signal.

Mr. W. A. Stanier said, with regard to acceleration of service by cab signals, that G.W. drivers placed implicit faith in their apparatus and ran dead to time in fogs when trains not equipped with cab signals were seriously delayed. The G.W. Rly. had also tried a purely mechanical audible cab-signalling system.

Mr. W. Willox said that when cab signals were sufficiently perfected no doubt they would be used on suburban electric trains. At present train stops were used as being the only means by which such a service as 42 trains per hour on one line could be maintained. In operation they had proved perfectly reliable at speeds up to 40 or even 50 m.p.h.

Mr. A. F. Bound (G.C.R.), in a communication, expressed the view that the existing visual signals must be retained, and any new system must be merely an adjunct to present methods. It was useless to deal with the fog-signalling problem; the proper course was to provide something which would ensure that the traffic should be worked according to the indications displayed by the signals. The main thing was to prevent a train from passing a HOME signal at DANGER by fixing the control at such a distance from the signal that the train would be stopped in time.

Mr. H. W. Moore (L. & Y.R.) wrote that the system described by Mr. Stanier appeared to meet every practical requirement, though it only gave a warning at the DISTANT signal. He thought an automatic appliance should be provided to stop the bell ringing.

Mr. J. C. Sykes thought that the driver should not be allowed too easily to liberate his brake when it had been applied automatically. The duties of the driver should not be added to; he should be allowed freedom of action until he did something wrong, and therefore he thought a properly designed train-stop was the solution of the difficulty. They were putting too much apparatus on the locomotive; the train-stop, however, was simple. The signalman ought to be provided with means to stop a train, in case of need.

THE DEVELOPMENT AND APPLICATION OF SEARCHLIGHTS.

At a meeting of the Illuminating Engineering Society on January 19th, Mr. P. G. Ledger opened an instructive general discussion on this subject, the paucity of literature relating to which was remarked and regretted by most of the speakers. After pointing out the distinction between beacons which are intended to be seen from a distance and searchlights which are intended to illuminate and reveal distant objects, Mr. Ledger stated that the electric arc was the only source having sufficient intrinsic brilliancy (200,000 c.p. per sq. in.) for high-power maritime work, though bunched incandescent filaments and the half-watt lamp were useful for locomotive headlights, fire brigade, aeroplane and other small searchlights. Searchlights were used during the last Franco-Prussian war, but with metal mirrors which suffered from distortion, corrosion and other defects. The perfection of the mirror and optical system generally was the chief improvement which had been effected in the construction of searchlights, and in this connection the work of Fresnel and Mangin must not be forgotten. The candle-power of a powerful searchlight was very indeterminate, varying as it did with the consumption of the carbons and, in effective value, with atmospheric absorption. Tests made in a clear atmosphere showed that the candle-power varied from 4,000,000 c.p. with a projector 40-cm. in diameter, using a 20-amp. arc, to 180,000,000 c.p. with a 150-cm. projector and 150-amp. arc; in the latter case, the intensification factor of the mirror would be about [illegible] and the mean horizontal intensity of the arc in the direction of the mirror about 46,000 c.p. The speaker exhibited a curve showing that increasing the input to searchlights increased the c.p. per watt at first rapidly, but then slowly; corresponding to 0.8, 1.7, 2.75, 4.9, and 9.5 kilowatts were 1, 5, 5.5, 6 and 6.5 c.p. per watt. Knowing the divergence of the beam (rarely less than 2° or 3°, nor need it be otherwise, or it would take too long to search a given area), the true centre of radiation could be determined and the law of inverse squares applied sufficiently closely to permit a fairly definite value to be assigned to the candle-power. Usually, however, the variety of carbons, current and voltage, and diameter and focal length of mirror, were alone specified. The "range" of a projector was even less definite than its candle-power. Often it was demanded that a projector should show up small objects which could not under any circumstances be seen at the distance specified. Any attempt to specify range must stipulate that the atmosphere be clear and that an object of definite size and colour be visible at a certain distance. As a rough guide, a modern 150-amp. searchlight would carry 10,000 yards in clear weather. Nerz's rule stated that the radius of action varied with the square root of the mirror diameter and the fourth root of the intrinsic brilliance of the source; this rule took no account of the size of object viewed.

The coming of aircraft had made it necessary to project beams vertically upwards for military purposes and had raised the intricate problem of arranging for flashing beacons operating in both horizontal and vertical planes. Vertical projection might be arranged by giving the projector barrel the desired inclination; by using a lens, with the arc beneath it, instead of a mirror; or by allowing light from a stationary projector to fall on a mirror capable of rotation in any plane. Yellow or red rays penetrated fog better than did blue light, and there was a possibility of increasing ranges by using coloured light; using a coloured mirror or screen would waste much light. Any improvement with a view to increasing the light available would have to be made by increasing the brilliancy of the crater; but progress in this direction must not diminish unduly the life of carbons (3 or 4 hours in large and 7 hours in small projectors.) A 100-amp. arc using a 27-mm. positive carbon might employ a 13-mm. copper-cored negative and the shadow of the latter, with a relatively long arc, was inconsiderable. Recent improvements had been in respect of rapid dismantling and easy manipulation, *e.g.*, automatic movement of the beam in accordance with the motion of an observer's telescope.

Mr. J. Eck said that we appeared to have reached the limits of performance with searchlights of the existing usual design; increased current input no longer gave appreciably more light on a distant object. A new type of lamp had recently been produced in the States having vapour-cooled electrodes placed at about 150° to each other. The positive carbon was 15-mm. in diameter and horizontal, the negative was 11-mm. in diameter and inclined. Both carbons were rotated steadily by a small motor which also served to actuate the feed and other movements in the lamp. Flat nozzles delivered methylated spirit vapour on to the carbon tips. The arc crater occupied the whole section of the positive carbon, and it was found that with lamps of this type, higher specific illumination and a more concentrated beam were obtained than from an ordinary projector of equal size. As compared with a standard projector of the same current capacity and mirror diameter, a projector with vapour-cooled arc produced 4.2 times as great average illumination along 238 ft. of arc at a distance of 6,800 ft., and 5.2 times as great illumination along 1,238 ft. of arc at a distance of 27,550 ft.

Mr. W. M. Mordey said that there seemed to be a tendency to revert to the earliest type of arc with inclined carbons and both incandescent tips exposed. Was it not possible to use an alternating-current arc with inclined and, of course, equally heated carbons, while still keeping a small enough source for [illegible] At present the capacity of projectors was largely limited by heating; possibly it would be worth while to water-cool the barrel and mirror.

Mr. Lyon said that oxy-petrol burners incandescing a refractory button permitted the construction of very portable self-contained searchlights. For aeroplane use a swivelling searchlight of 2,000 intrinsic candle-power weighed 60 lb. complete with generator, automatic field regulator (compensating for [illegible] and ballast resistance). A [illegible] lens was used and a sheet of plane glass prevented ash dropping on to the mirror. A half-watt signalling lamp with a specially efficient optical system, for aero-work, was also described. A [illegible] parabolic mirror permitted Morse signals to be read in this country, [illegible] This was distinctly promising in connection with the use of half-watt lamps for beacons.

[illegible] surrounding the crater, a whiter light and greater penetration was obtained: tests showed that gunners could find and hit a target [illegible] further away using a projector of the vapour-cooled type, instead of an otherwise similar standard lamp. The small, heavily worked carbons in the vapour-cooled type could be impregnated without the ill effects noticed when using ordinary current densities. Combustion was better at the higher working temperature, and due to less scattering of the beam the observer could keep within hail of the operator without being dazzled.

Mr. J. W. Willcox gave test data showing the excellent performance of metal-filament lamps in small searchlights (9-12 in. diameter, 2¾-3 in. focus) required to deliver a relatively small volume of light for pick-up distances not more than 5,000 ft. The multiplication factor of the mirror was 500 to 1,000 for 8° beams and 3,000 to 6,000 for 5° beams. Due to the sharper focus obtainable, incandescent lamps had been found better than arcs for locomotive headlights.

Mr. L. R. B. Pearce suggested that impregnation with strontium salts might introduce unstable resistance conditions and cause "spurting."

A Visitor stated that the French authorities made a practice of over-running incandescent filament lamps in a certain class of searchlight. By over-running 8 or 16-volt lamps 100 per cent., light could be obtained at ⅛ watt per c.p. The lamps lasted only one or two hours, which was quite sufficient for the purpose in view. Was it not possible that the use of several lamps concentrating on one spot would overcome the limitations of a single beam?

Mr. H. Smith quoted some of the conclusions reached in recent military searchlight investigations in America. By altering the shape and composition of carbons, 50 per cent. increase in light could be obtained. Coring steadied the arc and gave the crater the right shape and brightness. Though yellow rays penetrated farthest, it was no use trying to make yellow light. It involved a flame arc which fouled the mirror, choked operators and spoiled focus: the loss was greater than the gain.

Prof. Blondel (communicated) stated that existing methods of specifying range were too vague and empirical. Atmospheric absorption varied greatly in different districts and complete over-land data were not available. He gave mathematical expressions and lists of numerical factors and relevant physical data, and made allowance for the sudden decrease in visual acuity occurring when illumination falls below 0.15 metre-candle.

Mr. J. S. Dow pointed out that there were sound physical reasons why blue rays should be excluded from searchlight beams. Not only had they poor penetrating power, but also their dispersion produced a blue-white haze very objectionable in practice. Better definition of distant objects could be obtained if blue rays were excluded.

Mr. Chalmers said that Nerz's range formula neglected to account for the distance of the observer; this was not permissible if the object viewed subtended only one or two minutes of arc at the observer's eye. So long as glasses of moderate magnifying power were employed, small objects could be seen at as great range as large objects viewed by the naked eye.

Mrs. Hertha Ayrton said that previous speakers had almost ignored the question of arc stability, which was extremely important and depended on many factors. The supply generator used should give 15 or 20 volts excess pressure, on open circuit, above that required at the arc. Six years ago she had sent to the Admiralty drawings of the shapes to which carbons should be cut: this information had not been applied, but the recent American investigations again showed its importance. In investigating the best running conditions, the speaker had found 120 amps. at 70 volts on the arc, using a 38-mm. solid positive had given a long and stable arc with 20 per cent. more light than usual. Best results depended largely on the operator's skill.

Mr. A. P. Trotter said that the practical operation of searchlights was very simple, whereas to express their theory mathematically was difficult and unsatisfactory. So many arbitrary constants were involved that there was little theory left by the time one had evolved an accurate formula. Residents in London had nightly opportunity of observing what splendid beams were obtained from modern searchlights. As a matter of fact they showed less divergence than was dictated by theory. Any attempt to express and work with the candle-power of a searchlight was unsatisfactory. The only satisfactory method was to deal with lumens and flux of light.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

427. "Gas fires and stoves heated by gas or mineral oil or electricity." [illegible] January 11th.

[illegible] insulating material." Soc. Anon. des Combustibles Industriels. January 11th. (Convention date, January 9th, 1914, France.) (Complete.)

433. "Adjustable stand or holder for crystals used as detectors of electric signals in wireless telegraphy and wireless telephony." C. H. Parker. January 11th.

435. "Manufacture of metallic tungsten free from carbon." J. C. Butterfield. January 11th.

[illegible]." F. O. R[illegible] & J. G. Thompson. January 11th.

450. "Process of and means for manufacturing electric carbons." Compagnie des Charbons Fabius Henrion. January 11th. (Convention date, January 13th, 1914, Belgium.) (Complete.)

459. "Construction of brush holders for electric dynamos and motors." A. B. Back. January 12th.

464. "Auto cable-laying attachment for the laying and reeling up of telegraph and telephone cables." G. Kennard & E. A. Pells. January 12th.

482. "Electric-lamp holders and electrical accessories." J. N. Mollett & E. Mollett. January 12th.

484. "Transformer and circuit arrangements therefor." G. J. Van Swaay & H. I. Keus. January 12th. (Complete.) (Convention date, January 27th, 1914, Holland.)

491. "Electric motor control systems." British Thomson-Houston Co., Ltd. January 12th (General Electric Co., United States.)

498. "Selecting devices operated by current impulses." O. Imray. January 12th. (Siemens & Halske Akt. Ges., Germany.) (Complete.)

519. "Polyphase generator for high-frequency currents with polyphase-tuned spark-gap." L. Rouzet. January 12th. (Convention date, January 12th, 1914, France.) (Complete.)

528. "Alternating-current generators of the permanent-magnet type." R. Mercer. January 12th.

547. "Magnetos and dynamos." K. R. Smith. January 13th.

553. "Electric locks and switches for lifts." Smith, Major & Stevens, Ltd., & C. G. Major. January 13th.

558. "Adapter couplings, switch lamp-holders, and holders for other electric fittings." V. C. H. Gibson. January 13th.

561. "Electric wall plugs and the like." C. Pressland. January 13th.

562. "Electric lamp-holders." C. Pressland. January 13th.

565. "Gyro-compasses." J. Perry & S. G. Brown. January 13th.

569. "Electrical steering and like gear." Harland & Wolff, Ltd., & H. H. Bentley. January 13th.

580. "Manual and semi-automatic telephone systems." Betulander Automatic Telephone Co., Ltd., & W. Aitken. January 14th.

596. "Automatic electro-dynamic brake system for feed-reels and the like." H. V. James. January 14th.

611. "Electrical vibrators or buzzers." A. H. Nicholson. January 14th. (Complete.)

641. "Magneto ignition apparatus." M. S. Conner. January 15th.

647. "Electric signalling." F. G. Cole. January 15th.

651. "Electric condensers." G. A. Lister, E. A. Watson, & Morris & Lister, Ltd. January 15th.

676. "Electric arc lamps for kinematographic projections." A. Zanotta. January 15th. (Complete.)

677. "Electric cable sockets." C. Pressland. January 15th.

712. "Electric switches." E. G. Harcourt. January 16th.

717. "Protection of electric cables." J. H. Bowden & H. F. J. Thompson. January 16th.

718. "Automatic electric safety catches or locks." A. A. Smethurst & G. W. Sizer. January 16th.

722. "Safety-devices or vacuum relays for electric circuits." Siemens-Schuckertwerke G.m.b.H. January 16th. (Addition to 17,532/13. Convention date, January 16th, 1914, Germany.) (Complete.)

723. "Stray-wave protection devices for electric circuits." Siemens-Schuckertwerke G.m.b.H. January 16th. (Addition to 17,532/13. Convention date, January 17th, 1914, Germany.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps)

1913.

21,361. Apparatus for Operating Railway Signals and the like. R. J. [illegible] & A. P. Houghton. September 22nd.

29,615. Automatic or Semi-automatic Telephone Exchange Systems. G. A. Betulander. December 23rd. (December 24th, 1912.)

29,712. Transmission of Wireless Signals. R. C. Galletti & Galletti's Wireless Telegraph & Telephone Co. December 24th. (Cognate application, 2,7[illegible]8/14.)

29,752. Electric Motor Control Systems for Trains and the like. British Thomson-Houston Co. (General Electric Co.). December 24th.

30,083. Electric Motor Control. British Thomson-Houston Co., & H. C. Hastings. December 31st.

1914.

53. Semi-automatic Telephone Exchange Systems. W. Aitken & R. Aitken January 1st.

173. Ignition Systems for Internal-combustion Engines. C. T. Mason. January 3rd.

391. Switching Systems for Inserting and Cutting-out Resistances and the like. British Thomson-Houston Co. & H. C. Hastings. January 6th.

3,011. Electric Switches. H. Lucas & W. H. Edwards. February 5th.

3,360. Impulse Control Systems for Automatic Telephone Exchanges. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). February 9th.

5,050. Electric Arc Lamps. F. W. Sturgess. February 26th.

9,116. Marking Devices for Recording Instruments. Evershed & Vignoles, Ltd., & G. W. Binsted. April 9th.

9,468. Attachment of Electrical Conductors to Dynamo Brushes and the like. Soc. Anon. le Carbone & F. Gindre. April 16th.

10,948. Electric Railways. C. M. White (M. E. Sturges). May 4th.

11,624. Electric Igniters. F. Celeri. May 11th.

13,707. Devices for putting up and taking down Electric Lamps. A. H. Burbidge & R. E. Alderman. June 5th.

14,265. Portable Facing Tool for Electrical Contacts and the like. A. J. Croft. June 13th.

18,676. Selecting Devices for Automatic or Semi-automatic Telephone Systems. G. A. Betulander. July 30th. (August 1st, 1913.)

19,517. Magnetizing Permanent Magnets. P. Lynch, H. Wochner & F. W. Sauermann. September 7th.

21,583. Magneto-electric Machines particularly for Ignition purposes. C. T. Mason. October 27th. (Divided application on 29.655/13. December 23rd.)

21,610. Magneto-electric Machines particularly for Ignition purposes. C. T. Mason. October 27th. Divided application on 29.655/13. December 23rd.)

21,743. Magneto-electric Machines particularly for Ignition purposes. October 29th. C. T. Mason. (Divided application on 29,655/13. December 23rd.)

21,823. Ignition Systems for Internal-combustion Engines. C. T. Mason. January 3rd. (Divided application on 173/14. January 3rd.)

21,96[illegible]. Magneto-electric Generators for Ignition purposes. C. T. Mason. November 3rd. (Divided application on 29,655/13. December 23rd.)

THE

ELECTRICAL REVIEW.

VOL. LXXVI. FEBRUARY 5, 1915. No. 1,941.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: February 5, 1915. [No. 1,941.

Page
Electricity Supply ... 165
Copper ... 166
Electric Nitrogen Furnaces ... 166
Alien Enemies and Legal Rights ... 167
German Trade in 1913 ... 167
Modern Wiring Work, Particularly in Bad Situations, by H. C. Tofield ... 168
Correspondence—
  200 Telephone Electricians Wanted ... 169
  Jowers Protective Leakage Device ... 169
  A.C. *v.* D.C. for Lighting ... 169
  The Capture of German Foreign Trade ... 170
  Salaries of Junior Engineers ... 171
  Wonderful Accumulator Cells ... 172
New Electrical Devices, Fittings and Plant (*illus.*) ... 172
Legal ... 174
Our Legal Query Column ... 175
War Items ... 175
Foreign and Colonial Tariffs on Electrical Goods ... 177
Business Notes ... 177
The E.T.U.: London District ... 183
Notes ... 184
City Notes ... 187
Stocks and Shares ... 189
Market Quotations ... 190
Metal Market—Fluctuations in January ... 191
A New Nitrogen Electric Furnace (*illus.*) ... 191
The Telephone in Surgery ... 194
The Shape of the Pressure Wave in Electrical Machinery, by S. P. Smith, R. S. H. Boulding, and S. P. Smith (*illus.*) 195
Electric Heating and Cooking ... 197
Breakdowns in Colliery Electrical Plant, by L. Foster ... 198
Trading and Industrial Methods in Germany ... 199
New Patents Applied For, 1915 ... 200
Abstracts of Published Specifications ... 200
Contractors' Column ... Advertisement page xviii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 1s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND, N.Z: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.

DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency Ltd.

LAUNCESTON: Gordon & Gotch, Cimitiere Street.

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto I, 307.

SYDNEY: The Mining & Engineering Review, 57, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

IN THE PRESS.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

ELECTRICITY SUPPLY.

ON Wednesday evening last week, at a meeting of the Students of the Institution of Electrical Engineers, Mr. Charles H. Merz delivered an extremely interesting lecture on the subject of electricity supply on the large scale in populous areas, illustrating his remarks with lantern views and diagrams. By virtue of the positions he occupies and the unique experience that he has acquired, the lecturer is exceptionally well equipped for dealing with a subject which we may regard as his speciality, and it is to be regretted that the reproduction of his lecture *in extenso* is not permissible.

In the first place, Mr. Merz established by logical processes the fact that the interconnection of several large adjoining areas for the purpose of supplying electricity was essential to reliability combined with economy; each area can receive a supply from at least two directions, and instead of having a separate stand-by plant in each generating station, the whole of the stations become mutual guarantors of the continuity of supply. Plant of the same total rating then gives a greater degree of reliability than would otherwise be attained, and, roughly, we may say that with n stations working together, the individual generating sets may be n times as large. This, of course, results in a great reduction in capital cost, as well as in steam consumption. Generating sets of 25,000 KW. capacity have already been put to work, with excellent results, and Mr. Merz, who is accustomed to thinking in large units, sees nothing to prevent the installation of 50,000-KW. sets at no distant date.

Another result of interconnection is improved load factor, and the lecturer, showing maps of the North-East Coast network, by far the largest example of the kind in this country, gave startling figures for the load factor attained in that area. It must be admitted that the region in question, with its enormous industrial demand for electric power, possesses exceptional advantages from this point of view. The remarkable development of the so-called "waste-heat" station system was well illustrated by statistics and diagrams: but here again the district is quite exceptional in character. It is worthy of note that a company, free from the trammels that embarrass municipal undertakings, was able to carry out this huge system, which would have been impossible in the case of a municipality.

Amongst possible openings for the further development of electricity supply, and the improvement of the power factor, the lecturer referred especially to electric traction on railways, which has already made considerable progress on Tyneside, and he pointed out that there is a tendency to advocate electrification for suburban service only, on account of the advantages of electricity where there are frequent stops; but the economy of electric traction does not depend on the stops, but on the density of the traffic, and Mr. Merz emphasised the fact that a material saving can be effected on a railway of any length whatever, without regard to stops, if the traffic is heavy and continuous. The mineral traffic on some branches of the North-Eastern Railway fulfils the conditions, and the new electric service with overhead high-pressure supply to the locomotives, which will soon be inaugurated by the company on one of these lines, is expected to prove highly economical.

Some doubt, he said, had been cast upon the effect of diversity of demand upon the load factor of a large power station, but he met this not only by reference to the results achieved on the North-East Coast, but also by a telling satire upon the conditions at present obtaining in the London area. When practically all requirements are filled by electrical means, it will obviously be impossible for all the demands to occur simultaneously. If the present "system" were perpetuated, a suburban resident would have his breakfast cooked by electricity from one power station, and would travel to town in a train propelled by a second; his office would be lighted and heated by a third, and, as likely as not, his lunch would be cooked by a fourth, while his tramway journeys during the day would be energised by a fifth. In the evening possibly he would travel to the West-End with power from a sixth station, attend a theatre supplied from a seventh, and sup at a restaurant connected with an eighth. This absurd partition of the load would be avoided if all the supply were derived from one homogeneous interconnected system, and the benefits of the diversity factor would then be fully realised.

There can be no doubt as to the disadvantages of the present methods; the difficulty lies in finding a satisfactory way of co-ordinating the numerous systems, and the County Council finds that it has tackled a very thorny problem.

We understand that Mr. Merz looks forward to the development of electricity supply in London to something like 15 times its present volume; Sir John Snell guardedly hinted at 10 times, and we are inclined to think that Mr. Merz's estimate is somewhat biased on the high side by his experience on Tyneside, the industrial demands of which are much heavier than those met with in the London area. But there is certainly scope for enormous developments in connection with the domestic uses of electricity and electric traction, and we hope that eventually Mr. Merz's figure will be justified by realisation.

Copper.

The strength of the copper market has been unabated within the past few weeks, and it is by no means certain that the advance, important though it has been already, has yet spent itself. The excellence of the trade demand is admitted on all sides, the major portion of the buying coming from the brass section, which is unprecedentedly busy on ammunition orders, mainly for home needs, but also in part for the Allies.

An enormous consumption of copper is proceeding in connection with the provision of munitions of war, and there is not the smallest chance of all our efforts being abated to furnish the huge armies in the field with ample supplies wherewith to drive back the baby-killers and thieves who are endeavouring to lay waste the whole of Europe. Producers have fully recognised the strength of the position arising from the big demands which are encountered, and have raised their prices by steady and successive stages, until now they are in the neighbourhood of £68 10s. a ton for electrolytic. Very large business has been booked within the last three weeks or so, and the demand is still in evidence. Not only has the call for copper from Europe been important, but there has been a revival in United States home trade buying, and under the joint influence of the domestic and export demands, the stocks of refined metal in first hands across the Atlantic have been drawn upon to such an extent as to threaten a moderate degree of scarcity.

It had been suspected for some little time that a part of the buying of standard copper in the open market came from America, and this has now received confirmation. It is known that leading American producers have bought largely of warrants, and are contemplating the shipment of several thousand tons of rough copper from British warehouses to their refineries on the Atlantic seaboard of the United States. The assertion is made that it is only by securing material available here, that it will be possible for them to fulfil their engagements, for the supply of copper suitable for the refineries to run upon has been pretty well exhausted across the Atlantic. It remains to be seen whether the position has not been overdrawn in this respect, but meantime there is at least an even chance of the bulk of the rough copper at present available for the use of British refiners being shipped to North America for conversion into electro copper, which material will in the fulness of time be shipped over to us. The position is not liked, however, and the British Government have for the time put a stop to the shipment, though it is possible that the embargo may be removed in a few days.

There are vague reports that output is to be increased in America, and if the position in respect of rough copper is as described, it is indeed high time that mine and smelter production there was increased. It is sheer nonsense for the pro-German element in the United States to howl about British naval activity in stopping exports to Germany, and to allege that we incidentally are half paralysing business in the Montana mining camps, when the said mining camps are not permitted to produce sufficient copper to supply present needs. However, logic forms no part of the stock-in-trade of the pro-German.

The European visible supply on January 31st was 35,125 tons, against 36,308 tons on January 15th, and 35,432 tons on December 31st. A year ago the total was 25,944 tons. The supplies coming forward during last month totalled 35,502 tons, made up as follows:—North America 22,520 tons, Spain and Portugal 2,132 tons, and other countries 4,233 tons, the shipments from Chile being 4,617 tons, and those from Australia 2,000 tons. The deliveries were 35,809 tons.

Electric Nitrogen Furnaces.

The paper describing his three-phase electric furnace for the direct fixation of atmospheric nitrogen, which Mr. E. Kilburn Scott recently read before the Society of Chemical Industry, brings once again into prominence the problem how best to establish in this country an industry of such national importance as the manufacture of nitric acid. The derived salts of nitric acid, such as nitrate of lime or sodium and ammonium nitrates, are not only of value as fertilisers, but with the acid itself they form the foundation of the manufacture of explosives, and that we, as a nation, should be content to rely on oversea supplies for so vital an element of national defence is a state of affairs that calls at least for earnest consideration.

It has already been established by the successful operation of the Birkeland-Eyde, Schönherr-Hessberger and Pauling furnaces in Norway and elsewhere, that the direct method of fixing nitrogen by "burning" it in the electric arc can compete on the one hand with the old Chile saltpetre method, and, on the other hand, with the more indirect method of obtaining it from the air by means of calcium carbide and calcium cyanamide or the Ostwald contact process, although the possibilities of the latter method have by no means been gauged as yet to the full. Great Britain to be sure cannot develop water power either to the extent or for the price at which it can be obtained in Norway, but against this has to be set the saving in freights involved in shipping the liquid acid to this country, or in sending the ammonia liquor over to Norway, there to be converted into ammonia nitrate and shipped back again here in that form. The present yield of the nitrogen furnaces in practical operation is stated to be equivalent to some 60 to 70 grams of pure nitric acid per KW.-hour. If the results which Mr. Kilburn Scott's new furnace has given in the experimental stage are reached on an industrial scale, his yield should attain the high figure of 90 to 100 grams of acid per KW.-hour, an advantage which, even if it stood alone, would weigh heavily in the scale against the superiority which Norway's natural gifts afford her. The fact that the increased yield is very largely the result of employing the hotter flame of a three-phase instead of a single-phase arc furnace, the inherent simplicity of the new furnace, and its smooth working on the small scale, are strong reasons why the increased yield should no less be realised in practice than in the laboratory.

The whole question, apart altogether from the merits of one particular process, has a broader aspect from the point of view of the conservation of power. The utilisation of the idle hours of central power stations for the running of auxiliary power-consuming chemical processes is constantly being urged by progressive engineers. The situation created by the war affords an opportunity for progress in this direction, which should be at once seized, both by the power producers and the power consumers. The manufacture of nitrates is only one among quite a considerable number of electrochemical and electrometallurgical processes which can be developed as well in this country as they have been on the Continent, if one can only bring about the necessary co-ordination between the different interests concerned. The discussion of this matter is one which our great engineering societies are in a pre-eminent position to initiate and to guide.

Alien Enemies and Legal Rights.

Ever since the commencement of the present war commercial men and their legal advisers have been in a state of considerable doubt as to their rights and liabilities in dealing with alien enemies. Some difficulties were resolved by special Acts of Parliament and certain Royal Proclamations; but it was reserved to the Judges to declare the rights of an alien enemy as a suitor in English Courts of Law. As a result of certain cases recently argued before the full Court of Appeal, the following principles have now been authoritatively laid down :—

1. The term "alien enemy," when used in reference to civil rights, does not mean a subject of enemy nationality, the test not being nationality, but the place of business; in other words, not nationality, but domicile.
2. An alien enemy has no right to sue in the King's Courts during the war except by special licence or authorisation of the Crown.
3. An alien enemy can be sued in the King's Courts during the war, and, if so sued, may appear and defend, and, if defeated, may appeal.
4. A plaintiff, being an alien enemy, against whom judgment has been pronounced before the war, cannot present or prosecute an appeal during the continuance of the war.

There are some points about these principles of law which are likely to surprise the non-legal reader. In the first place, it seems that a man of German birth, whether a registered alien or not, is not an alien enemy, and can enjoy all the rights of a British subject, if he happens to be living in England. On the other hand, a loyal British subject who happens to be interned in Germany or Austria at this moment, must be regarded as an alien enemy. If he were in a position to communicate with his solicitor in London he could not issue a writ. On the contrary, a German merchant in London who could still sing with heart and voice :—

Ich habe mich ergeben, mit Hertz und mit Hand,
Dir Land voll Lieb und Leben, dir Deutsches Vaterland !

may still sue and recover money in the King's Courts.

It is possible that many of our readers, at the outbreak of the war, had money owing to them by German firms. If those firms can be sued it were well to bring suit at once; but there are two difficulties :—

1. The difficulty of effecting service of proceedings.
2. The difficulty of recovering anything if the suit is successful.

However, if there are any assets in this country and a manager who is in control of them, something may be gained by the institution of proceedings.

German Trade in 1913.

Although only issued at the beginning of January, the report on the trade of Germany in 1913 by Sir Francis Oppenheimer, British commercial attaché in Berlin—to which we briefly referred a fortnight ago, and of which we give an ample abstract on another page to-day—contains a mass of information which is worthy of careful study by British firms who are engaged on the promotion of the export trade in general. The report mentions, in the first place, that there is hardly a branch of manufacture or trade which has not its own organisation and journal, and thus the conditions of the home market are said to be fully disclosed, whilst news from abroad is published and carried into distant workshops. As in previous reports, so in the present one, is the question of syncates discussed at length. The well-known fact is pointed out that the huge works which have each concentrated under one roof, particularly in the coal mining and iron and steel trades, various stages of manufacture have little interest in the various syndicates controlling the respective stages of manufacture unless they are granted preponderating figures of allotments. On the other hand, the smaller works naturally prefer a state of syndication which guarantees their existence, checks competition, secures steady prices in the home market, and provides export bounties for the foreign orders. The huge undertakings have become world concerns; they embrace so many branches of manufacture and command so many markets as to reach above local industrial tides. The rise of the gigantic works, although it has been greatly assisted by modern developments of the banking system, is chiefly attributed to the application of science to manufacturing by carrying the science of the utilisation of by-products to its utmost limits, and therefore reducing the cost of production. The huge concerns, of which every industry boasts increasing numbers, exercise a steadying influence on the country's economic life, because their interests are world interests. At the same time the desire for high figures of allotments in the syndicates appears to act as a fatal temptation to the expenditure of vast sums upon extensions which no one expects to see permanently utilised. The result is an enormous augmentation in the productive capacity, and actual over-production shortens the period of a boom and leads to a forced export trade. Indeed, the export trade, which alone is capable of feeding the extended works, may even grow, while the strength has gone out of the boom, notwithstanding a record export trade, as in 1913.

The report, proceeding to state that the desire to save expensive labour has naturally led to an increased use of machinery, records a very interesting point. It is that the Germans, instead of being so willing, as in the past, to agree to customers' special requirements, are having a scramble for orders for standard patterns, it having become difficult to find makers who will accept stray orders for goods which differ from the ordinary patterns. Coming to consider the question of export markets, the report recalls, more particularly from the second half of 1913, the fact that the necessity for a larger German export seemed uppermost in the public mind, and that two scientific institutions were formed early in 1914 to teach the science of international trading. The export trade receives practical official support, export railway rates have been reduced, and cable rates for week-end messages were also lowered to a number of countries early in 1914, whilst foreign loans are made subject to the, grant of commercial concessions. In addition, the export trade is supported by the shipping companies, a uniform bill of lading was agreed upon at the close of 1913, and manufacturers, merchants, and shippers have combined to form special foreign trading societies, which now exist individually for Greece, Turkey, Argentina, Brazil, South America generally, Russia, France, the Balkans, Austria, Hungary, Italy, and Roumania. These societies, which have the moral support of the highest official circles in Germany, formed themselves into a union early in 1914, so as to benefit mutually from each other's experience, and they intend to centralise their labours in regard to statistical and other material to be collected in view of negotiations for the new treaties of commerce. Finally, the foreign trade is facilitated by the existence of 17 foreign banks which have branches in different parts of the world.

The foreign trade in machinery and electrical manufactures is briefly referred to towards the end of the report. The value of the imports and exports, accepting one mark as the equivalent of a shilling, is recorded as follows :—

	Imports.		Exports.	
	1912.	1913.	1912.	1913.
Machinery ...	£3,850,000	£4,050,000	£31,515,000	£33,915,000
Electro technical products ...	520,000	650,000	11,985,000	[illegible]

It appears that out of the total exports of machinery in 1913 a quantity of 19 per cent. of the weight was forwarded to Russia, 11 per cent. to Austria-Hungary, 10 per cent. to France, 7 per cent. to the United Kingdom, and 5 per cent. each to Belgium, Holland and Italy. In conclusion, the report mentions that the export trade in electrical products to Austria-Hungary, Russia, France, Italy and Switzerland is being rendered increasingly difficult owing to the rise of local industries which are being developed under the local system of protection.

MODERN WIRING WORK, PARTICULARLY IN BAD SITUATIONS.

By H. C. TOFIELD.

Systems of wiring for electric light and power installations are of interest to many, and with some fifteen years' experience in designing and supervising the erection of installations of all kinds and under nearly every condition of service, the writer may claim some knowledge of this important subject.

At one time it was considered that a good class installation of screwed, galvanized conduit would satisfy the requirements of almost any position. It was, so to speak, the last word in wiring practice and was expected to protect the wires under all circumstances.

From the point of view of mechanical protection it was generally a success, but from other considerations frequently a failure.

Since the advent of what are known as cab-tire sheathed (C.T.S.) wires and cables, which are now made by several eminent cable manufacturers (although it seems only fair to state that they were originally designed for this purpose by the St. Helens Cable and Rubber Co.), wiring methods in what may be termed "difficult situations" have undergone a radical change.

Notwithstanding, however, the remarkable advantages afforded by this C.T.S. system of wiring, comparatively little seems to be known about it either in regard to published descriptions of work done, or by many of the consulting engineers and contractors. These people still specify and use the older systems of wiring for work that could be dealt with much more effectively and cheaply by the C.T.S. type.

So the writer, having used this class of cable for a number of installations, principally in and around the Black Country, where, it will be admitted, conditions are exceptionally severe, and having installed it in chemical works and similar places where it has afforded the most gratifying results, considers it will be to the public interest to publish some notes upon this class of cable, and hopes they will not be taken for a mere write-up of a comparatively new article.

A short description of the methods of wiring and the types of accessories used with the C.T.S. system should be of interest to all those who are called upon, from time to time, to provide an electrical installation which will be proof against the effects of moisture and corrosion.

The principal defects of the ordinary systems of wiring, when installed in unsuitable positions, may be briefly summarised:—

Wood casing.—Casing should only be used in conjunction with vulcanised rubber-covered wires under ideal conditions and where the premises to be wired are perfectly dry. It is prohibited under the I.E.E. rules for damp situations.

Screwed conduit.—Screwed conduit when installed with proper inspection fittings and galvanised where run in wet situations, affords a sound protection to the V.I.R. wires against mechanical damage and dampness. It will not last for any length of time in chemical works or where other certain manufacturing processes are being carried on. It is also susceptible to condensation, which is another objection to its use in many situations. Water condensed inside the conduit, due to changes of temperature, and rust, rot the insulation on the wires and it then becomes simply a matter of time as to when leakages will take place, the period being governed by the quality of the wires installed and the amount of moisture present.

Lead-covered wires.—If V.I.R. and lead-covered wires are used in wet situations where traces of acid are present, the lead covering is quickly attacked and destroyed. It is particularly affected by electrolysis, and careful earthing of the sheathing must be carried out in order to prolong its life in this respect. Oil impregnated paper and lead-covered wires, as sometimes manufactured for house wiring, have been used in dry situations with success, but if the lead sheathing is injured they become useless. Under certain conditions the lead covering gradually crumbles away, especially where ammonia is present. Lead is likewise seriously affected when secured to damp brickwork and buried in new plaster. When lead-covered wires are used, very careful handling and skilled labour in erecting and jointing are necessary.

Cased wires.—V.I.R. wires cased in either tinned copper or soft metal suffer from most of the defects of lead covered wires, moreover they require a number of special accessories and wiremen experienced in the particular system to erect same. They are very subject to mechanical damage and where run in plaster require suitable protection. In chemical works and all similar situations they are useless.

General.—The above remarks only lightly touch upon the defects of the various systems enumerated, but they are sufficient to indicate that when any of them is used under adverse conditions, trouble with the installation will be experienced sooner or later.

The introduction of a system which would be suitable for all situations has, until lately, been considered an object almost impossible of attainment, and this will not occasion surprise when it is borne in mind that such a system must also be capable of satisfactorily meeting the requirements of any type of installation met with in practice.

The private house, public building, factory, and works each call for special treatment and as in many cases nowadays severe atmospheric conditions have to be contended with, it is a matter of no small difficulty to provide a method of wiring which will be equally effective under all circumstances.

In many situations, more especially in certain manufacturing works, the conditions are so varied that the achievement of one object defeats another.

Assuming all technical difficulties to be overcome, it is a great advantage to be able to employ a method of carrying out the work which will substantially resemble the means adopted when erecting casing, conduit or lead-covered wires, so that any competent wireman, without previous experience in the new system, can install it in a satisfactory manner and within a reasonable time.

Extensive deviations from the systems with which the workman is acquainted saddle the contractor with the expenses occasioned by his permanent staff having to acquire the necessary experience of the new method, and when pressure of work demands the employment of additional labour, he is at a still greater disadvantage.

The C.T.S. wiring system presents no difficulty in this respect, for it is practically identical with V.I.R. and lead covered wiring, so far as the simplicity of installing it is concerned, while it has the additional advantage that the wires may be very roughly handled and bent in any shape required without impairing their insulating and other qualities.

Wherever used, in the writer's experience, it has proved most successful, not only where it was adopted for house wiring and ordinary workshop installations, but where used in positions in which nearly every other system had been tried in the past and had failed.

The details of C.T.S. wiring may be briefly enumerated as follows:—

When used in wet and corrosive situations.—1. For working under the most severe conditions it may be depended upon to meet every possible requirement and, in the writer's opinion, will outlast any other system of wiring.

2. The fittings required in connection with this class of wiring are a novel form of corrosion-proof

junction-box (used for the purposes of jointing or looping the wires when necessary), a special type of corrosion-proof switch, and a lamp holder. These accessories must not be confused with the usual type of so-called acid-proof fittings, as the C.T.S. type *will* fully protect the ends of the wires against all outside corrosive influences. Ordinary good quality watertight ironclad distribution boards and main-switches can be used and the cases of these should be drilled as required to take ebonite glands. With the addition of a simple form of ebonite cleat, the system may be said to be complete and no further special accessories of any kind are required.

3. The wiring of an installation can be carried out by any competent wireman without previous experience of the C.T.S. system, and in less time than most other systems require.

When used under ordinary conditions.—1. For private house, workshop and factory wiring in dry situations, it provides a first class installation *without the use of any special accessories*, but a novel type of patented ebonite junction-box can be obtained in order to save looping the wires down to switches, &c. The wires may be run either concealed in floors, down partitions and behind wainscotting or, if desired, on the surface. They can be safely buried in plaster or laid direct in the ground, and they are equally impervious to moisture, acids, or chemical fumes, while vermin appear to ignore them.

2. *All ordinary switches, ceiling roses, distribution boards and other accessories can be used.*

3. The saving effected in running the wires, owing to there being neither casing nor tubing to erect nor special fittings to assemble, is at once apparent.

From the above remarks it will be clear that a system of wiring is provided which will satisfactorily cope with almost any condition that can arise in practice.

Comparison of Costs.—The cost of installing C.T.S. wires complete with ordinary accessories will compare favourably with any other good class wiring system, and the labour costs are specially low where C.T.S. wires are used for wiring buildings in course of construction and existing buildings where all work is required to be concealed, and therefore cutting away is entailed.

The following table is intended to give an idea of the approximate cost per point controlled by one switch for wiring carried out with various systems under average conditions. Pendants, lamps and shades are not included.

	Cost per point.	
	s.	d.
1. Heavy gauge screwed conduit	21	0
2. Brazed light gauge slip conduit with continuity fittings	14	6
3. Close joint ditto	10	6
4. Lead-covered V.I.R. wiring in damp situations	13	0
5. Ditto in dry positions	10	6
6. Stannos wiring used as concentric earthed return system	12	6
7. Ditto run as two separate conductors with copper sheathing as protection	22	0
8. Casing and V.I.R. wires	12	0
9. C.T.S. wires run in dry situations with ordinary accessories	13	6
10. V.I.R. wires run on porcelain cleats	9	6
11. Twin V.I.R. and cotton-covered flex on button insulators	8	6

The above figures can only be approximate, and they will vary very considerably according to the kind of fixings available.

The ease and rapidity with which C.T.S. wires can be run under floors and inside partitions, also on brick walls which are to be plastered, are exclusive features of this system and a revelation to those who have used lead covered and similar systems requiring a multitude of fitments. And, as labour is the chief factor in estimating for work, since there is usually very little difficulty in computing the material required, this important point will appeal favourably to prospective users.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

200 Telephone Electricians Wanted.

Your courtesy in putting my letter in your issue of January 1st. when I asked for some telephones for the Royal Artillery, has been rewarded, and I have been able to get in touch with several people who are providing the necessary instruments. May I ask you to help further, and insert an advertisement for men in the following form :

"200 telephone electricians wanted by the Royal Field Artillery for enlistment. Age 19-38 ; for three years or the duration of the war, or six years with the Colours and eight with the Reserve. Capable of repairing telephones and lines under fire. Will be taught Morse code and to ride. Army rates of pay at present prevailing. Must be able to pass usual medical examination.

"Apply in writing, stating age, height, qualifications and experience, to the Secretary of the National Service League, 72, Victoria Street, S.W., who will provide railway pass warrants for suitable men. Envelopes must be marked :—'Telephonists.'"

R. MacLeod,
Secretary, National Service League.

72, Victoria Street, London, S.W.
February 1st, 1915.

Jowers Protective Leakage Device.

Mr. Ernest F. Butler's letter in your issue of the 22nd inst. contains one or two mis-statements which we should like to correct.

We would beg to point out that this device is so arranged that on the occurrence of a leakage current the starter is automatically brought to the "off position and mechanically locked in that position until the starter cover has been taken off and the mechanical interlock removed. Once this has occurred, therefore, it is not possible for the "heedless operator" to make persistent efforts to start up the motor with a fault on it, as the starter arm is locked mechanically. It is not necessary, therefore, to bring the starter to the first contact ; in fact, it is impossible to do so.

The maximum current which can be broken on the first stop of the starter is, of course, limited by the starter resistance, and we cannot see how any arc which would burn the operator could take place. The point to remember is that the starter arm is locked off mechanically.

It is not claimed that the device is a perfect one to deal with every possible condition. Practical experience, however, shows that it deals with a very persistent cause of trouble, as follows :—

A fault develops on the motor which causes the overload release on the starter arm to operate. The user immediately starts the motor up again, and keeps on doing this until more serious trouble results. With this device, however, he is prevented from doing this, as the arm is mechanically locked off. His instructions then are to pull the main switch out and report the matter to the works, and a proper electrician looks into the matter and remedies the fault.

The device is intended for those cases where motors are installed on premises where a competent electrician is not always available, and it is believed that starters fitted with this device will have a great advantage over the practice hitherto followed.

The General Electric Co., Ltd.
A. Railing, *Director.*

Birmingham, *January 27th*, 1915.

A.C. v. D.C. for Lighting.

I have read with considerable interest and much wonder the series of statements made in Mr. Fowler's letter of the 23rd inst., published in your issue of to-day's date.

It would be a great relief to all classes of electrical workers if Mr. Fowler could explain fully his second paragraph. It seems to me that the question of the number of live wires is independent of the type of supply—unless an earth-return is used. If this rather unsatisfactory expedient is used, surely less trouble is likely to be experienced from the use of a low-voltage alternating current than from the continuous current with its attendant electrolytic tendencies.

As to the cost of the installation—on any but installations of comparatively large size, the branch cables are selected more from the view point of mechanical strength than from current-carrying capacity, and consequently the increase in cost due to the lower voltage will be small, except in the case of the main cables.

Mr. Fowler's experience with metal-filament lamps would seem to have been obtained with the older "squirted-filament" lamp, as a very wide experience shows that the drawn-wire lamp is certainly not excessively fragile. But any wire, however well made, is naturally increased in strength when it is increased in diameter, and so it stands to reason that the lower-voltage lamps are fundamentally stronger than the higher-voltage lamps of equal candle-power.

Mr. Fowler's knowledge of the conditions of service of metal lamps is amply indicated by the "hedging" which takes place in the latter part of his third paragraph. After having stated that 250-volt lamps are better than 110-volt lamps, he qualifies this by his reference to "traction lamps"—which are only made up to 125 volts.

Admitting the trouble caused by A.C. circuits in conjunction with accumulators—which I cannot see affects the lighting question (except in private supply stations)—my own opinion is that for general "handiness" for lighting purposes, low-voltage A.C. supply is by far superior to high-voltage D.C. supply. When the matter is considered from the point of view of the Electric Supply Co., the advantages of the former system become even more apparent.

The final sentence of the letter under discussion needs no comment, as it is a reiteration of the second paragraph.

C. A. Hall.

Monkseaton, *January 28th*, 1915.

I have read with interest Mr. Fowler's letter in your issue of January 29th, 1915, *re* lighting installations on the above systems, and would like to offer a few remarks on what Mr. Fowler points out as being the chief trouble with regard to A.C. supply.

Referring to the second paragraph in his letter on A.C. supply, his contention is that there are always two live wires at the point of entry into any room, and that there is always one terminal fully alive, even when the single-pole tumbler switch is off. I presume that by being "fully alive," he means alive at a potential above earth equal to the supply pressure. This difficulty can easily be overcome by permanently earthing one side of the system, and always seeing that the switch is connected in the live side of the circuit.

Take, for instance, a case where three-phase, four-wire, L.T. distribution is in operation, with the neutral or star point permanently earthed, and assuming a two-wire, single-phase lighting supply taken from it, I fail to see why a single-pole tumbler switch, connected in the live side, will not make the circuit dead or at earth potential.

Further, with reference to the last sentence in his letter, *re* D.C. supply, I suppose when he speaks of the live side of a D.C. circuit, he means the outer of a three-wire D.C. system, and the dead or harmless side the neutral of the same system, which is rendered so by permanently earthing at the supply end. What is possible with D.C. in this respect is possible with A.C., as is proved by the extensive use of Stannos copper-sheathed concentric cable for lighting installation work. When installing this, the inner or insulated conductor in a circuit is used as the live or switch wire, and the bare copper sheath or outer conductor is used as the neutral or dead side of the circuit, and is bonded and permanently connected to earth; in many instances, it is laid direct in the plaster on the walls.

I trust Mr. Fowler will agree that what I have said is quite feasible, for I can assure him that the above is now in operation in many towns.

P. Wardle.

Carlisle, *January 30th*, 1915.

The letter to you of the 8th inst., by "Ex-Gas," in reference to the above, and Mr. Stretton's reply in your issue of the 22nd inst., have been brought to my attention.

The effect of low frequency in causing objectionable fluctuations or flicker on tungsten-filament lamps has received a great deal of investigation, and a number of papers have been presented on this subject before the various engineering societies, particularly the American engineering societies. Mr. John W. Howell, in a paper before the Institute of Electrical Engineers, at New York City, put the practical point of the matter very clearly as follows:—

"The variation of light from a filament due to the variation in current caused by the successive impulses of an alternating current depends upon the heat capacity of the filament, the heat radiating characteristic and the resistance characteristic. Tungsten has a specific gravity about 10 times that of carbon and a specific heat one-fifth as great, so the heat capacity of a tungsten filament is about twice that of a carbon filament of the same dimensions. The heat radiating characteristic of tungsten is better than that of carbon because at a given temperature it radiates heat less rapidly than does carbon.

"The resistance characteristic of tungsten is also more favourable than that of carbon for the retention of energy and heat as the current wave recedes. All these physical characteristics of tungsten are, therefore, better than those of carbon in respect to the retention of heat, and they all tend to make the flicker of tungsten lamps less than that of carbon lamps of the same size filament.

"The actual diameters of tungsten filaments, however, are much smaller than those of carbon filaments of the same candle-power lamps, and this more than offsets the advantages of the other characteristics, for the flickering of tungsten lamps is greater than that of carbon lamps of the same candle power, while it is much less for lamps with the same size filaments."

Taking the matter practically, the question of flicker does not depend on the frequency on the lamp alone, but is very greatly influenced by the area and brightness of the illuminated surface within the field of vision.

As a general rule, Mazda lamps on 25-cycle circuits under ordinary conditions have been satisfactory in respect to flicker. Objectionable flicker increases as the wattage or size of the lamp decreases and the area of light service in the field of vision increases.

A 40-watt lamp, for example, in the centre of a room might show no objectionable flicker on 25 cycles, but the same lamp moved close to a light-coloured wall or ceiling is apt to result in an objectionable flicker effect. The tendency to objectionable flicker under any condition decreases very rapidly as the frequency is increased above the value of 25 cycles, so that on 40 cycles the liability of flicker being noticeable is much reduced. In general, it is desirable to avoid using frequencies as low as 25 cycles for general lighting work.

F. W. Willcox.

London, E.C., *January 25th*, 1915.

The Capture of German Foreign Trade.

I hope you will pardon me if I say that your efforts to impress on British electrical traders the importance of getting busy have caused me great amusement.

After some 25 years' Colonial experience of the British trader, the idea of his "capturing" a customer off his own bat is quite beyond belief. The patriotism of the Colonial may cause him to capture the trader, and so leave the latter to flatter himself that "alone he did it," but most decidedly, if precedent goes for anything, the position will not be reversed.

The British trader (electrical and otherwise) suffers from a number of more or less inherited disadvantages. One is his ingrained sense of superiority to the Colonial engineer. Another is his ignorance of what constitutes the British Empire, and the geography of the same. A third is a bland disregard of instructions, and of his customers' wishes generally. I have met many specimens of the British trader during his travels, or mine, and have to admit that he is usually a very fine fellow when once he has got over his surprise at finding that Colonial skins are the same hue as his own; that they speak English without the twang he has read so much about; that they have quite important electrical engineering projects completed or building; and that their knowledge of their profession is not necessarily a minus quantity. Once he has shed the above layers of insulation, he frequently becomes quite human, and even learns to conceal his superiority.

I have mentioned the British trader's ignorance of Colonial geography, which sometimes makes me wonder if maps are published in the British Isles. Here is an instance:—I had occasion recently to write from Dunedin, New Zealand, to a certain advertiser in your paper about his manufactures. He replied stating that Mr. So-and-So, of Geelong, had his agency in Australia, and suggested that I might drop in and see him. As Geelong is about 1,400 miles from Dunedin, and is a small and rather insignificant inland town in Victoria, with a very wet ocean intervening, I had to decline the invitation, and business did not result.

For quite a long time before war broke out I suspected that the British trader was mostly a German. My surmises seem to have been confirmed by the lists I have read in your columns of Germans trading under British names. There were two reasons for my suspicion. One was the unusual consideration given to our orders for material; the other the frequent difficulty in securing sworn declarations that the material was made in England. (These declarations are necessary in order to secure preferential tariff rates.) It is, however, only fair to admit that the neglect to sign declarations is not clear proof of the alien nature of the trader, because the genuine British trader seldom remembers to sign them either until the invoice has been returned to him for that purpose, and a cash deposit paid to the Customs Department at this end, in addition to the general inconvenience experienced.

Recently I sent a fairly large order for some material to one of your really British firms, and instructed them to be very careful to send a small portion of the material per post, otherwise an important contract would be delayed a month. Of course he packed this essential portion, which weighed about 3 lb., with the rest of the goods, and my company will have to wait for over a month for some large payments, due to the non-completion of the contract, which could otherwise have been finished a few days after the arrival of the goods. I need scarcely say that your British trader did not forget to draw on us at sight for his payment—and rightly so. I only mention this last point, because it is about the only one that never is neglected.

Let me give you another instance of your British trader. Some time ago my company ordered several hundred pieces of marble from a well-known firm, and explained that it was for electrical purposes. It duly arrived very badly packed, and was put into use. The first piece erected was a small slab for carrying the fuses for a house-lighting job, and as soon as current (230 volts) was switched on, the main fuses blew right across the terminals. Examination showed a metallic vein joining them. We naturally thought this was a solitary example, but when half-a-dozen other slabs in succession caused insulation troubles we thought it time to examine the rest of the consignment. We then found that every piece without exception was full of metallic veins, and quite useless for electrical purposes, and had to be scrapped. I wrote to the suppliers quite civilly, pointing out that we had ordered marble, and not samples of iron-ore, and that I thought they should replace the consignment sent, and at the same time I ordered a further lot. By the return mail I received a most indignant letter, stating that what I averred was utterly impossible; that they supplied marble to all the largest switchboard makers in England; and, finally, that unless we apologised for our libellous statements they absolutely declined to do further business with us. We get our marble from America now.

Once when I was a small boy temptation overcame me, and I swallowed a peppermint that I had promised to safeguard for my sister. To mark the occasion I was sentenced to write out 500 times: "An Englishman's word is his bond." It made quite an impression on me, but nothing to an experience I had last year with another of your enterprising British traders.

A certain problem required to be dealt with, and I sent full particulars to London to a firm that professed to specialise in this particular direction. I stated that we had to give our customer an absolute "no-cure-no-pay" guarantee, and that whatever they recommended and quoted for would have to be guaranteed in turn. They cabled out a quotation in due course. In order to be on the safe side I cabled back asking if they guaranteed the plant, and they replied that they did. To make a long story short, the plant sent was quite inadequate, and we had to spend a large sum of money besides losing all our profit, before fulfilling our guarantee. All this took over a year, and at various times I wrote your British trader (one of the sample British traders who is going to capture the German trade), and received various suggestions, all involving expense, which were carried out. Finally the contract was completed, and I then suggested that as we had entered into the contract in the first place entirely on this British trader's guarantee, he should at least reimburse us for our actual cash-out-of-pocket. I have lately received his refusal, but this time have handed the matter to our solicitors, and I hope you may yet read the details I have omitted—in your journal. "An Englishman's word is his bond"!

Contrast this with the treatment we received from an American firm. We required a certain piece of apparatus for operating on a 230-volt circuit. Unfortunately it arrived wound for 110 volts, and we were put to an expense of about £100 fixing the difficulty up. We reported this to the American maker, and by return received a full apology and a draft for the amount. I have had this sort of treatment several times from American firms.

All the instances given above occurred before the war. Now let me tell you how the British trader proceeded to capture Colonial business from the foreigner as soon as war broke out. It happened that my company had sent orders to England for several thousand pounds' worth of material of all kinds, and most of these orders were actually in hand at the time hostilities commenced. We were notified immediately that orders could not be filled, and where stocks were actually available prices were raised to an exorbitant degree—in some cases even doubled—although they had not cost one single penny more to make, up to then. It was simply a case where supplies were short, and the British trader saw a chance to make a large unearned profit on what he had. Of course I quite recognise that since the war started many articles which depended on Germany for raw material must increase in price. My remarks are confined to material made before the war started.

In New Zealand we have a Customs tariff that gives the British trader a considerable advantage over the effete foreigner. In my opinion it is a mistake, and simply tends to make the British trader lazy. If we trebled the preferential Customs duty, he would just raise his price in proportion, and pocket the extra profit.

I have stated that the British trader does not show consideration for his customers' wishes. I will offer one final example—an experience of a friend of mine. My friend wanted certain articles that are supplied in small wooden cases of somewhat flimsy nature. He has a special use for these cases afterwards, but usually finds that it is impossible to get the nails out without spoiling them. A few months back he was called upon by a British trader and a German. He asked whether these cases could not be supplied with screwed lids. The Britisher said that it would upset the routine of the works, and declined. The German agreed without any demur at all. The order went to Germany.

No doubt it will be objected that I have exaggerated, and shown prejudice in the instances that I have given you of bungling, &c. I can only assure you that my statements are strictly correct. My experience in business has been confined to British and Americans, and I have constantly declined to knowingly do business with Germans for years past, although a much greater profit could often have been made thereby. I have occasionally had German goods landed on me, but that was not my fault, but due to the fact that the British electrical trader appears to have been mostly a German.

The British trader is one everlasting source of exasperation. The American is courteous and considerate, and makes beautiful stuff, in spite of the British belief to the contrary.

If the British trader wants to capture the trade that has hitherto gone to foreign countries, he will have to mend his ways. Holding meetings, passing resolutions, writing to the papers, waiting for business to come to him instead of going after it; wearing a "superior" air; posting catalogues without mentioning the trade discounts; ignoring customers' reasonable (or sometimes even unreasonable) wishes; none of these will do it. When this war is over, Germany will have huge factories simply yelling for work at any price, and on any condition. Then will be the time the British trader will feel the pinch. Let him get busy capturing friends in the meantime. Here is one very willing victim. But I can't picture him doing it.

Galvo.

New Zealand, *December 18th*, 1914.

Salaries of Junior Engineers.

I do not think much of "Mr. Experienced's" knowledge of central station practice as exemplified by his ideas of the duties of a shift engineer.

Routine has, of course, some bearing on the matter, but very little. How about coal, oil and water testing; arrangements of labour owing to the absence of an individual; efficiency tests; hourly reading of thermometers for circulation water, flue, boiler, atmospheric, economiser and feed temperatures; observing that the vacuum is maintained at the highest possible and continual testing if vacuum is low; readings for atmospheric humidity; maintenance of CO_2 apparatus and proper distribution of fire in grates; observing ammeters and when and where to "split" in case of trouble; getting a feeder on to hospital bus-bars, in case of breakdown, in the minimum of time with the maximum of safety?

Add to this examination and recording of defects in plant, and statistics regarding coal, water and oil used per B.T.U., and it will be seen that there is not much chance either to play cards with the switchman or chat with the driver, and if one did so either all control or organising power would be lost at once, as well as all self-respect. I enclose my card.

Three to Eleven.

The letter appearing in your issue of January 22nd, signed "Experienced," should undoubtedly be treated with contempt rather than discussion, but the inference drawn from it makes it conclusive that "Experienced" knows very little of his subject. Although this will be apparent to the engineer reader, the Electrical Review, having a wide circulation, is read, among others, by members of municipal electricity committees.

Often these gentlemen, although successful business men, are not acquainted with the various duties and responsibilities, and the conditions under which the staffs of some of these undertakings work, consequently, "Experienced's" letter needs elucidating. For the benefit of these gentlemen, I would point out that the trained shift engineer, with or without college education, does *not* work by "Rule of thumb," neither is he the frivolous person depicted. He is mostly over the age of 25, and obtains his appointment in open competition. As regards the running of stations by automatic machinery, the introduction of mechanical stokers undoubtedly enables one fireman to work more boilers, yet the possibility of creating smoke and wasting fuel by the unskilled fireman is as great as ever.

Automatic voltage regulators merely dispense with volt boys. Regarding the statement that the real work is upon the station superintendent and his assistants, I should like to know who are his assistants if it is not the shift engineers? Often the superintendent's day is mapped out. He starts at 9 a.m., goes to dinner at 1 p.m., and finishes his day at 5 p.m., and has half-day Saturday and all day Sunday clear. A large portion of his time is occupied in making up works costs and fagging for the assistant engineer. During the most important times of the day these gentlemen are away; then the entire responsibility rests upon the shift engineer. As for the "good steady drivers," their duties consist of starting, stopping and oiling engines. This only occupies a fraction of their time, the rest of which is mostly spent in sitting down, reading and smoking.

The shift engineer's position is mostly one of responsibility without power, and he is for ever between the sandbanks and the deep sea. He is often blamed for the act of a mulish fireman, or an absent-minded driver, or even a fluctuation of pressure due to the fault of a badly-balanced network. The chief, being a busy man, cannot come into contact often with the shift engineers, whose reputation therefore is dependent to a great degree upon those above him, and it is often woe betide the shift engineer who excites their professional jealousy. From a perusal of past correspondence in the Electrical Press generally, the writer is of opinion that relationship, and political and social ties, often loom more prominently in promotion than abilities in some municipal undertakings.

In concluding, I would say to "Experienced" that we shift engineers do not work seven days a week and all holidays, only obtaining time off by working for each other, for fun. I contend that we have much more right to vent our grievance than many an ignorant driver, who knows nothing of the law of Ohm, properties of steam, combustion of fuel, or even the construction of his own engine, whose sole ambition is to spot a winner and who has never spent a copper on a technical journal in his life.

Mr. Ebben's letter, in my opinion, is far too gentlemanly for a Hyde Park oration, and so are the methods of the Association of Electrical Station Engineers. Let us fellow-shiftmen, where we are asked to give our services for a few pence more, or, perhaps, less, than the engine driver or fireman, join one of the great Unions of skilled workers, for it is apparent that only by doing so shall we obtain our emancipation from being

Slaves of the Lamp.

The following is an extract from a letter I have recently received from a member of the A.E.S.E., which is typical of many others:—"Regarding my subscription I am so thoroughly disgusted with the 'profession' that I am taking up a clerk's position in a short time and then will not be eligible for membership. After struggling for years on a pittance I managed to pass the A.M.I.E.E. examination, and still can only earn 35s. per week."

The obvious deduction from this is that the engineer managers of electric supply authorities fail to recognise the examination of the Institution of Electrical Engineers which we have been told should be the [illegible] of an electrical engineer. The majority of the engineer managers are members of the I.E.E.; one would almost believe that they had no confidence in their own Institution.

I will say no more at the present critical period of the nation's history, but will leave the foregoing to the conscience of the Institution of Electrical Engineers and that of the engineer managers.

W. J. Ebben,

Hon. Gen. Secretary, A.E.S.E.

London, N.E., *February 2nd*, 1915.

Wonderful Accumulator Cells.

Having read "A. W. B.'s" alleged reply to my letter, in which sulphate is as conspicuous by its absence as it is in my test cell, I may presume that my claim is not disputed. To close this rapidly diverging correspondence I offer a four-cell battery made up with celluloid, wood, ebonite and the "wonderful" separators, which, with the exception of the last, will be found, when totally discharged, to sulphate in the order as printed. I decline to be drawn into criticising any matters not appertaining to "A. W. B.'s" original letter.

A. Faraday Hawdon.

Newcastle-on-Tyne, *January 25th*, 1915.

["A. W. B.'s" letter was abbreviated by ourselves; it did contain references to sulphate, but as they appeared to be somewhat cryptic, if not incoherent, they were omitted.—Eds. Elec. Rev.]

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Direct-current Motors.

The British Thomson-Houston Co., Ltd., of Rugby, have introduced a new type of direct-current motor, known as the D.R., in which is incorporated the firm's very extensive experience in this class of work. Commutating poles have been incorporated in the design, giving a wider speed range with field control, and practically sparkless commutation.

The magnetic structure is arranged to render the motors free from objectionable hum, and ventilation is secured by means of a substantially-designed fan mounted at the back of the armature, the air being drawn through radial ducts in the armature core.

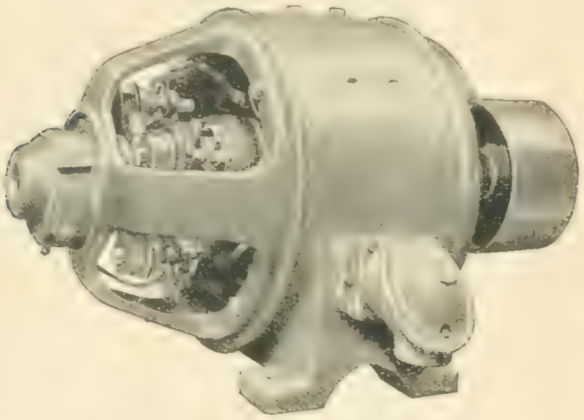


Fig. 1.—New Type B.T.H. Motor.

The commutators are also provided with ventilating ducts. The armature coils are vacuum dried and treated with special moisture and acid proof compound.

All D.R. motors have an overload capacity of 25 per cent. for 30 minutes, and will withstand a momentary overload of 100 per cent. without injurious sparking or heating, whilst all protected enclosed ventilated, drip proof and pipe ventilated type motors will operate for six hours with a maximum temperature rise (measured by thermometer) of 40° C.

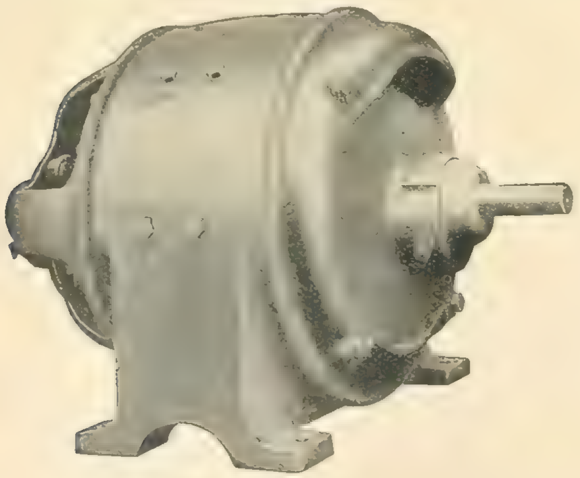


Fig. 2.—B.T.H. Motor showing Hooded End Shield.

The motors can be readily converted into protected, enclosed ventilated or drip proof types by the substitution or removal of covers, while to convert into pipe ventilated, or totally enclosed (water or gas-tight) types, it is only necessary to substitute one or both end shields respectively.

The bearings are carried on the end shields, and the latter can be turned through 90° or 180° to facilitate mounting the motor on the wall or ceiling.

The standard machines are either shunt or compound wound, but series wound motors can be supplied when required, also baseplates for motor generator sets.

A Series Lighting System.

With the advent of high amperage Mazda half-watt lamps, a large number of existing arc lamps are being replaced, especially for street lighting and similar purposes. In cases where lamps can be arranged to run in short series and where the temporary failure of the series through the breakdown of one of the lamps would not be serious, no special apparatus is required. Where lamps, however, are required to operate in long series, it is necessary to provide suitable apparatus to prevent the sudden extinction of a large number of lamps. The B.T.H. street lighting system provides the following alternatives:—

(*a*) Substitutional resistance with automatic cut-out for each lamp.

(*b*) Automatic constant-current transformer for each circuit with automatic film cut-out for each lamp.

(*c*) Automatic film cut-out only for each lamp.

System (*a*) is expensive where a large number of lamps have to be equipped, and where expense is a barrier, system (*b*) is recommended.

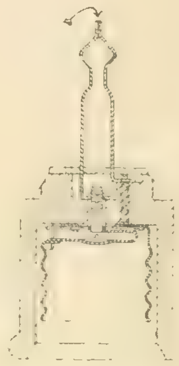


Fig. 3.

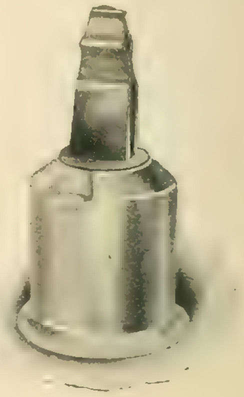


Fig. 4.

Fig. 5.

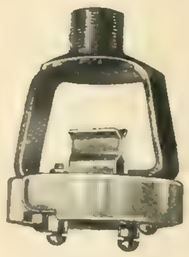


Fig. 6.

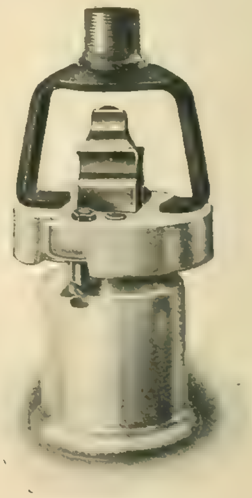


Fig. 7.

Automatic Film Cut-Out for Half-Watt Lamp.

In system (*c*) a short-circuiting cut-out to each lamp is satisfactory on ordinary circuits, providing that not less than 10 lamps are in the series, or where apparatus can be provided at the central station for plugging in an additional lamp where the ammeter shows that one of the lamps of the series has failed.

The automatic film cut-out referred to above in systems (*b*) and (*c*) is a most interesting accessory, which we have pleasure in describing and illustrating in this article. The disk (fig. 5) consists of two aluminium plates insulated from each other by a piece of chiffon veiling and held together by varnish. These disks will readily break down between 150 and 200 volts, and are placed between the prongs of the holder in the position shown in figs. 3 and 4. Fig. 6 shows the receptacle with the connecting clips. The holder is inserted into this receptacle as shown in fig. 7, and can be inserted or removed from the line of circuit without danger from, or interruption to, same. The spring contact of the holder upon removal of the lamp makes contact with the outer shell and completes the circuit, thus enabling a new cut-out to be fixed without puncturing same on replacement.

This interesting device is one of many articles described in price list No. ML-10,480, of the British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C. This price list shows a variety of waterproof lanterns, street lighting fittings, ironclad ship and mill fittings, &c., for Mazda lamps of all types.

Electric Hand-Grinding Machine.

The electric hand grinding machine, illustrated in fig. 8, has been designed with a view to obtaining the most practical arrangement of the hand grips, so that the weight of the motor is taken equally on the two hands, whilst at the same time this arrangement permits of the use of the grinding wheel in the most awkward situations. The machines are made for direct current or for three-phase, the direct-current machine having a ½-H.P. motor and the three-phase machine a ¾ H.P. motor. Both are suitable for use with emery wheels up to 4-in. diameter by ½-in. wide. As the machines can be supplied for all ordinary voltages, and are very inexpensive, they are finding some considerable favour in works and in foundries where they are primarily used for finishing off rough castings, and so avoiding much of the labour of chipping and rough filing. The motors are provided with special ball bearings so as to obtain the lightest possible running, and the switch is very conveniently placed on the top of the motor.

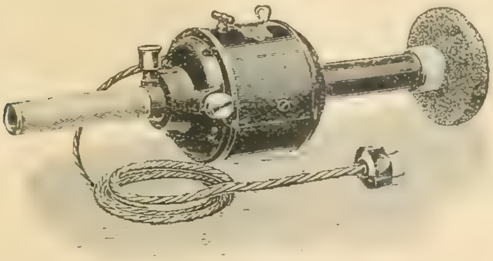


FIG. 8.—ELECTRIC HAND GRINDING MACHINE.

Further particulars can be obtained from MESSRS. MORRIS AND LISTER (LONDON), LTD., 3, Palace Chambers, Bridge Street, Westminster, or MESSRS. DRAKE & GORHAM, LTD, 1, Felix Street, Westminster.

Paragon Earthing Cone.

The Paragon patent earthing cone, which has been introduced by MESSRS. SCHOLEY & CO., LTD., of 56, Victoria Street, S.W., has been widely used abroad. As shown in fig. 9, it consists of a substantially constructed hollow cone made of pure copper, suitably perforated, and filled with small charcoal or coke. Running down through the cone and securely soldered to the copper tip at the bottom is a braided hollow copper cable, into which the earth wire is soldered. On the top of the cone is placed a copper cap. The dimensions of the cone vary from 1 to 2 ft. in length, and as the width at most is only a few inches it is readily installed at a small cost, a small hole being bored in the ground, and the cone being then surrounded with a mixture of coke and moist earth.

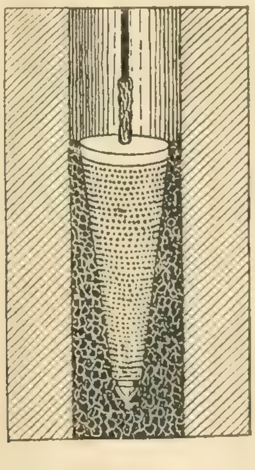


FIG. 9.—PARAGON EARTHING CONE, AS INSTALLED.

Beuttell Fittings.

MESSRS. A. W. BEUTTELL, LTD, have sent us particulars of a number of new patent fittings which they have designed for use with the tubular lamp for shop windows, cornice lighting, &c. The essential feature of the Beuttell system is the use of a rectilinear filament as the source of light, which can, of course, be accurately placed at the focus of a suitable reflector—more accurately than a bulb lamp, or any other electric light, except the arc. The focus of a bowl-shaped reflector is necessarily a mathematical point, whereas that of a cylindrical reflector is a line, with which the filament can be made to coincide; thus the optical requirements are strictly complied with in the case of the tube lamp and reflector, and a high degree of concentration of light can be obtained. In recent patterns the reflecting surface, when of silvered glass, has been given a corrugated shape, the corrugations being of defined depth and contour, and disposed obliquely to the line light source, to prevent the production of streaks; when a plain reflecting surface is used, a corrugated glass screen is interposed in the path of the light rays. The maximum candle-power can be raised to more than five times the rated C.P. of the lamp. Besides the well-known strip form of fitting, in various patterns, portable fittings for lighting showcases are now made, wood moulding strip (fig. 10) fittings for shop-windows such as that illustrated in fig. 11, theatre footlights, &c. Fig. 12 shows the polar distribution curve for the fitting illustrated in fig. 11.

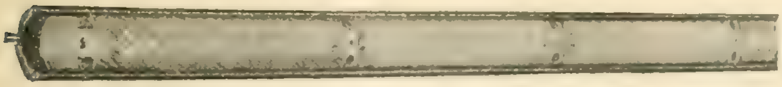


FIG. 10.—MOULDING STRIP WITH METAL REFLECTOR AND CORRUGATED GLASS SCREEN.

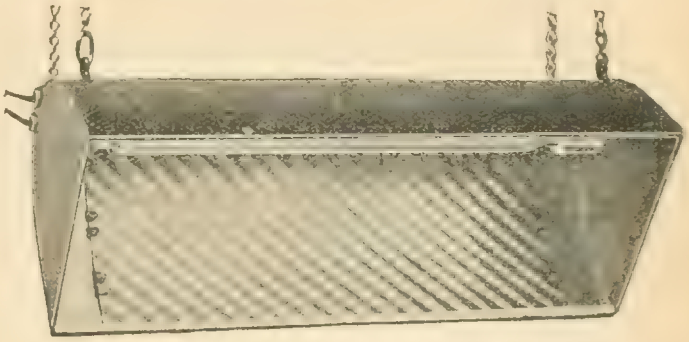


FIG. 11.—FITTING FOR SHALLOW SHOP WINDOW.

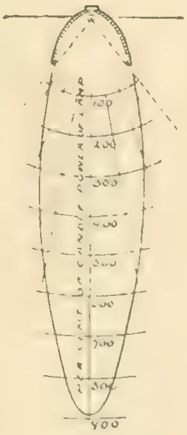


FIG. 12.—POLAR CURVE.

The fittings are sold by Messrs Siemens Bros., the Edison and Swan Co, and the Linolite Co., Ltd.

New Ladder.

MR. J. H HEATHMAN, of Parson's Green, Fulham, S.W. has devised an improved patent ladder which can be put to a variety of uses. As shown in fig 13, it consists of a set of three light but strong ladders, which can be used separately or together; two of the ladders can also be fastened together as a self-supporting trestle, and the third ladder can again be attached to these to give additional elevation, after the fashion of a very tall "step-ladder."

FIG. 13.—HEATHMAN "TREBLE" LADDERS.

Immersion Heater.

A neat device made by the ELECTROCALOR S.A., of Geneva, Switzerland, has recently been introduced to the English market; it consists of a pair of concentric carbon electrodes enclosed in a perforated earthenware sheath, and connected with a flexible cord and plug for attachment to a lampholder.

The circuit is entirely open until the heater (which is called the Thermo Fox) is inserted into a liquid which completes the circuit, and the voltage of the circuit is immaterial. Obviously, in brine or other well-conducting electrolytes the current would be excessive, and therefore, except when water or coffee is to be heated, the heater is enclosed in a nickel-plated jacket filled with water, which prevents the access of the outer solution or liquid to the electrodes. A rubber tube protects the flexible where it is connected to the heater.

The device possesses several novel features, and if used with reasonable care should prove very useful for a variety of purposes. It should be used only on A.C. circuits. The sole agency for this country is in the hands of **MR. E. MEYER**, of 62, Grosvenor Road, Highbury, N.

LEGAL.

EYDMANN v. THE PREMIER ACCUMULATOR CO., LTD.

THIS case came before the Court of Appeal, composed of the Master of the Rolls and Lord Justices Swinfen Eady and Phillimore, upon the appeal of the company (the employers) from the award of the Northampton County Court Judge in a claim made against the company under the Workmen's Compensation Acts by Mrs. Mabel Evelyn Eydmann and her infant children, as the widow and children of Harold Joseph Eydmann, a workman employed by the company.

While packing up lead-lined boxes at the Northampton borough generating station on April 7th last year, through one of the boxes slipping, Eydmann cut his thumb by a projecting piece of lead and septic poisoning set in, with the result that he died on May 31st. The County Court Judge awarded the applicants compensation. The ground of the present appeal was that the proper statutory notice of the accident had not been given, and that the appellants were prejudiced thereby.

At the conclusion of the arguments of counsel, their Lordships allowed the appeal, holding that the employers had not received proper notice of the accident, and that the applicants had not discharged the onus of proving that the employers were not prejudiced by the want of notice.

ELLIS v. FARADAY & SONS.

IN the King's Bench Division, on Monday, February 1st, before Mr. Justice Bailhache and a common jury, an action was brought against defendants, electrical engineers of Wardour Street, W., by Mrs. Maria Ellis, aged 72 years, to recover damages for alleged personal injuries sustained by the negligence of the defendants' servants. The defendants denied liability. The case for the plaintiff was that in January, 1914, she was knocked down by a box tricycle belonging to the defendants and was seriously injured, one of her legs being broken in two places. She was treated at the Middlesex Hospital, and subsequently through the injury to her leg she fell down and broke her right arm. She claimed to recover damages and £65 special expenditure incurred.

MR. HAROLD FARADAY said that it was suggested to him that £20 should be paid to settle. No agreement was arrived at, and the matter passed into the hands of the solicitors. The jury awarded plaintiff £100 damages. Judgment was entered accordingly.

HAMILTON v. MARCONI'S TELEGRAPH CO., LTD.

THIS pending action was mentioned to the Lord Chief Justice in the King's Bench Division and the hearing fixed for February 9th. Mr. Duke, K.C., said he appeared for the defendants and Sir Edward Carson, K.C., was for the plaintiff and the application was that the case should be fixed for hearing on February 9th.

His **LORDSHIP** inquired the reason, and was told that if the day was not fixed it might necessitate one counsel giving up his brief, which was undesirable now that the briefs had been read. His Lordship said the case would be in the list for hearing on February 9th.

UNDERWOOD v. BRITISH URALITE CO., LTD.

IN the City of London Court on January 28th, before his Honour Judge Rentoul, K.C., and a jury, an action was heard in which Mr. A. L. Underwood made a claim against the British Uralite Co., 1903, Ltd., to recover £90 as damages for breach of contract about the purchase of a Bruce Peebles generating set, comprising an engine and dynamo, then at Gravesend.

Mr. C. Doughty and Mr. Macaskie appeared for the plaintiff, and Mr. Morton Smith for the defendants.

MR. DOUGHTY explained that the plaintiff was a machinery broker and dealer in the City of London, who did a large business in buying machinery and selling it again. The claim raised an important question with regard to the principles on which machinery brokers and dealers dealing in electrical machinery, &c., did their business. There had been several dealings between the plaintiff and defendants. Defendants were in a large way of business, and at Gravesend they had large works. From time to time, no doubt owing to the various processes which the defendant company were interested in, parts of their machinery became out of date, or they desired to replace them with machinery of more modern type. When that occurred plaintiff had seen them and had found for them purchasers of that machinery. In those dealings it was the custom of the trade for the broker always to buy himself, and himself to sell to his own purchasers. He was not in any sense the real purchaser, in that he did not buy to keep. He always bought to sell, and, as a rule, he did not buy until he had sold on to somebody else. Plaintiff obtained particulars, photos and plans of the particular machinery which it was desired to sell. He then advertised it as if it were his own in all the ordinary trade papers, and being in that line of business all his life he knew through the knowledge he had acquired just where he could place the particular bit of machinery, whereas people like the defendants who might know their own business very well might have machinery on their hands for years because they did not know where to find a market for the machinery which they desired to sell. Plaintiff having found a purchaser then purchased from the defendants. There were occasions if the price was sufficiently tempting, when the plaintiff would himself buy the machinery as a speculation, hoping to find a purchaser afterwards. If he did that the price would have to be very low because there was a risk of putting down a considerable sum of money for heavy machinery, for which one had not an immediate purchaser on the market. The almost invariable custom was to find the purchaser first. That was to the advantage of the seller. If a broker was going to buy as a speculation he did so at a breakdown price. If he had a customer ready he bought at a price which would show a profit. In October defendants had a generating set for generating electricity for sale, and they got into communication with the plaintiff about it. His manager went to Gravesend to take particulars. It was a steam engine and dynamo that was for sale, also other electrical accessories. Plaintiff thought he could place the machinery if he could get an option on it. Defendants gave him an option for a week for the set at £250, thus undertaking not to sell it to anyone else for that time. Then plaintiff advertised it in those channels with which he was very familiar, and sent circulars round describing it. He came into communication in that way with Mr. Martin, a machinery broker in Birmingham, who knew who wanted the set. Correspondence passed between plaintiff and Martin, who knew one another very well. Martin brought to London Mr. Robinson, who was an engineer. Martin and Robinson went to the defendants to see the machine. Plaintiff's option had been renewed. On November 4th the buyer was ready to make a deal. The option for £250 was renewed till November 4th. It was arranged that the plaintiff should, at his own expense, go to Gravesend with the proposed buyer, and he dismantled the machine so that it might be properly examined. Plaintiff's men took down the cylinders and stripped it. It was satisfactory, and Robinson told the plaintiff the deal was as good as complete, but he must see his directors. Martin was going to pay £325 to the plaintiff, and Martin was to make a small commission of £30 from the buyers, whom he had disclosed to the plaintiff. There was no definite contract between the plaintiff and Robinson before November 4th, when the option expired. Therefore plaintiff did not actually accept the offer to buy at £250, because it was not necessary according to the views of all machinery brokers in London. He was confident that the set was as good as sold. Robinson was the engineer to Kynochs, of Birmingham, and he had been sent by them to look at the machine, although it was wanted by the Kynoch Town, near to Gravesend, the manager of which telephoned on November 13th to the defendants in perfect good faith, and said he wanted to speak to them about a generating set which their engineer had inspected. He agreed to buy the set from the defendants at £340, without even looking at it. Defendants accepted it, and the sale took place. Plaintiff was not complaining of Kynochs. Defendants knew perfectly well what they were doing, and made no communication to anyone. A director of Kynochs agreed to buy the set, and wrote to Martin offering £350. Martin telephoned to the plaintiff to say he would buy the set introduced by him. Then the defendants curtly said the set had been sold, and they would not say who were the purchasers. Plaintiff found out that it was Kynochs. Martin began to think that the plaintiff had "sold" him, but that was not so. Plaintiff now claimed his profit as the defendants' behaviour was contrary to all good business dealing and contrary to law.

MR. UNDERWOOD, the plaintiff, was called, and he said there was a custom in the machinery trade for firms who wanted to sell machinery, as defendants did, not to go behind the broker's back and effect a sale, thus saving his commission or profit.

MR. W. W. MARTIN, having been called, saying there was a very strict custom that the vendor was not to deal with the purchaser direct,

MR. M. J. PALEY, engineer, Kynoch Town, Stanford-le-Hope, supported the plaintiff's case, as did also **MR. A. G. BROWN**, of W. & E. Moore, Ltd., Poplar.

For the defence, **MR. KNIGHT**, manager to the defendants, said that the plaintiff had only had one previous transaction with them. The custom deposed to by the plaintiff did not exist. They had done nothing to cause the first sale to go off, nor to sell the machinery direct to Kynochs. They had no knowledge who the plaintiff took to Gravesend in the first place, and therefore there was no reason why they should not deal with Kynochs when they came along. Had plaintiff come to them in a proper manner and asked them to meet him, they would have done so. They had not gone behind the plaintiff's back, or done anything dishonourable.

JUDGE RENTOUL, K.C., summed up, and the jury found for the plaintiff for £71. Judgment was entered accordingly, with costs.

A stay of execution was ordered with a view to the defendants appealing, Mr. Morton Smith remarking that there was no justification for the verdict, having regard to the evidence which had been given.

Gutmacher *v.* Levy Bros. & Co.

In the City of London Court, on Tuesday, Mr. Edward J. Gutmacher, sales agent for Eastman Electric Machine Co., 1, Talbot Court, Gracechurch Street, sued Messrs. Levy Bros. & Co., 13-17, Goswell Road, for £3 for wiring and fitting up an electric installation for an Eastman electric cloth-cutting machine which plaintiffs sold to the defendants. He said he made an arrangement with the defendants that he should fit up the machine with electricity, and his electrician did the work. That was on October 1st. The work was done the same week. Defendants had sent him a guinea, which he returned as the amount was wholly insufficient. He supplied the machine on trial, and as it was not approved of it was returned. Now he wanted to be paid for fixing the electric installation. The machine was to be fitted free if it was purchased, but it was not.

Mr. F. Boustred, defendants' solicitor, said that as plaintiff told defendants he would have to pay for the installation, they agreed to give him a guinea towards the expenses, not because there was any liability upon them to do so. Plaintiff denied that.

Judge Atherley-Jones found for the plaintiff for 30s., and supposed the decision would not please either party.

Asuncion Tramway, Light and Power Co., Ltd. : Brazil Railway Co. *v.* The Company and Others.

This debenture-holders' action came before Mr. Justice Sargant in the Chancery Division on Tuesday, February 2nd, on a motion for judgment, in default of defence, the plaintiffs seeking to enforce their debenture security. Mr. Bischoff, for the plaintiffs, said that there was originally opposition by one gentleman, who had put in a defence in which he did not admit the amount of the advances made by the plaintiffs. His Lordship : Some advances were, however, admitted? Mr. Bischoff said yes, and that gentleman now appeared by Mr. Luxmon and did not oppose an order in the terms of the proposed minutes. Mr. H. E. Wright, for the company, raised no opposition to an order being made, and his Lordship pronounced the usual debenture decree directing the usual accounts and inquiries.

Macdonald *v.* L. & Y. Railway Co.

At the Liverpool Assizes, on January 28th, Mrs. Jane Macdonald, of Waterloo, the wife of an officer on H.M.S. *Carmania*, of the Cunard Line, was awarded £150 damages against the L. & Y. Railway Co. in respect of injuries. The plaintiff boarded an electric train at Bootle, thinking it was going to Waterloo, but the train went on the Aintree line, and, on pulling up at Ford Station, the plaintiff tried to alight. As she was doing so the train was suddenly started, and she was thrown on to the platform. The defence was that the plaintiff found herself in the wrong train, and made a rush to get out of the train when it was moving.

Judgment was entered for the plaintiff for £150.

OUR LEGAL QUERY COLUMN.

"Electric" writes: "I shall be pleased if you could help me in the following matter :—

"A tenant took a house from me for three years with gas light and asked if I would put electric light in the house. I could not run to this, but he then asked if I would allow him to put it in for his own benefit, this I agreed to. His time is up and he now threatens that unless I pay half the cost of wiring the house he will pull the wires out of the iron tubing.

"1. Please inform me if he can legally do this?

"2. If so, can I make him take away the tubing he has had plastered in the walls, and the switches, and make good with plaster and paper to match, and restore the gas as before, although the fittings were sold for old iron, &c.?"

⁂ There can be no doubt that where a tenant makes any alterations in the leased premises, the landlord is entitled either to (*a*) call upon him to restore the premises to their original condition, or (*b*) to annex any improvements made without paying the tenant any compensation therefor. In the present case there do not appear to have been any written terms of the letting. A tenant from year to year of a house is only bound to keep it wind and watertight, to use it in a tenant-like manner, and to make fair and tenantable repairs, such as putting in windows or doors that have been broken by him, so as to prevent waste and decay of the premises. He must not commit any waste, but he cannot be compelled to replace doors, windows or stairs worn out with age, or to re-roof the house, renew the main timbers, or execute other general or substantial repairs. Tenants for terms of years are, however, under more extensive obligations to repair, since it appears that they are liable for permissive waste, though tenants for life are not. "Electric" appears to have a tenant for a term of years, and had he put in electrical fittings without leave, he could be called upon to remove them. It is apprehended, however, that the fact of the landlord having given him leave to substitute electricity for gas will now make it difficult for the landlord to call upon him to take out the electric fittings and restore the gaspipes and the premises generally.

"Plume" writes : "I am chairman of a Corporation Electricity Committee. For some years we have been supplying current for photographic printing at power rates. We have now a Local Government auditor. Our town clerk says it is illegal to supply current at power rates for photo-printing, as it is lighting, and not power, and that if we continue the L.G.B. auditor will surcharge us, on the grounds that we are giving preferential terms to one section of tradesmen using light.

"At the last Committee meeting I produced letters from the following Corporations, showing that they all supply current for photo prints at power rates :—Liverpool, Leeds, Manchester, Bradford, Bristol, Birmingham, &c. In answer to these letters the town clerk said it is certainly illegal, but these Corporations have not L.G.B. auditors, otherwise they would not charge at power rates.

"1. Is it illegal to supply current for photo-printing at power rates?

"2. If we supply at power rates, are we liable to be surcharged?

"3. Can you quote any test cases bearing on the point?"

⁂ As to (1) the problem suggested is one which has never been decided in a Court of Law. It is conceived, however, that although the question is somewhat near the line, the use of electricity for photo-printing is user for lighting, and not for power purposes. In being so used, it is applied to the doing of that which could be better done by ordinary sunlight, and which might be done by gaslight. Moreover, one of the arguments adduced in support of the economic policy of supplying for power at lower rates than for light, is that in the former case the consumer will generally want to be supplied during the day, when the generators might otherwise be idle. Light for photo-printing would, in the ordinary course, be supplied by the sun during the day.

As to (2). In effect, supply at power rates does confer a favour upon a certain class of consumer, and would contravene Sec. 19 of the Electric Lighting Act, 1882, which provides that : "Where a supply of electricity is provided in any part of an area for private purposes, then except in so far as is otherwise provided by the terms of the licence, order, or special Act authorising such supply, every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply." Of course it might be argued, in answer to the complaint of an ordinary consumer, that "Plume" was being favoured, that "Plume" was not getting or using electricity "under similar circumstances." But it is apprehended that the broad distinction is between the use of electricity as a means of producing "light," and as a means of transmitting power. As to (3).—See answer to No. 1.

WAR ITEMS.

An Open Letter to Germany.—An electrician writing on board one of His Majesty's ships in the North Sea says:—"Can you not put an open letter to the German Fleet in your next issue? Do they really know how eager we are for a pitched battle?"

French Government Contracts.—The Board of Trade desire to draw the attention of manufacturers, merchants and shippers to the following regulations governing the export of articles destined for the use of the French Government:—

1. Application for permission to export to France goods of which the export is prohibited by Proclamation will receive special consideration if it can be clearly shown that the goods are destined for the use directly or indirectly of the French Government. Such applications must be made to the Commission Internationale de Ravitaillement, India House, Kingsway, W.C.

2. Documents issued by provincial military or naval officers, other local authorities, or Government contractors in France will not be recognised as evidence of the destination of the goods unless formally approved in writing by the competent department of the French Government.

3. British manufacturers, merchants and shippers are accordingly warned that, before entering into any contracts for the supply of goods stated to be for the use of the French Government, they should first obtain from their clients written evidence that the approval of the Ministry of War, Ministry of Marine, or other department concerned has been obtained.

4. Application for permission to export the articles in question must then be made in writing to the Commission Internationale de Ravitaillement, accompanied by the necessary documentary evidence. The applicants should not proceed with the execution of the order until they have satisfied themselves that a permit to export will be granted.

Any firms accepting contracts without complying with the above regulations will do so at their own risk and with full knowledge that permission to export the goods which they have contracted to supply may be refused.

Applications for permission to export goods which are ordered by firms or individuals in France for purely industrial purposes, and which are not destined for the use of the French Government, will continue to be made in the ordinary manner to the Commissioners of Customs and Excise, Customs House, E.C.

Mr. Alexander Siemens's Sympathies.—The "Times" publishes the following letter which was a few days ago addressed by him to the Royal Institution, of which he is secretary. It was read at the meeting of members held on Monday last:—

Caxton House, Westminster, London, S.W.,
February 1st.

It has come to my knowledge that a short declaration on my part, with regard to my position as a British subject, and with regard to my sentiments about the war, would be acceptable to the managers of the Royal Institution. I, therefore, venture to lay before you the following statement:—

I have been born in Hanover, both my parents having been British subjects until Hanover was separated from the United Kingdom in accordance with the provisions of the Salic Law.

In the year 1866 the kingdom of Hanover was annexed by Prussia, and thereby universal military service was introduced.

In July, 1867, I first came to England, and I went back to Germany in 1868 to absolve my military duties, but I was not accepted on account of my shortsightedness. I had, however, to present myself again, when the war against France broke out in July, 1870, and I joined a regiment of the Line for one year.

In October, 1871, I returned to London, where I have resided ever since.

As it became probable that I should spend my life in this country, I resolved to follow the example of the late Sir William Siemens by becoming a naturalized British subject.

To carry out this plan I obtained my formal release from German citizenship in March, 1878, and my certificate of naturalization (No. 2,671) was filed at the Home Office on August 16th, 1878.

Thus I have been a subject of the kingdom of Hanover for 19 years, of Prussia for 12 years, most of which time I spent in Germany, and of the United Kingdom for over 36 years, nearly all of which I spent in London.

As a consequence my sympathies in this war are entirely on the side of the Allies, and I cannot express strongly enough my abhorrence of the way in which Germany has disregarded international treaties and conventions, as to the conduct of hostilities, and more particularly of the raids made on unfortified watering-places in this country.

I should like to add that in return for the advantages I have enjoyed as a British subject, I have done my best to serve this country whenever an opportunity for doing so presented itself to me.

ALEX. SIEMENS.

The above statement by Mr. Siemens may be described as characteristically conscientious. It entirely confirms the opinion that we ourselves and a host of other admirers had formed of the writer during his 36 years' residence in this country in intimate and eminent connection with British electrical and engineering affairs.

German Engineers and their Prospects.—The official journal of the Association of German Engineers and Technicists, in a retrospect of the year 1914, reviews the effects of the war upon the prospects of German trained engineers and technical men. The review is written in a somewhat chastened style, contrasting agreeably with the We-are-the-Victorious-Elect bombast of the German generals and professors. "We are unable," says the paper, "nor do we wish at the present time, to probe the causes of this bloody war. But we must take account of the facts of the present conflict, no matter what may be our individual convictions on the question of the war itself. It is certain that the wholesale destruction of life of the world-war cannot be reconciled with our ideas of humanity. Yet, no abandonment of the struggle now begun is possible which would endanger German civilisation and German economic life. The civilisation of our country must not be destroyed, nor its economic strength shattered. The future of all technical employés in particular is bound up with a result of the war that shall be favourable for Germany. If Germany at the mercy of our enemies, were broken up not only territorially but also economically, it is the men of our profession who would be the worst sufferers. An economically vigorous German industry is the necessary premise for the social advancement of our members." "[illegible]."

British Aluminium Employés.—In connection with the British Aluminium Co., Ltd., an illuminated roll of honour has been prepared, bearing the names, ranks, and regiments of the employés who have enlisted, and surmounted by a pictorial representation of the rally to the flag. From the factories at Kinlochleven, Foyers, Burntisland, Milton, Larne Harbour, and Warrington, and from the head office, the total enlistments are 462. The Scottish regiments have claimed many of the recruits, the Argyll and Sutherland Highlanders having the honour of the highest individual total of all (66). The list includes the name of an officer in a French infantry regiment. The navy is also well represented.

Accrington Electricity Employés.—The Chairman of Accrington Electricity Committee reports that several of the specially trained staff are desirous of joining the colours, in addition to those who have already done so. As their places would be extremely difficult to fill, he has sought the Council's opinion as to what course should be taken. The question is now under consideration.

Silvertown War Relief Fund.—The employés of the India Rubber, Gutta Percha and Telegraph Works Co., Ltd. have subscribed £537 13s. 3d. in the last 21 weeks to the National Relief Fund, British Red Cross Society, and Belgian Relief Fund, and we understand that they hope to continue to distribute £100 monthly between these three funds for as long as may be necessary.

Personal.—Mr. W. J. Leeming, electrical engineer to the Buxton U.D.C., who has joined the Forces, has been presented by the staff with a set of hair brushes in a leather case. During his absence his duties will be undertaken by Mr. Copland, M.I.E.E., at Mr. Leeming's present salary, less £2 per week payable to Mr. Leeming, and with permission to continue his consulting work.

The Burnley Electricity Committee has decided that it cannot see its way to consenting to the enlistment of Mr. Starkie (electrical engineer), Mr. Taylor (assistant engineer), and Mr. G. D. Clegg (switchboard attendant).

Temporary Lieut. L. B. Hogarth, of the 11th Border Regiment, who, as announced in the "London Gazette," has been gazetted Temporary Captain, was, prior to the outbreak of war, electrical engineer at Whitehaven, having previously occupied the position of borough electrical engineer at Morecambe.

Mr. B. James, electrician, Glasbury, has joined the Military Wing of the Royal Flying Corps.

Mr. W. E. Jewell, electrical assistant to Mr. C. Jones, electrical engineer to the Metropolitan Railway, has joined His Majesty's Forces as Captain (Pioneer) in the 16th Royal Irish Rifles, and is at present stationed at Lurgan near Belfast.

Mr. J. Pendreich, of the Pendreich Electrical Firm, Edinburgh, has been with the Expeditionary Force since the commencement of hostilities. His address is:—Corpl. J. Pendreich, Army Service Corps, c/o Requisitioning Officer, 8th Infantry Brigade, 3rd Division, British Expeditionary Force.

In the "London Gazette" list of aliens to whom certificates of naturalisation have been granted lately the following appear:—

Wm. Sylvester de Ropp, Russia, electrical engineer, Kensington, London.

Geo. Henry Funck, Germany, director of the Lubricating and Fuel Oils, Ltd., Westminster, London.

Jean Baptiste Annibal Légé, France, engineer and scientific instrument maker, Chelsea, London.

Otto Jens Marstrand, U.S.A., assistant to a civil engineer, South Norwood, London.

Roll of Honour.—A report presented recently to the Bradford Tramways Committee shows that no fewer than 187 men from the department have been engaged in active service on the Continent. The following employés of the Department have been killed:—Conductor A. Eushworth, Cleaner W. E. Harvey, Driver J. Kemp, Conductor J. Bamford, Conductor A. Padfield, and Conductor G. Garnham. The following have been wounded:—Conductor J. Craven, Conductor A. Conderson, Conductor M. Ratcliffe, Cleaner C. Bennett, Conductor J. Holdsworth, Flagman H. Walker, Driver P. Parker, Driver J. Boothman, Driver P. Walker, Conductor H. R. Smith, Conductor H. Enderby, Conductor A. Morton, Conductor H. Lea, Conductor A. Cryer, Conductor A. Bernhardt, Conductor W. Lane, Conductor C. Dennison, Conductor E. Clubley, Cleaner J. McIver, Conductor H. Hoste, Cleaner J. Corey, and Driver W. S. Marshall. Conductors A. E. Marsden and W. Challis, and P. Binns (labourer) are prisoners in Germany.

Keeping Turbine Blades Clean.—Impure water, even though treated, is sometimes the cause of a fine coating of lime forming on turbine blades. Lime, magnesia and graphite carried over with steam from water used in the boilers at Leavenworth, Kan., formed an objectionable coating on the blades of the turbine, making it quite a task to keep the machine clean. But now, since it has been found that kerosene injected into the steam line will clean the blades, the turbine gives no more trouble. At a convenient spot in the steam line between the throttle and the valve rigging a small hand-pressure pump has been installed through which kerosene may be injected. Entering thus with the live steam, the oil particles are driven against all blades, and only an occasional injection from the pump is needed to keep the blades bright and clean.—*Electrical World.*

X-rays and Contraband.—At Boston, U.S.A., every bale of wool or cotton loaded for shipment to Germany is being subjected to an X-ray test for the prevention of the exportation of arms or other contraband that might be concealed inside. Representatives of the British Consulate are present with United States Customs officers to make assurance doubly sure.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

New Australian Tariff.

We reprint from the Sydney *Daily Telegraph* certain portions of the new Excise Tariff which may be of interest to our readers; our contemporary considers that the most pronounced feature is the extended charges against goods other than of British manufacture:—

	Produce of U.K.	General tariff.
Tariff items (in some cases the old tariff is given in brackets)—		
Copper wire, bars, plates, rods, tubes; lead sheet, piping; platinum bars, rods, strips; zinc bars, sheet; iron and steel tubes and pipes (except riveted or cast), ad. val. ...	Free	10 %
Rails, fishplates, bolts, ties, rods, switches, crossings, &c., for tramways or railways; rolled iron or steel joists, columns (not drilled), per ton...	17s. 6d.	25s.
Steam engine indicators, revolution counters, &c., ad. val.	Free	10 %
Rock boring, drilling, and coal-cutting machines, ad. val.	25 %	30 %
Motive power machinery and appliances (except electric), viz.:—		
(*a*) Economisers; mechanical stokers; steam traps; steam turbines; superheaters; water purifiers, ad val. ... ... (Free, 5 %)	Free	10 %
(*b*) High-speed reciprocating steam engines for direct coupling or directly coupled to electric generators or to pumps, subject to Departmental By-laws, ad val. ... (Free, 5 %)	25 %	30 %
(*c*) N.E.I., ad val. ... ...(20 %, 20 %)	25 %	30 %
Electrical machines and appliances:—		
(*a*) Electric heating and cooking appliances, ad val. ... ...(10 %, 15 %)	10 %	20 %
(*b*) Electric fittings consisting wholly or partly of metal, viz.:—Switches, fuses, and lightning arresters, ad val. ... ... (Free, free)	20 %	30 %
(*c*) Regulating, starting, and controlling apparatus for all electrical purposes, including distributing boards and switchboards, except telephone switchboards and telephone distributing boards, ad val. ... ...(20 %, 20 %)	20 %	30 %
(*d*) Dynamo-electric machines; static transformers and induction coils for all purposes; electric fans, ad val. ... ...(20 %, 25 %)	25 %	30 %
(*e*) Electric fittings not containing metal to be dutiable according to material.		
Electrical appliances, viz.:—		
(*a*) Telephones, telephone switchboards, telephone distributing boards, and appliances, ad val.	Free	10 %
(*b*) Electroliers; chandeliers; pendants; brackets; zinc tubing, ad val.	25 %	30 %
(*c*) N.E.I., ad val.	20 %	25 %
Electrical articles and materials, viz.:—		
(*a*) Accumulators or storage batteries; arc lamps; cable and wire (covered); carbon in blocks of 12 sq. in. and over; electric vacuum tubes; measuring and recording instruments; prepared insulating tape; anodes, cathodes, and hooks for plating purposes, ad val. (Free, 5 %)	Free	10 %
(*b*) Arc lamp carbons, ad val. ... (Free, 10 %)	Free	10 %
Lamps and lanterns; lampware, but not columns of street lamps, ad val.	15 %	25 %
Glass parts of lamps separately imported, ad val.	20 %	25 %
Miners' safety lamps, ad val.	Free	10 %
Glass cells for batteries, ad val.	Free	5 %
China and porcelain ware, ad val.	20 %	25 %
Kinematographs, ad val.	25 %	35 %
Rubber manufactures, in which rubber forms a part, ad val.	25 %	35 %
Chassis for electric railway and tramway vehicles, ad val.	25 %	30 %
Bodies for ditto, ad val.	35 %	45 %
Chassis for vehicles with self-contained power (electricity), not including rubber tires, ad val.	Free	10 %
Bodies for vehicles with self-contained power (electricity), including dashboards, footboards and mudguards:—		
Single-seated bodies, each	£15	£17
Double " " each	£21	£24 10s.
Bodies with fixed or movable canopy tops, each	£36	£42
Vehicles, n.e.i., ad val.	35 %	45 %
Thermit and other welding compounds, ad val. ...	20 %	25 %
Scientific, surgical, dental (electrical) instruments and appliances; machinery for educational use	Free	Free

BUSINESS NOTES.

Consular Notes.—TASMANIA.—*Hydro-electric Installation.*—The United States Consul at Hobart reports that the Government have purchased the partly-completed hydro-electric plant at Great Lake, about 60 miles from Hobart, and propose spending £100,000 at once towards it completion. A company has been working on this scheme for several years, and after spending nearly £500,000, had to cease work on account of lack of funds. It is intended to develop cheap power at Great Lake and transmit it to all parts of the State for industrial and lighting purposes. Most of the material and machinery necessary for this enterprise has been obtained. It is also proposed to spend over £400,000 upon railway and tramway construction work. While it is likely there may be some deductions therefrom, the United States Consul considers it practically certain that there will be much activity in this line of work during the current year, and that the demand upon foreign sources for all material necessary for such work, except sleepers, will be brisk. Such work is usually done by day labour under charge of the engineers of the State Railway Department.

BAGDAD.—*The Tramway and Lighting Scheme.*—The United States Consul at Bagdad reports the presence in that city of two surveyors who have been engaged in laying out the route for the proposed electric tramway. They were sent by the British interests controlling the concession, as a definite step to develop this enterprise. One of the chief hindrances to the construction of the tramway has been the narrowness of the Bagdad streets. The surveyors have now been ascertaining how many, and which, buildings must be removed, and what such removal would cost. In addition to the concession for the tramway, the same interests are reported to have secured a concession for the erection of an electric lighting plant in Bagdad. Before the introduction of the crude-oil engine the price of coal in Bagdad (53s. to 70s. per ton) contributed toward making the installation of an electric plant a precarious venture from a financial point of view; but if an electric lighting and power plant using oil for fuel can be built in connection with the tramway, much of this uncertainty would be removed, provided the first cost of installation (including street widenings for the tramways) does not prove to be excessive.

LISBON.—*Railway Electrification.*—The United States Consul-General at Lisbon reports the signature of a decree by the President of the Portuguese Republic for the electrification and lease of the railway connecting Lisbon with Cascais. The line is about 16 miles long and is owned by the Portuguese Railway Co. It serves the so-called Riviera of Portugal and, in the Consul's opinion, should be a paying investment. It is proposed to run electric trains every half hour and to make the entire run in 25 minutes.

SEVILLE.—*Tramway Extension.*—Writing on the subject of tramway extension at Seville, the American Consul there says that the river driveway in the direction of Palmera has undergone such changes during the past few years, with many new houses built in the Avenida de la Reina Victoria, that the Seville Tramway Co. have decided to extend their line to meet the needs of that neighbourhood. It is rumoured that work is about to commence on a new bull ring to seat 4,000 persons at Tabladilla, which will probably serve as an incentive to the early completion of the projected tramway extension. It is anticipated that the construction of this tramway will do a great deal towards urbanising the avenue mentioned, and that further improvements will result.

NORWAY.—*Electrical Manufacture.*—According to a recent report by the United States Consul at Christiania, motor factories in Norway are developing rapidly, many of them having been enlarged during the past 12 months, and new ones established. A number of these factories have been joined in a union called A/S Det Forenede Motorfabriker (United Motor Factories), with headquarters at Bergen. Norwegian motor factories are in close competition with the Swedish, Danish and American manufacturers. Manufacturers of electrical machines and apparatus had a successful year. One of the largest manufacturers in this line, specialising in telephone apparatus, established a branch factory in Italy.

KWANGTUNG.—In July last a contract was let to a [illegible] firm for the erection of a small electric light plant at Kongmoon, Kwangtung Province, China. The contract called for Swedish engines and German dynamos and fittings. The United States Consul reports that as a result of the war the machinery has not arrived, and, in his opinion, the course of prices is such that it is likely the contract will be annulled.

Book Notices.—The *Practical* [illegible] *Book and Diary* (London: Technical Publishing Co., Ltd., price 1s. 3d. post free) has been issued for 1915, with additions relating to electric motors, fuses, and wireless telegraphy; other features have been improved, and the useful lists of books appended to the various sections have been revised. A lengthy section is devoted to Acts of Parliament and Official Rules and Regulations, including those relating to electricity on board ship.

"Alternating Current Electricity." By W. H Timbie and H. H. Higbie. London: Chapman & Hall. Price [illegible]

Trade Announcements.—Mr. J. [illegible], electrical engineer, of 9, Cross Street, Wakefield, is retiring from business.

Messrs. Fyfe, Wilson & Co., of [illegible], Glasgow, inform us that they have secured the sole selling rights for the world of "Quartowatt" non-luminous heaters, which are manufactured in Glasgow.

Private Arrangements.—The Altheat Co., Ltd., 62, Oxford Street, London, W.—In pursuance of the provisions of the Companies' (Consolidation) Act, a meeting of the creditors of the above was held on Monday, at the offices of the liquidator, Mr. A. Slatter, 62, Oxford Street, W. The liquidator stated that the liabilities of the company amounted to £370, although that amount might be slightly increased. The assets consisted of stock and book debts £346, estimated to realise £268. A lot of the goods possessed by the company consisted of gas and electric radiators, which had been sold on sale or return. There were no unpaid calls in arrears. The company was a private concern and was formed to develop patent gas stoves and electric radiators. They had been put on a commercial basis, and last July negotiations were proceeding for the formation of a company, with a capital of £15,000. Those negotiations were put a stop to by the war. The company was formed in 1912, with a nominal capital of £5,000. Shares of the value of £2,000 were issued to the vendor (Dr. Wild) for his patents. Of the remaining 3,000 shares all but about £700 worth were subscribed for. In answer to questions the liquidator stated that sums amounting to £300 had been loaned to the company, and charges given on the patents. There was also a sum of £80 at the bank, which was likewise subject to the charge. The opinion was expressed by creditors that the whole of the charges on the patents could not hold good as against the creditors, and the liquidator said he himself was of the opinion that one charge for £150 could not be enforced. After shortly discussing the position the creditors decided that an application should be made to the Court for the appointment of Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby and Hawkins, 4, Charterhouse Square, E.C., to act as joint liquidator with Mr. Slatter in the winding up of the company. The liquidator stated that negotiations were in progress for the sale of the electric radiator patents, and for a reconstruction of the gas part of the business. The principal creditors are:—

Shaw & Hobbs, Birmingham	£43
Coalbrookdale Co., London	134
Phillips & Co., London	26
Bullen & Co., London	15

Stoker Contracts.—Among the more important orders recently received by the Underfeed Stoker Co., Ltd., are the following:—

War Office, Waltham Abbey, 4 B.; Charing Cross, West End and City electric supply department (repeat), 2 E.; Edinburgh Corporation electricity department (repeat), 8 D.; Barrow-in-Furness electricity department (repeat), 2 E.; Borough of Sunderland electricity department (repeat), 1 E.

Several orders have recently been received by Messrs. Ed. Bennis & Co., Ltd., for re-linking chain-grate stokers of another make with their patent chain-grate link. Among such orders is one from the Powell Duffryn Steam Coal Co., Ltd., Middle Duffryn power station, Mountain Ash, another from the British Xylonite Co., Ltd., Brantham Works, near Manningtree, and a third from the West Ham Corporation electricity station.

Catalogues and Lists.—Messrs. Scholey & Co., Ltd., 56, Victoria Street, Westminster, London, S.W.—8-page pamphlet entitled "How to Save Money in the Boiler-house," containing a description, with illustrations and diagrams, of the Cope's boiler-feed-regulator.

Messrs. Stewarts & Lloyds, Ltd., Winchester House, London, E.C.—42-page catalogue of Stewarts' patent steel pipes for gas, water, sewage, &c. Excellent photographic reproductions are shown of pipes in course of laying in Ceylon, Australia and elsewhere, and interesting information is given on such matters as the cost of laying, corrosion, protective coating, steel *versus* C.I. pipes; there is also a standard specification for lap-welded steel pipes.

Messrs. Kohler Bros. (incorporated with Crompton & Co., Ltd.), 56, Ludgate Hill, London, E.C.—8-page illustrated list describing the "Standard" type Kohler electric printing machinery system, two and four-motor drive, and giving a list of prominent newspaper offices where it is in use.

Messrs. Alfred Herbert, Ltd., Coventry.—Monthly machine tool review for January.

Liquidations.—The Universal Belting Co., Ltd.—A meeting will be held at 8, St. James's Square, Manchester, on March 6th, to hear an account of the winding up from the liquidator, Mr. J. A. Ashley.

Premier Lighting and Engineering Co., Ltd.—Mr. E. H. Hawkins, of 4, Charterhouse Square, E.C., has been appointed an additional liquidator in the voluntary winding up.

Acton Lamp Co., Ltd.—Mr. Justice Joyce has appointed Mr. J. Gibson Harris, F.C.A., Receiver and manager on behalf of the debenture-holders of this company, with power to carry on the business.

Tannett Walker & Co., Ltd., Hunslet, Leeds.—First meetings of creditors and contributories February 11th, at Leeds Law Institution, 1a, Albion Place, Leeds.

Bankruptcy Proceedings.—T. M. Woodcock, electrical engineer, Sheffield.—Trustee, (Mr. J. C. Clegg, Official Receiver, Figtree Lane, Sheffield), released December 21st, 1914.

H. H. Oxley (O. Huxley), consulting engineer, Hanwell.—A first dividend of 1s. 8d. in the £ is payable on February 3rd, at the office of the Official Receiver, 14, Bedford Row, W.C.

W. H. Pease, electrical engineer, Scarborough.—A first and final dividend of 5⅜d. in the £ is payable on February 2nd, at the Official Receiver's offices, 14, Figtree Lane, Sheffield.

J. G. M. Hilton, electrical engineer, Birmingham.—Last day for proofs for dividend February 17th. Trustee, Mr. A. S. Cully, Official Receiver, 191, Corporation Street, Birmingham.

New Zealand.—An Auckland firm is inquiring for British agencies for c.i. pipes, water meters, oil engines, motor-cars and accessories, and electrical goods of all kinds. Communications should be addressed to H.M. Trade Commissioner for New Zealand, P.O. Box 369, Wellington.—*B. of T. Journal.*

Tiflis.—A local merchant who has hitherto imported from Germany is inquiring for British agencies for scientific instruments, steelware, and electrical appliances. Further communications should be sent to the British Consulate at Tiflis.—*B. of T. Journal.*

Netherlands.—There is stated to be a demand in the Netherlands at present for electric wire and cable. Communications should be addressed to the British Consulate-General, Rotterdam.—*Board of Trade Journal.*

For Sale.—Aberdeen electricity department invites offers for the following second-hand plant: Two 100 K.V.A. Brush motor-generators complete; Stockton-on-Tees electricity department have for disposal one 150-KW. Brush "Universal" vertical reciprocating engine. Particulars are given in our advertisement pages to-day.

Calendar.—From Mr. K. C. Inouye, of 169, Motomachi Schichome, Yokohama, contracting agent of the Yokohama Electric Co., Ltd., we have received a wall calendar with daily slips for 1915.

LIGHTING and POWER NOTES.

Aberdeen.—The Electricity Committee reports that 1,315,900 units were generated in December last, against 1,203,850 in December of the previous year, an increase of 85,050 units.

Accrington.—Gas Engine Trials.—The Electricity Committee has declined to accede to a request from Messrs. Peebles & Son, Ltd., for a reduction of the price charged for electric current supplied to them under their agreement.

The borough electrical engineer reports that the second of the new gas-engine generators has been run on trials, and that it is hoped to put it into normal use in a few days. The new gas-making and by-product plant is working satisfactorily. All the 1914 contract machinery is working, with the exception of a few auxiliaries, and these will be rapidly put in working order.

Australia.—The Doncaster (Vic.) Council has decided to float a loan of £2,000 for the purpose of installing an electric lighting scheme in the shire.

Barrow.—The Electricity Committee has decided to provide a supply of current to the Corporation gasworks for stand-by plant.

Belfast.—The Council, on the recommendation of the Tramways and Electricity Committee, has appointed a Committee, with the electrical engineer, to visit Bradford, Sheffield, Leeds and Greenwich, to obtain information as to administration and other matters relating to the electrical undertaking.

Bispham.—New Loan.—The U.D.C. has decided to increase to £320 the amount for which the L.G.B.'s sanction has been asked in connection with the laying of electric lighting mains along Blackpool Road, this being the difference between the cost of overhead work and underground cables.

Blackpool.—Proposed Loan.—Application is to be made for L.G.B. sanction to the borrowing of £24,500 for electricity extensions.

Blackrock.—L.G.B. Inquiry.—On January 26th an inquiry was held into the application of the local U.D.C. for a loan of £13,000 for an electricity scheme. Evidence was given by Mr. Tierney, engineer of the scheme, and Mr. Spencer Hawes, who advocated Blackrock having its own scheme in preference to joining with Kingstown.

Brighouse.—Electric *v.* Steam Drive.—The Sewage Committee of the T.C. reports that as a result of substituting electricity for steam for driving the lime crusher at the sewage works, the saving for the past 12 months had been £180. The wages bill had been reduced; energy had cost £54 as against £94 the average cost of coal for the past four years, also 75 hours per week had been worked as against 57 previously.

Brymbo.—E.L. Scheme.—The Lighting Committee has received the consent of the Public Works Loan Commissioners to borrowing £300 for the proposed electric lighting scheme. The tender of Messrs. Loxley & Co. has been recommended for acceptance, and a meeting is to be called to determine the rate to be charged for the work which is to be carried out at once.

Chelmsford.—Restricted Lighting.—The Lighting Committee of the T.C. recommends that £200 be deducted from £417, the amount of the Electric Supply Corporation's account for the quarter, owing to the restricted lighting, and that the question of the amount of the rebate be considered at a future meeting.

Chile.—Messrs. Oscar Spoerer & Co. have permission to install an electric lighting system at the port of Tolcahuano.

Chorley.—Workhouse Lighting.—A deputation from the B. of G. is to visit Ormskirk workhouse to obtain particulars of the electrical installation in vogue for heating, lighting and power purposes.

Cleckheaton.—Bulk Supply Proposal.—The Electricity Committee of the D.C. has decided not to take a supplementary bulk supply from the Yorkshire Electric Power Co.'s station at Thornhill.

The scheme adopted for the extension of the electricity works, at a cost of £8,500, was deferred in order to consider the Yorkshire E.P. Co.'s offer.

Connah's Quay.—Prov. Order.—The Council is to apply to the B. of T. for a prov. order in connection with the proposed electric lighting scheme; there are only two objectors, viz, the G.C R. Co. and the Connah's Quay Gas and Water Co., and it has been decided to proceed with the scheme at once.

Continental.—Norway.—The Government has for years been buying up waterfalls in the various parts of the country with a view to keeping some in reserve and harnessing them as required. Last year the State acquired in all six waterfalls or large water rights, which purchase involved a total capital expenditure of £15,400, and in this year's budget there is included a sum of £5,500 for the same purpose, which most probably will be exceeded. The State has now become the owner of 38 waterfalls in all, which in unharnessed condition are estimated to represent a total of 156,490 electrical H.P. When the water is regulated and harnessed this amount will be brought up to 776,080 H P.

In regard to the situation of these waterfalls 12 800 H P. are located in the interior of the country, and a long distance from the sea, for which reason it is not possible to transmit the energy to the coast, and it will have to be employed for local purposes in the surrounding districts; 464,900 H.P. are, however, to be derived from waterfalls, from which energy can with advantage be transmitted to the coast; 100,420 H.P. have been bought up for the express purpose of supplying the necessary energy to the railways when these are electrified.

The remaining 197,600 are to be produced in falls which are situated in the direct vicinity of the coast.

The concessions given to private companies, and which are completed, number five in all. These are two concessions to the Rjukan Co. and one each to the Norwegian Electrical Metal Industry, the Moelven Pulp Manufactory and the Arendal Smelting Works, from which the State has derived fees amounting to £4,000 up to the present time.

Germany.—According to the *Electrical Review and Western Electrician*, a proposal has been submitted to the Prussian Ministry and the chief of the province of East Prussia suggesting the allocation of State funds for the electrification of the province, which has suffered severe damage. The dearth of labour and scarcity of horses will be obstacles in the way of revival of trade, and it is held that the use of electric power would be a remedy.

Cuba.—The *Gaceta Oficial* (Havana) announces that the following persons have been granted permission to install electric generating and lighting plant in Cuba:—Senor Eduardo R. Valera, at the town of Catalina de Güines, Province of Havana; Senor Manuel Andujar, at Báez, Province of Santa Clara; Senor Isidro Rovira, at Cabanas, Province of Pinar del Rio; Senor Donato Hernandez, at Arriete and Ciego Montero, Province of Santa Clara. In each case the concession will be rescinded if the plant is not in working order within a year from the date of the concession.—*Board of Trade Journal.*

Doncaster.—Hiring Clauses.—A poll of the burgesses on the trading clauses of the Corporation's Parliamentary Bill resulted as follows:—For Clause 129, which gives the Corporation power to let on hire electric appliances, &c., 796; against, 1,291.

Dublin.—The Lord Mayor, at a meeting of the City Electricity Committee, expressed regret that the past year's working of the undertaking had not been as satisfactory as had been hoped, the trading having been seriously affected by the war and other matters outside their control. The Lighting Committee, in a report to the Corporation, asked for the amalgamation of that Committee with the Electricity Committee, to avoid overlapping of work. The growth of the electricity concern may, it is thought, make it necessary to use the Tara Street premises as a distributing station.

Asylum Lighting.—Mr. R. Jones, chairman, at a meeting of the Richmond Asylum Joint Committee, mentioned that the saving on the substitution of electric light for gas in the institution more than paid all the annual charges and repayment of capital of the new installation.

Dundalk.—The Council's electric lighting scheme is now making a profit. There was a loss on the first nine months' working of £163, and also a slight loss on the second year's working.

Erith.—The Woolwich borough electrical engineer has asked the Erith Council to consider the question of taking a bulk supply of electricity from the Woolwich Council or to allow it to supply current in the Erith district. The matter was deferred until after the appointment of the new engineer.

Eccles.—Public Lighting.—The borough electrical engineer is to submit an estimate of the cost of the Barrow system of electric lighting, as carried out on the length of tramway track from Swinton to Irlams-o'-th'-Height.

The Electricity Supply Committee of the Corporation has received an inquiry for terms for supplying electricity to the Manchester Ship Canal landing stage at Irwell Park, and has replied that it will be in a position to consider terms for supply on receiving from the company its decision in regard to the Committee's application for permission to take water from the canal for condensing purposes.

Greenock.—New Loans.—The Corporation has decided to apply to the Scottish Office for permission to borrow an additional £20,000 for extensions. The T.C.'s plant represents a total capacity of 11,900 KW., of which 9,000 KW. is modern A C. plant, and it will be impossible to meet the obligations of the department next winter without an additional 5,000-KW. set. The £20,000 proposed to be borrowed is to be expended on the purchase of a new turbo-generator of 5,000-KW. capacity.

Haslingden.—New Loans.—Application is to be made to the L.G.B. for sanction to the borrowing of £7,500 for the provision of mains, £1,500 for services, and £3,000 for the provision of transformers, switchgear, &c., making £12,000 in all.

The Corporation has decided to supply electricity to the works of the Nobles Explosives Co., and Messrs. Haworth & Hartley.

So long as the public hall is used as a military hospital, a discount of one-third will be allowed off the charges for electricity.

Haworth.—The U.D.C. has decided to oppose the Yorkshire E.P. Co.'s proposed Bill.

Horrabridge.—E.L. Scheme.—The inauguration of the electric supply scheme took place last week; the installation, carried out by Messrs. Crompton & Co., includes a 25-H.P. Blackstone engine, coupled to a 15-KW. dynamo; a 12-H.P. water turbine, coupled to a 7-KW. dynamo; and a 200-ampere D.P. storage battery. Electricity is distributed by overhead wires to all parts of the village. Some 20 lamps, each of 50 C.P., are in use for street lighting.

Keighley.—The R.D.C. has decided to petition against the Yorkshire Electric Power Bill. With reference to the Keighley prov. order formal objection has been lodged and the Board has appointed representatives to meet a Committee of the Keighley Corporation with reference to the terms of the order.

Leigh-on-Sea.—Public Lighting.—Preparations are to be made by the Southend-on-Sea T.C. for installing the electric light at the Broadway, a business centre. Leigh is now comprised in the borough.

Lexden and Winstree.—Workhouse Lighting.—The B. of G. was informed that there had been a decrease in the cost of electricity during the past three months, and that in another 12 months the Board would have saved enough on electricity to defray the cost of the plant.

Limerick.—L.G.B. Inquiry.—On January 22nd, Mr. A. D. Price, L.G.B. Inspector, held an inquiry into an application by the Corporation for a loan of £5,000 for the purpose of providing additional plant at the electric power station.

Liverpool.—Annual Report.—The City Council has received sanction to borrow £40,000 for the provision of electric mains. The city electrical engineer, in his report on the estimates for 1915, remarks that during the past year the reconstruction of the Lister Drive, No. 1 station, has made satisfactory progress, and the first section of the boiler house has been completed, and the whole plant put in commercial service with very satisfactory results. The first of the 6,000-KW. sets has been run, and the second set is being assembled and will be completed very shortly. The engineer is of opinion that it would be advisable to deal with a portion of the plant in the destructor stations which has been in use for a considerable period, and has under consideration a scheme to replace some of these sets with plant of modern construction, and he has made provision for this work in the estimates. During the past year several trials have been made with electrical vehicles, and a 2-ton vehicle has been ordered to be used in connection with the cartage of mains' materials, stores, &c.

London.—The annual meeting of the Metropolitan Boroughs' Standing Joint Committee has decided to ask the City and Borough Councils to request their Members of Parliament to oppose the London Electric Supply (No. 2) Bill.

L.C.C. Bill Defeated.—At Tuesday's meeting of the L.C.C. the London and District Electricity Supply Bill, which has aroused so much opposition in the municipal circles interested, in and round London, failed to receive the necessary majority to enable it to proceed in the present session of Parliament. A total of 69 votes was necessary in favour of the Bill, but the voting was 61 in favour and [illegible] against, 14 Reform members being absent on active service. Sir John Benn, while admitting the technical part of the scheme was satisfactory, said the financial part was disastrous. Mr. Norman pointed out that if the scheme was abandoned, the Bill of the companies would hold the Parliamentary field.

Bethnal Green.—The B.C. has been recommended to oppose the London Electric Supply Bill. The Electricity Committee [illegible] of the electricity sub-stations proposed to be [illegible] Tyssen and Digby Streets.

[illegible].—It is proposed to apply to the L.C.C. for sanction to borrow £6,500, in connection with the installation of trunk feeder protective apparatus.

[illegible].—Street Lighting.—The Lighting Committee of the T.C. has considered the question of discontinuing the lighting of streets by electric lamps and reverting to gas lighting, but has postponed further consideration of the matter until its next meeting, in order that the borough engineer may furnish particulars of the annual expenditure in lighting streets by electricity.

Maidstone.—New Turbine Plant.—The Electricity Committee recommends that a 1,000-kw. turbo-alternator be installed, at a cost of £5,300, and also that notice be given to large consumers that owing to the great increase in the cost of coal it may be necessary to raise the price of current as from January 1st under new contracts.

Newbury.—Hospital Lighting.—It has been decided to have the electric light installed at the Isolation Hospital.

Oldham.—Supply of Motors.—Representatives of the Chamber of Trade have interviewed the chairman of the Electricity Committee of the Corporation, who explained the difficulty under which the department laboured in its endeavour to extend the use of electricity, and that no encouragement was given to people to apply to it, and only in certain cases had it supplied motors, when it was feared the business would be lost. The interview closed with an arrangement by which the members of the trade would co-operate with the department in extending the use of electricity in other directions.

Ormskirk.—At a meeting of ratepayers on January 29th it was unanimously decided to petition the U.D.C. urging opposition to the Ormskirk Gas and Electricity Bill, which the Ormskirk Gas Light Co. has promoted.

Penistone.—Workhouse Lighting.—The L.G.B. has sanctioned an expenditure of £124 for lighting the workhouse premises by electricity.

Peterborough.—Improved Working.—The revenue from the electricity works for December last was £1,299, as against £1,144 the previous year, and the surplus £828, as against £616. The engineer reported that the cost of production had been reduced from ·9d. per unit to ·76d., a reduction of 16 per cent. in generation costs, due to the greater efficiency of the turbo-generator and mechanical stokers, the whole of the new plant having been in use throughout the month.

Reigate.—Prov. Order.—The R.D.C. has decided to consent to the application of Mr. Gilbert Allom for a prov. order for E.L. at Chipstead.

Salford.—Sewage Pumping, &c.—A report with reference to the provision of electrically-driven pumping plant at the sewage works, has been approved. The T.C. has been recommended to authorise the purchase of an additional turbine-driven boiler-feed water pump and feed-water heater at the electricity station.

At the recent Council meeting a resolution was to be brought forward to the effect that a Special Committee be appointed to control the lighting of the borough, and that the Committee should consist of four members of the Electricity Committee, four members of the Gas Committee, along with six other members of the Council.

Southampton.—Tariffs.—The electrical engineer has reported upon the suggested adoption of a different type of charge for domestic purposes, *i.e.*, a fixed charge per annum based upon the rateable value of the premises (or upon the kw. installed) plus ½d. per unit metered, but does not recommend any alterations in the charges at the present time, in view of the fact that it had recently been decided that the flat rate was the most suitable for the town. The Council has agreed with the views of the engineer.

Stalybridge.—The Generating Station Committee of the Joint Board has authorised the engineer to spend not more than £25 on experimental lighting of workmen's dwellings.

The price of electricity for heating and cooking purposes has been fixed at ¾d. per unit net, subject to a meter rent of 6d. per quarter.

Stoke-on-Trent.—The L.G.B. has informed the Electricity Committee of the T.C. that it is not prepared to sanction a further loan in respect of land for the power house, and asking what steps the Council proposes to take with regard to the overdraft on revenue account of £6,890 on March 31st last. The Committee has decided to give an undertaking to liquidate the overdraft referred to during the next three years. The Finance Committee recommends the town clerk to try and arrange with the Board that the three years shall commence upon the termination of the war.

Swansea.—The Estates Committee has recommended the extension of a lease to a local timber merchant subject to his using electric power instead of suction gas, as to which complaints have been made. It was urged that this was a form of coercion, but eventually the Committee's recommendation was adopted.

Sunderland.—Receipts and Estimates.—The estimates of the Corporation supply undertaking for the year ending March, 1915, show a probable income of £65,801, as compared with £67,514 the previous year, made up as follows:—Power and heating, £33,610; private lighting and heating, £18 115; tramways, £11,339; sales department, £4,000; and public lighting, £2,735. The working expenses are estimated at £36,122, compared with £36,221 last year, the net revenue being £35,933, as against £37,296. After repayment of loans, interest and other outstanding charges the balance remaining of £6,852 will be placed to the renewals fund.

Surrey.—The County Council has unanimously decided to oppose the London Electric Supply Bill; the Richmond T.C. has already decided to petition against it.

Warrington.—School Lighting.—The Electricity and Tramways Committee's offer to provide electricity to Oakwood Avenue Council School, upon a guaranteed revenue of £50, has been accepted by the Education Committee.

Willesden.—The Electricity Committee of the U.D.C., reporting upon the effect of the war upon the amount of electricity used, stated that in the Christmas quarter of 1914 the number of units used was 1,387,533 as compared with 1,431,374 in 1913 and 1,211,760 in 1912.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Tramway Purchase.—The Corporation Tramways Committee, having under consideration the proposed purchase of the Suburban Co.'s system, has agreed to obtain the advice of Mr. Dalrymple as to the value of the undertaking.

Argentina.—The City and Suburbs of Buenos Aires Tramways Co., concessionaires of a tramway line from the municipal boundary to the Tigre, recently notified the Government of the Province of Buenos Aires that they found it impossible to comply with the requirement of the concession that the works of the first section should be terminated within 15 months. They therefore asked to be allowed 18 months, and the Provincial Government has accorded the extension of time asked for. —*Review of River Plate.*

Barnsley.—B. of T. Report.—Lieut.-Col. von Donop, in reporting on the tramway accident which occurred on December 2nd—which was reported in our pages at the time, and was due to the conductor of a car which was standing on a falling gradient, releasing the brakes by mistake when the driver was absent, thus allowing the car to run away down the hill—attributes it to want of care and promptitude on the part of the driver and conductor. The former he holds largely responsible, while the latter failed, apparently without reason, to apply the hand or slipper brakes from his end of the car. The inspector points out, however, that the short length of 1 in 50 gradient is not a suitable place for a tramway terminus, and that the driver should not be allowed to leave his car when it is standing there.

Barrow.—The T.C. has decided to urge upon the British Electric Traction Co. the necessity for increasing the number of electric tramway-cars at Barrow, the renewal of defective points, and greater passing place accommodation on the Abbey Road route.

Blackpool.—The Corporation proposes to borrow £675 for the purchase of four top-deck covers for tramcars.

Burnley.—A Sub-Committee is considering the application of the tramway employés for permission to form a rifle club at the depôt.

Continental.—Norway.—The electrification of the railway between Kiruna and the Riksgränsen Station on the Norwegian frontier has now been completed, and traffic was opened on January 19th. Loaded trains of 40 wagons are run at a speed of 60 km. per hour; previously the highest speed allowed was only 27 km. The work has been successfully carried out, although accompanied by some mishaps, among which may be mentioned that the telegraph line from Sweden to Narvik has been put out of service altogether, due to induction effects. Steps have now been taken to lay a double telegraph line. The telephone line is a double line supplied with discharging poles and transformers, and the induction on this is very small.

Prof. Pleyl and Engineer Holmgreen, of Stockholm, have now solved the problem in regard to induction as far as the telegraph line is concerned.

Edinburgh.—Tramway Extensions.—The Tramway Committee has considered the proposals of the County Council with regard to the proposed tramways in the city's prov. order. In the case of the Corstorphine extension there appears to be little difficulty in the way of an agreement between parties, and it is hoped that the line, the construction of which has become a pressing need since the opening of the Zoological Park, will be laid down. In regard to the Colinton-Craig Lockhart extension, difficulties have arisen regarding road widening. Recent developments in the Colinton district have shown need for transport facilities.

Eccles.—A Sub-Committee of the Salford Corporation is considering terms upon which the latter would be prepared to undertake liability for the repair and maintenance of the overhead tramway electrical equipment.

Halifax.—Nine Months' Working.—For the nine months ending December 31st, the income from the tramways was £87,907, and the expenditure £75,972, leaving a profit of £11,935.

India.—The Railway Board has decided to equip all passenger trains with electric light and to discontinue the use of gas for train lighting. Electric lighting is exclusively used on some of the narrow gauge lines.

London.—"Bakerloo" Extension Opened.—On Sunday last the greater part of the Queen's Park extension of the "Bakerloo" tube was opened for traffic, the line being completed, although the Queen's Park station is not yet available for use, so that a temporary terminus for passengers has been made at the preceding station, Kilburn Park, the other intervening stations to Paddington being Maida Vale and Warwick Avenue. All the stations are equipped with escalators between the booking halls and platforms below. The new line runs out into the open near Queen's Park, the last quarter mile being beside the North-Western line. Automatic and semi-automatic signalling on the McKenzie, Holland & Westinghouse Co.'s electro-pneumatic system has been installed, similar to that in use on the older section of the line, except that A.C. track circuits have been adopted. Ultimately it is intended to run four through trains an hour over the new line between Watford and the Elephant and Castle Station (the South London terminus), and there will also be numerous connections at Queen's Park between the North-Western Co.'s Watford service and the tube service, terminating at Queen's Park. At an inspection of the line on Friday last, four all-steel cars were used, fitted with a special system of radially opening doors, with safety indicators under the gateman's observation.

Manchester.—Tramway Extensions.—The Tramways Committee has intimated its willingness to pay the extra cost of an additional strip of land to be acquired for the purpose of widening the proposed new Southern Road from 80 to 108 ft., the object of the Committee being to have this additional strip specially reserved for tramway purposes on which a special type of tramway track would be constructed which would enable better transit facilities to be provided. It is recommended that steps be taken with a view to an application being made to Parliament for an extension of time for the construction of tramways in Stretford and Davyhulme, authorised by the Manchester Southern Tramways Act, 1903.

The all-night car service, which has now been in operation more than a year, and which has proved a great boon to night workers, is to be continued for another year.

Newcastle.—Female Conductors.—At a meeting of the Tramways Committee on January 28th, the general manager remarked on the scarcity of men in the city, and said that with the sanction of the Committee he was contemplating employing female conductors on some of the quieter routes. The matter will probably be brought forward at the next meeting of the Committee.

Rochdale.—Tramway Accident.—A collision occurred on January 27th between two tramway cars in Whitworth Road; both drivers' platforms were crushed and the drivers pinned against their control apparatus and seriously injured. Two passengers also complained of injury.

South Shields.—A Tramway Proposal.—An interesting proposal, brought before the Tramways Committee, is an extension of the system by incorporating with it the system of the Jarrow and South Shields Light Railway Co., which extends from Jarrow to Tyne Dock in South Shields, where it joins the system of the Corporation. The matter is still in embryo, but it is understood that shortly a deputation will wait upon the Jarrow Corporation to ascertain its views on the matter. About a dozen or more years ago the present proposal formed part of the scheme of the then South Shields Tramways Co., whose complete scheme included a line southwards to Sunderland, while other sections of what was practically the same scheme were intended to connect Jarrow with other towns on Tyneside, and, through Gateshead, westward with some of the colliery districts adjoining the latter borough. The ballot at South Shields as to the promotion of a Parliamentary Bill for (*inter alia*) tramway extensions, resulted in 2,376 voting for the proposal, and 1,180 against it, so that the Bill will be proceeded with.

Stalybridge.—Proposed Tramways.—The Ashton-under-Lyne T.C. and Denton, Audenshaw, and Limehurst D.C.'s have each decided to oppose in Parliament the Bill promoted by the Stalybridge Joint Tramways Board, one of the objects of which is to take over the tramways of the Oldham, Ashton and Hyde Electric Tramways Co., whose lease will shortly expire. The Parliamentary Bill is also being opposed by the Town Councils of Dukinfield and Mossley (who are part owners of the Joint Board Tramways), on the ground that the proposed extension of the tramways in the direction of Glossop is not required.

The Joint Board at a meeting on January 28th confirmed the promotion of the Bill. The General Purposes Committee has decided to insert a clause to the effect that no project for the supply of electricity or tramway service outside the four boroughs—Stalybridge, Hyde, Mossley and Dukinfield—be proceeded with unless two-thirds of the members of the Board vote in favour.

Sunderland.—Tramway Extensions.—The estimates for the year ending March 31st, 1915, show an anticipated total revenue of £74,882, compared with £75,226 (actual) for the previous year. The expenditure is put down at £42,246 for working expenses, and there is a balance of £32,636 to carry to the net revenue account. From the net revenue account £10,374 will be taken for the payment of loans, and £6,463 for interest, £1,217 for income-tax, £8,145 for the reserve and renewals fund, and £5,000 for the relief of the rates. This latter is the same amount as has been devoted for that purpose for several years.

U.S.A.—Co-operative Electric Vehicle Garages.—A scheme that is expected to give an impetus to the adoption of the pleasure type of electric motor vehicle is at present being developed by the New York Electric Vehicle Association. It is that of establishing a co-operative garage in the West-end of New York, specially adapted to the storage and maintenance of this type of automobile, at a uniform charge of £9 per month, this charge to also include the cost of the current required for the charging of the batteries, and the cleaning of the vehicles. In connection with the garage a showroom is to be established in which the cars made by the firms co-operating in the enterprise will be offered for sale.

TELEGRAPH and TELEPHONE NOTES.

Illicit Wireless Installations.—At Wood Green Police Court, on January 29th, S. W. White, 17, a wireless telegraph student, was charged with having in his possession, without the written permission of the Postmaster-General, a complete wireless installation. The accused was remanded on bail.

Long-Distance Telephony.—Telephonic communication has been inaugurated between Washington and San Francisco, *viâ* New York and *viâ* Boston, a distance of about 5,000 miles. The feat was made possible by loading the line with Pupin coils.

Telephonic Interruptions.—It is stated that the storm last month brought down more than 12,000 wires in London and the South of England—mainly in South London, where the service taken over from the National Telephone Co. is on the overhead system. The snow fell in a damp, clinging condition, and accumulated on the wires, afterwards freezing, and under these conditions a breeze brings them down wholesale. Owing to the shortage of labour, great difficulty has been experienced in repairing the damage, and it will take a considerable time to complete the work of restoration.

It is stated that 80 per cent. of the overhead lines south of the river broke down, and the storm was the worst on record in this respect. The snow formed a coating 1½ in. thick on the wires.

As 1,000 out of the normal staff of 4,000 men had enlisted, the Post Office engineers were severely handicapped, and were glad to have the assistance of 100 skilled linemen from the Royal Engineers, lent by the War Office.

The Telegraphic Union.—The *Journal Télégraphique*, the official organ of the International Bureau of the Telegraphic Union, at Berne, had to suspend publication in August last, but has resumed its activities with the issue for January 25th.

United States.—The Marconi Wireless Telegraph Co. of America, states that the trans-Atlantic high-power stations at New Brunswick, N.J., and Belmar, N.J., were completed and were being tested out when the European war interfered with the work, the English Government having commandeered the corresponding stations at Carnarvon and Towyn, Wales. The trans-Pacific service was opened on September 24th, and uninterrupted communication is being maintained with Honolulu. Within a few months the company's high-power stations in Massachusetts—the transmitting station in Marion and the receiving station in Chatham—will be complete and ready for service with Norway, Russia and Northern Europe. The Japanese station, which is to work in connection with the trans-Pacific system, will be ready at the end of April and will thus complete the trans-Pacific link.—*Telegraph and Telephone Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 6th. U.D.C. Twelve months' supply of cables, meters, joint-boxes, &c., lamps, uniforms, tickets and other stores. See "Official Notices" to-day.

Australia.—Brisbane.—March 10th. Motor generator, power board, &c., for Postmaster-General. See "Official Notices" January 15th.

Melbourne.—March 16th. White Wheatstone receiving tape, for Postmaster-General. See "Official Notices" to-day.

Aylesbury.—February 6th. U.D.C. Supply of electric motors to consumers (hire-purchase agreement). See "Official Notices" January 22nd.

Bedwas.—March 4th. Electrical goods for 12 months, for the Bedwas Navigation Colliery Co., Ltd. Forms of tender from the Secretary.

Belfast.—February 10th. Twelve months' supply of electric lamps, carbons, fittings, batteries, &c., for the Midland Railway Co. Northern Counties Committee (Ireland). Forms of tender from Mr. Ellis, Stores Superintendent, York Road Station, Belfast.

Birkenhead. — February 8th. Corporation. Twelve months' supply of electrical and tramway stores. Forms of tender from Mr. G. P. Shallcross, Borough Electrical Engineer, Craven Street.

Blackburn. — February 13th. Corporation. Twelve months' supply of stores, including a number of electrical items, for the Electricity Committee. See "Official Notices" Jan. 29th.

Blackpool. — February 17th. Corporation. Uniform clothing for tramway traffic staff. Traffic Superintendent's office, Blundell Street depôt.

Bolton. — February 11th. Corporation. Low-tension sub-station switchgear, for the Electricity Department. See "Official Notices" January 8th.

February 22nd. Corporation. Twelve months' supply of stores, for the Tramways Committee. See "Official Notices" to-day.

Bristol.—February 11th. Twelve months' supply of carbons, joint, junction and fuse boxes, wattmeters, ampere-hour meters, boiler castings, globes, &c. See "Official Notices" Jan. 29th.

Cardiff.—February 22nd. Installation, 750 points, at New Technical Institute, Cathays Park, for the City Council. See "Official Notices" January 22nd.

Colchester. — February 6th. Corporation. Twelve months' supply of stores, including lighting fittings, car equipment, overhead equipment, cable, &c. See "Official Notices" January 22nd.

Glasgow.—The General Finance Committee of the T.C. has remitted to ex-Bailie Arch. Campbell and the Superintendent of Clocks to arrange for the renewal of the electric clock batteries in connection with the installation of electric clocks in the north-western district of the city.

Gloucester. — April 1st. Twelve months' supply of stores, for the Electricity and Light Railways Committee. Forms of tender from Mr. F. H. Corson, General Manager, Light Railways Offices, Bristol Road.

Halifax.—February 15th. Corporation. Twelve months' supply of stores, including lighting fittings and electrical accessories, cables, telephone wire, meters, &c. See "Official Notices" January 22nd.

Ilford. — February 23rd. U.D.C. Twelve months' supply of stores for the electricity works. See "Official Notices" to-day.

Llandudno. — February 12th. U.D.C. 440-B.H.P. compound condensing steam engine, and 300-KW. multipolar dynamo, &c. Particulars from the Clerk, Town Hall.

Leeds.—February 20th. Corporation. Twelve months' supply of stores, including cable, mains boxes and fittings, jointing and insulating material, electric lamps, fittings, &c., for Electric Lighting Department. See "Official Notices" January 22nd.

February 17th. Electrical work, Hough Lane School, Bramley, for the Education Committee. Education Architect.

London.—BERMONDSEY.—February 5th. B.C. Twelve months' supply of carbons and brushes, cable and jointing material, stoneware conduits, meters, demand indicators, main fuses, oils, meter boards, street frames, covers and joint-boxes. See "Official Notices" January 22nd.

L.C.C.—February 10th. Installation (184 wiring points, 246 lighting points) at Scawfell Street Elementary School, Hackney. See "Official Notices" January 29th.

H.M. OFFICE OF WORKS.—February 12th. Cylinder and machinery oils for one year. Controller of Supplies, 18, Queen Anne's Gate, S.W.

ISLINGTON.—February 24th. Twelve months' supply of electrical stores, for the B.C. See "Official Notices" to-day.

ST. PANCRAS.—February 15th. B.C. Arc lamp carbons, for the Electricity Department. See "Official Notices" January 29th.

ST. MARYLEBONE.—February 17th. Stores, including meter-boards, casings, &c., cables, box compound and insulating materials, &c., for Electricity Department. See "Official Notices" Jan. 29th.

Manchester. — February 16th. Corporation. Twelve months' supply of stores for the Tramway Department. See "Official Notices" January 29th.

Newcastle-under-Lyme.—February 5th. Three-wire single, L.T. paper, lead-covered cable, armoured feeder and distributor mains, for the Electricity Department. See "Official Notices" January 22nd.

Portsmouth. — February 16th. Corporation. Six months' supply of stores, for the Tramway Committee. See "Official Notices" to-day.

Rotherham. — February 22nd. Corporation. Two water-tube boilers, automatic mechanical stokers, economisers, superheaters, foundations, steel chimneys, steam valves, steam pipes, induced-draught plants, and all auxiliaries. See "Official Notices" January 29th.

Southend-on-Sea.—February 5th. Corporation. 140 tons of Sandberg steel rails and fishplates (specifications, &c., £2 2s., returnable), and 26 steel poles with brackets and scrolls. Mr. E. J. Elford, Borough Engineer, Clarence Road.

Spain.—February 15th. The municipal authorities of Prat del Llobregat (province of Barcelona) are inviting tenders for the concession for the electric lighting of the town during a period of 15 years.

February 18th. Tenders are being invited by the municipal authorities of Canalejas de Penafiel (province of Valladolid) for the concession for the electric lighting of the town.

Stockton-on-Tees.—February 19th. Corporation. Two 500-KW. rotary converters, transformers and starting apparatus. See "Official Notices" to-day.

Swindon. — February 17th. Corporation. Four-way and other stoneware conduits, for the Electricity and Tramway Department. See "Official Notices" to-day.

CLOSED.

Bolton.—The Electricity Committee has accepted the tender of Mr. Wm. Gornall for the construction of the Bradshawgate sub-station.

Delagoa Bay.—A contract for 12 months' supply of direct-current ampere-hour meters to the Delagoa Bay Development Corporation has been placed with the Electrical Apparatus Co., Ltd.

Glasgow. — The Tramways Committee recommends acceptance of the following tenders :—

Commutators.—P. R. Jackson & Co., Ltd.
Lead-covered cables.—J. Hally Craig.
Motor armature coils.—Manchester Armature Repair Co.
D.C.C. wire.—B.I. & Helsby Cables, Ltd. ; London Electric Wire Co. and Smiths, Ltd.

The Committee has accepted the offer of the Otis Elevator Co., Ltd., for a new goods elevator in the extension of the head office, and an alteration on the existing passenger lift at the head office.

The Clyde Navigation Trustees have accepted the offer of the St. Helens Cable Co., Ltd., for the supply of electric cable.

Huddersfield.—The Electrical Apparatus Co., Ltd., has received a contract for 1,000 single-phase meters for the Corporation.

Hull.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., amounting to £135, for three motors (10 H.P.), for driving the machinery in the new workshops, has been accepted by the Corporation Tramways Committee.

Leyton.—The tender of Mr. R. H. Bacon has been accepted by the U.D.C., at £125 10s., for work at the water-cooling tower.

Having regard to the present difficulty in the supply of materials, the Urban District Council has decided, in connection with the contracts expiring on March 31st next, to obtain quotations for a six months' supply only of service-line cable and arc lamp carbons. With regard to engine oils, the Electrical Engineer has been directed to communicate with the present contractors with a view to the renewal of their contracts upon the same terms. Messrs. W. Cory & Sons, contractors for the supply of slack coal to the electricity works, cannot now undertake to supply at contract price up to more than 50 or 60 per cent. of the quantities ordered. The firm offers to make up the balance with other equal nutty slack at a price which is 2s. above the contract rates. Having regard to the fact that no good purpose would be served by inviting tenders (the present contract expiring on March 31st next), the Electrical Engineer has been authorised to make the best arrangements he can with the present contractors or others for the supply of the slack.

Liverpool.—The City Council has been recommended to accept the following tenders :—

Sutton Heath and Lea Green Collieries Co , Ltd.—Annual supply of best quality steam slack.
Walter Scott, Ltd.—2,500 tons, Sandberg silicon steel tramway rails, 131 lb. per lineal yard ; 300 tons, Sandberg silicon steel tramway rails, 130 lb. per lineal yard, for curves ; and 40 tons, fishplates.
Hadfields, Ltd.—100 tons tie-bars.

London.—Shoreditch.—The Electricity Committee has received the following tenders for the supply of lead-covered, paper-insulated single and twin cable required for services during the period ending March, 1915 :—

	·0024 sq. in., single.	·035 sq. in., single.	·095 sq. in., single.	·0224 sq. in., twin.	
Siemens Bros. & Co., Ltd. (accepted)	£70	£87	£187	£185	Per mile.
Western Electric Co., Ltd.	71	88	178	187	
W. T. Henley's Tele. Works Co., Ltd. ..	72	89	180	180	
W. T. Glover & Co., Ltd.	72	90	179	187	
B.I. & Helsby Cables, Ltd...	72	90	182	192	

To be in accordance with the specification of the British Engineering Standards Committee, and, as regards the single cable, suitable for a working pressure of 660 volts D.C., and the twin cable 1,100 volts D.C.

Hammersmith.—The Electricity Committee reports that four tenders only were received for the supply of mechanical stoker coal for a period of one to three years, and in each case the tenderers added conditions which made the acceptance of the tenders without value. In these circumstances, and with the object of increasing and maintaining the coal reserve, the Committee has authorised the borough electrical engineer, in consultation with the chairman and, where possible, with the Committee, to accept satisfactory offers of coal up to 3 000 tons, advantage being taken as far as possible of the prices offered by the tenderers.

Stepney.—The B.C. Electricity Committee reports the purchase of 4,300 tons of coal for the electricity undertaking in lots of 100 to 500 tons, at prices ranging from 8s. 9d. to 19s. 6d. per ton ; also the acceptance of the offer of Messrs. Foster & Co. to supply 100 tons per week of Kingsbury fine slack coal at 10s. 1d. per ton for 12 months from February 1st, for the Limehouse generating station. The Borough Electrical Engineer reports that the British Central Electrical Co., Ltd., have informed him that, as the French Government have prohibited the exportation of carbons, they are unable to carry out their tender for 10.000 pairs of carbons accepted by the Council on January 6th. The Committee reports that, on the advice of the Electrical Engineer, it recommends the acceptance of the quotation of Messrs. Geipel & Co. to supply 10,000 pairs of carbons of the National Carbon Co.'s make, at £12 15s. per 1,000 pairs, the order to be placed as and when required. The Committee also reports the acceptance of the offer of Messrs. W. Geipel & Co. for 7,000 pairs of flame arc carbons, at 18s. per 100 pairs.

L C.C.—A contract for the supply of electric lamps (Schedule No. 17) has been placed with the Edison & Swan United Electric Light Co., Ltd. Items 8 to 27 (metallic-filament lamps with filaments of "drawn" wire in one continuous length).

Manchester.—The following tenders have been accepted by the Electricity Committee :—

Two 500-K.V.A. additional transformers.—Johnson & Phillips, Ltd.
One 500-K.W. additional motor-converter.—Bruce Peebles & Co., Ltd.
Cable.—B.I. & Helsby Cables, Ltd.
Copper to be made up into cables.—B.I. & Helsby Cables, Ltd.

The Education Committee has accepted the tender of Messrs. Higgins & Co., Manchester, for the electric light installation at the Old Hall Drive Municipal School.

The Tramways Committee has accepted the following tenders :—

Permanent-way special trackwork.—Hadfields, Ltd. ; Titan Trackwork Co., Ltd. ; Lorain Steel Co.
Permanent-way points, tongues and hardened-steel centres.—Edgar Allen and Co., Ltd.

Neath.—The U.D.C. has placed a 12-months' meter contract with the Electrical Apparatus Co., Ltd.

Romford.—The following tenders have been received by the Guardians for the reorganisation of the House telephone service, including the provision of new cables, instruments and batteries :—

Private Telephone & Electric Co., Ltd.	£59
General Electric Co., Ltd.	76
F. A. Greene	90
F. Hodgson & Co.	92
Gent & Co., Ltd. .. .. (withdrawn)	—
Siemens Bros. & Co., Ltd. .. .. „	–
Young & Marten, Ltd.	93
Turnham & Co.	94

The lowest tender has been recommended for acceptance.

Ship Lighting.—A contract for the supply of "Royal Ediswan" lamps for one year has been given by the British India Steam Navigation Co. to the Edison & Swan United Electric Light Co., Ltd.

Southampton.—The T.C. has decided to extend the contract with the British Electric Transformer Co. for a further period of two years.

Stalybridge.—The Joint Board has accepted the tender of the Sturtevant Engineering Co., Ltd., for two air filters.

York.—The Electricity Committee recommends the acceptance of the tender of the Worthington Pump Co., Ltd., for a forced-draught cooling tower, at £2,126, including the cost of foundations for a second tower when required, and the tender of the British Thomson-Houston Co., for alterations and improvements to the switchboard at the Electricity Works, at £176 10s. 6d. It also recommends the acceptance of the tender of the same company for specially designed switchgear required in connection with the charging of the electric omnibuses, at £80 per set for each of the two boosters.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Friday, February 5th. At 9 p.m. At Albemarle Street, W. Paper on "Science and Industrial Problems," by Prof. A. W. Crossley, F.R.S.

Association of Mining Electrical Engineers (London Branch).—Friday, February 5th. At 8 p.m. At Northampton Polytechnic Institute, St. John Street, Clerkenwell, E.C. Paper on "Protective Devices Against Lightning and Surges," by Messrs. E. K. Scott and L. F. Frogarty.

Electro-Harmonic Society.—Monday, February 8th. At Holborn Restaurant. Ladies' Night.

Institution of Mechanical Engineers (Graduates' Association).—Monday, February 8th. At 8 p.m. At Storey's Gate, S.W. Annual Lecture on "History of the Metallurgy of Iron and Steel," by Sir R. A. Hadfield, F.R.S.

Institution of Civil Engineers.—Tuesday, February 9th. At 8 p.m. At Great George Street, S.W. Paper on "Engineering Operations for the Prevention of Malaria," by Mr. F. D. Evans.

Association of Engineers-in-Charge.—Wednesday, February 10th. At 7 30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Boilers and Boiler Mountings," by Mr. Vernon Smith.

Saturday, February 13th. Social and Dance.

Institution of Automobile Engineers.—Wednesday, February 10th. At 8 p.m. At Institution of Mechanical Engineers, Storey's Gate, S.W. Paper on "Magneto Ignition," by Mr. J. F. Henderson.

Institution of Electrical Engineers—Thursday, February 11th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Conditions Affecting the Variations in Strength of Wireless Signals," by Prof. E. W. Marchant.

(**Manchester Local Section**).—Tuesday, February 9th. Liverpool visit. At 7.30 p.m. At the Laboratories of Applied Electricity, Liverpool University, Brownlow Street. Paper on "Conditions Affecting the Variations in Strength of Wireless Signals," by Prof. E. W. Marchant.

(**Scottish Local Section**).—Tuesday, February 9th. At 8 p.m. At 207, Bath Street, Glasgow. Paper on "Distribution and Rise of Temperature in Field Coils," by Prof. M. MacLean, Messrs. D. J. MacKellar and R. S. Begg.

(**Birmingham Local Section**).—Wednesday, February 10th. At 7 30 p.m. At the University, Edmund Street. Paper on "Polyphase Commutator Machines," by Mr. N. Shuttleworth.

(**Yorkshire Local Section**).—Wednesday, February 10th. At 7 p.m. At the Technical College, Bradford. Lecture on "Wireless Telegraphy," by Prof. E. W. Marchant.

Physical Society of London.—Friday, February 12th. At 8 p.m. At Imperial College of Science, South Kensington, S.W. Papers on "The Criterion of Steel Suitable for Permanent Magnets," by Prof. S. P. Thompson, F.R.S. ; "A Galvanic Cell which Reverses its Polarity when Illuminated," by Mr. A. A. C. Swinton ; "An Investigation on the Photographic Effect on Recoil Atoms," by Messrs. A. B. Wood and A. I. Stevens.

Salford Technical and Engineering Association.—Saturday, February 13th. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "How Plants Protect Themselves," by Mr. J. E. McDonald. Ladies invited.

Greenock Electrical Society.—Saturday, February 13th. Visit to Royal Technical College, Glasgow.

North of England Institute of Mining and Mechanical Engineers.—Saturday, February 13th. At 2 p.m. At Newcastle-upon-Tyne. General Meeting.

THE E.T.U.: LONDON DISTRICT.

We have received from Mr. J. Potter, district secretary of the Electrical Trades Union, the following report of a meeting of the London members of the Electrical Trades Union held on Saturday last, in the Chandos Hall, at which the joint report of the sub-Committees of the L.E.M.A. and the E.T.U. was adopted, together with resolutions for an advance of wages, Government intervention with regard to food prices, and a protest against the method proposed for making financial grants under the Housing Act, 1914.

Brother Rolf occupied the chair, and after a few preliminary remarks, called upon the district secretary to give the report of the Joint Board of the L.E.M.A. and the E.T.U.

Brother Potter stated that the period of six months' trial of the L.E.M.A. Working Rules having expired, the Board had drafted a report which was being placed before both Associations. In the first instance, the employers had drafted a report, which they afterwards withdrew in favour of the report presented by the delegates from the Union, to which they had made small additions. (These additions are marked by capital letters).

January 28th, 1915.

To the London Electrical Masters' Association.
To the Electrical Trades Union.

Report of Joint Board.

"1. The Joint Board appointed for the purpose of investigating, over a period of six months from July 1st, 1914, complaints in respect to the operation of the Working Rules issued by the London Electrical Masters' Association, 1914, has met on four occasions, viz. :—November 3rd, November 24th and December 17th, 1914, and January 28th, 1915.

"2. The Board has dealt with a number of complaints as to breaches of the Rules by members of the Masters' Association and non-members, comprising :—Eight breaches of Rule 1 (Disability), 12 breaches of wages, and five breaches of country money. The result of the Board's action as regards members has been generally satisfactory ; but as regards non-members, although the action taken by the Board has in some cases tended toward improved conditions, in others it has elicited no response. No complaint of a breach by the men has been received. In these circumstances the Board would recommend the Association and the Union to consider the possibility of bringing any pressure to bear in the case of unfair conditions being employed.

"3. The results of the Board's investigations show the desirability in the interest of all parties of the careful observance of the Rules both by members and non-members.

"4. The Union's representatives have on several occasions raised the question of amending certain Rules, but owing to the powers of the Board being limited to the investigation of complaints of non-observance or cases of hardship WHERE THE RULES ARE OBSERVED, and giving interpretations of the Rules for the guidance of members, we are precluded from making any suggestions in that direction. The Board would advise that the scope of the inquiry should be extended to allow the consideration of alterations to the Rules, SHOULD SUCH ALTERATION BE THOUGHT DESIRABLE, and any recommendations be submitted to the Masters' Association and the Union.

"5. The Board recommend that a Committee similarly constituted to the present one should continue to sit and to meet every two months."

Brothers Western, Webb, and Greenwell, delegates to the Joint Board, having spoken, and a number of questions having been answered, the Report was adopted.

Brother G. Butler, South-West Branch, advocated that an application be made for an advance of wages to 11d. per hour with a 50-hour week.

Brothers Greenwell, District Committee, and C. Collins, Central Branch, moved the following resolution, which was carried :—

That an application be made to the London Electrical Masters' Association for an advance of wages to 1s. per hour, with a 48-hour week.

Brothers Stavenhagen, West Branch, and Slark, District Committee, moved the following resolution, which was carried :—

That the delegates to the Joint Board move for the deletion of the Disability Clause and all reference to pipe-fitters and improvers from the working rules.

Brothers Vaughan, District Committee, and Greenwell, District Committee, moved the following resolution, which was carried :—

That this meeting of London Electrical Workers protests against the Government's decision to loan funds to local authorities under the Housing, No. 2 Act, 1914, only when and where unemployment is acute in the building trades, and a demand be made that financial help be given irrespective of trade fluctuations.

Brothers Vaughan, District Committee, and Stavenhagen, West Branch, moved the following resolution, which was carried :—

That this meeting of London members of the Electrical Trades Union calls upon the Government to take immediate action with regard to high prices of food stuffs, coal, &c., which are pressing hardly upon those whose life is already a struggle for subsistence.

Brothers Scrace, Fleet Street Branch, and Buchan, Fulham Branch, spoke to the resolution.

Brother Kinniburgh, General Organiser, made a statement on the new rules and emphasised the necessity of strengthening the organisation.

It was decided that the report of the Joint Board and the other resolutions carried by the meeting should be communicated to the technical and general Press.

It was decided to hold another general meeting of members on Monday, March 1st, 1915.

NOTES.

Institution and Lecture Notes.—Wireless Society of London.—The Presidential Address for the current session was delivered to this Society by Mr. A. A. Campbell Swinton, in the I.E.E. Lecture Hall, on January 26th, the meeting being well attended. After announcing that it was the Committee's wish that in the present crisis he should remain in office a second year, the President read a fraternal greeting from Colonel Ferrié (now on active service) who wrote that on land and sea wireless telegraphy had fulfilled all the functions expected from it in this war, and would doubtless be yet more valuable in later stages of the campaign. A suitable reply having been framed on behalf of the Society, the President announced that the Society had furnished a number of operators complying with the very stringent requirements of the Post Office, and had besides rendered other services, concerning which more could be said later. They would have to wait also to learn just what part wireless telegraphy had played in the present war. Using an excellent collection of apparatus, much of it of historical interest, Mr. Campbell Swinton demonstrated the fundamental phenomena of electromagnetic and electrostatic induction and high-frequency discharges. A single-phase electromagnet exemplified electromagnetic induction by lighting a lamp "wirelessly," by heating a metal ring held round it and by throwing off or "levitating" a ring not subjected to mechanical restraint. A three-phase magnet caused great amusement by the way in which its rotating field spun all manner of metallic objects, such as coins, rings and skeleton squirrel-cage rotors. Mr. Swinton exhibited slides to show the nature of condenser discharges, and using current of about 200,000 cycles per second frequency, he showed how a lamp could be lighted, though short-circuited by a few inches of copper wire, the latter being in an inductive loop. He also demonstrated electrostatic induction from loop to loop, and showed that sufficient current at this frequency could be passed through the body to light a 100-volt, 20-c.p. carbon lamp; at ordinary frequencies such a current would be fatal. By further raising the pressure, using Tesla's transformer, a variety of interesting discharges was obtained, and using current at 20,000 volts, an arc was struck and maintained between hot rods of soda glass (which is a conductor when heated). Finally, the Poulsen modification of Duddell's musical arc was exhibited, and it was shown that whereas a Tesla discharge was noisy and intermittent, the Duddell arc provided a quiet and continuous discharge of very much higher frequency and much more suitable for wireless telegraphy and telephony.

Diesel Engine Users' Association.—At the last meeting of this Association, held at the Institution of Electrical Engineers, the use of Mexican fuel oil was discussed. Letters were read from several firms or undertakings who had actually used, or were using, this particular class of fuel oil, giving their experiences in the matter. An interesting report on the influence of sulphur in liquid fuels used in internal-combustion engines was referred to, and it was arranged that this should be circulated among the members of the Association. The Admiralty specification for fuel oil was also discussed, and the Committee of the Association was requested to collect further information on the subject of specifications for this class of fuel, with a view possibly of eventually preparing a specification which could be used as a standard by the members of the Association.

Mr. Geoffrey Porter (of Worthing) had prepared some interesting notes on the subject of Diesel engine insurance, and, after a discussion on this subject, it was suggested that the insurance offices should be approached with a view of discussing with them the whole question of insurance against breakdowns, for which risks such a wide variation in rates obtains at the present time.

The next meeting is to be held on Friday, February 19th, at the Institution of Electrical Engineers. Information and particulars concerning the Association can be obtained from the acting hon. secretary, Mr. Percy Still, at 19, Cadogan Gardens, London, S.W.

At the meeting of the Birmingham Local Section on Friday last, Prof. Andrew Gray delivered his Kelvin lecture on "Lord Kelvin's Work on Gyrostatics." There was a good attendance.

Associazione Elettrotecnica Italiana.—The Association has elected as its new president Signor Guido Semenza, formerly vice-president and secretary of the International Congress and of the Comitats Elettrotecnico Italiano. In a speech delivered at the yearly meeting of the Association of Working Electrical Installations on "The Present Conditions of the Market for Electrical Energy," the new president outlined the four chief openings which lie immediately before the Italian electrical industry. These are—Railway traction, agriculture, electrochemistry and electrometallurgy. Italy, in the opinion of Signor Semenza, offers a larger scope for the development of electric traction than any other country. The chief hindrance to its realisation is one of finance, which may be overcome by the electrotechnical industry directly interested, who will thus contribute to create a demand, so to speak, for their own products. One gain which will result from the introduction of electricity into agriculture will consist in the utilisation of the surplus summer and daylight production. And while the chemical and metallurgical industries cannot pay existing prices for energy, small improvements, which will inevitably be effected, will facilitate a vast absorption of electricity, and tend to a great expansion of the electrical industry in the near future. In a more comprehensive elaboration of his views in the *Elettrotecnica*, the author points out that the yearly absorption in Italy of electrical energy for motive power and lighting purposes has now reached such a degree of regularity as to preclude the possibility of rapid movements, but the utilisation of the water resources has barely begun. At the moment it is somewhat at a standstill, owing to the falling off of the demand for electrical energy. Hence there is need for seeking new outlets for existing surplus supplies, and for those new ones which may be profitably obtained in the future. The various services of agriculture offer, as previously stated, an outlet, as does railway electrification, which, in his opinion, although started, has not made a definite spring; house heating and domestic cooking present other outlets, but the latter is fettered by taxation difficulties. Additional arguments for the development of the electrochemical and electrometallurgical industries are found in the dearness of coal (mostly imported, and made still dearer by the war), while water-generated electricity can be produced at a cheap rate, and in the fact that many Italian native ores can only be economically treated by the electric system.

National Illumination Committee of Great Britain.—The report of the chairman was presented at a special annual meeting of the Committee on January 12th, and stated that the work done had consisted mainly in the establishment of rules and appointment of officers. The Committee has passed a resolution to the effect that it is desirable that a uniform international method be adopted for rating and marking all sources of light, with a view to the consideration of the subject at the next Session of the International Commission on Illumination. Messrs. H. G. Colman and W. Duddell have been appointed representatives of Great Britain on the Executive Committee of the Commission. The officers are as follows:—Chairman, Mr. Edward Allen; Vice-Chairmen, Messrs. W. Duddell and A. P. Trotter; secretary and treasurer, Mr. W. J. A. Butterfield, 66, Victoria Street, S.W.

Association of Mining Electrical Engineers.—At a meeting of the West of Scotland Branch at Glasgow, on January 23rd, a paper by Mr. Bowman, on "Electricity at the Coal Face," was read. Mr. Bowman maintained that electricity might be advantageously and economically used where the colliery was fairly large and old, with a number of steam-using auxiliaries, where the roads were long, where the seams were thin, where Special Rule 15 did not apply, and when the load factor due to pumping could be kept high. Electricity was particularly advantageous where a group of collieries could be unified under one electrification scheme. According to his own experience, electricity applied direct would generally give the most economical results, but it might be advisable in connection with coal-cutting, from the point of view of safety and reliability, to use compressed air.

Royal Scottish Society of Arts.—Dr. J. Erskine Murray is delivering a course of lectures to the Society on "Electric Waves and the Principles of Wireless Telegraphy and Telephony."

Royal Institution.—At a general meeting on February 1st the special thanks of the members were returned to Dr. H. D. Rolleston for his gift, in the name of Miss Davy (niece of Sir Humphry Davy), of a bust of Sir Humphry Davy, executed in 1822 by Samuel Joseph.

Society of Engineers.—The new President, Mr. Norman Scorgie, was installed and read his inaugural address on Monday last. The President's gold medal was presented to Mr. A. S. E. Ackermann, for his paper on "The Utilisation of Solar Energy."

Institution of Electrical Engineers.—On Thursday last week, in London, and again at the meeting of the BIRMINGHAM LOCAL SECTION on Friday, Prof. A. Gray, LL.D., F.R.S., read the Kelvin Lecture, on "Lord Kelvin's Work on Gyrostatics." The lecture was fully illustrated with experiments.

Willesden Polytechnic Electrical Engineering Society.—The thirteenth annual dinner is to be held on Saturday evening, February 6th, at Reggiori's Restaurant, Chapel Street, Edgware Road, at 7 p.m. The chairman is Mr. Frederic H. Taylor, A.M.Inst.E.E.

Educational Notes. — CITY AND GUILDS (ENGINEERING) COLLEGE, Exhibition Road, S.W.—The following special advanced courses have been arranged for the Electrical Engineering Department :—

"Design of Alternating-Current Turbo-Generators," by Prof. Miles Walker, on Wednesdays, February 10th to June 2nd, at 4-5 p.m.

"Design, Manufacture and Uses of Transformers," by Mr. A. P. M. Fleming, on Thursdays, March 4th to June 17th, at 4-5 p.m.

See also our advertisement pages to-day for further particulars.

Rate of Pay for Armature Winders.—The Cour of Arbitration of the Board of Trade has determined that the rate of wage of the armature winders in the L.C.C. tramways department shall be increased from 10d. to 10½d. per hour as from January 1st. The Court, in making their award, desire to express their regret that, as recorded in the minutes of the meeting of the Rolling Stock Conciliation Board, held on November 26th, 1914, representatives of the men should have stated that, in the event of an increase of the rate of wages not being granted, the employés had determined to slow down to such an extent as to make the L.C.C. pay the same amount for work done, as it would pay if the present rate were increased.

Parliamentary.—*Standing Orders.*—All the Private Bills have now been before the Examiners for proof of compliance with Standing Orders. The consideration of several has been postponed, whilst in the case of the Halifax Corporation Bill non-compliance has been found, owing to the promoters having failed to secure the consent of the road authorities in regard to several lengths of tramways proposed outside the borough. The Bill will now go before the Standing Orders Committee, who will decide whether it shall proceed.

South Shields Bill.—A poll has been taken of the ratepayers in regard to the South Shields Corporation Bill, which was defeated at a town's meeting. A majority decided in favour of proceeding with the Bill.

Doncaster Corporation Bill.—At the town's meeting called some time ago to consider the Bill of the Corporation, Clause 129, which provides that the Corporation may, in connection with its electricity undertaking, sell, let for hire, and fix, repair and remove, but shall not manufacture, lamps, meters, electric lines, fuses, switches, lampholders, motors and other electric fittings, was defeated. The Corporation has since taken a poll, and the clause was again defeated.

Germany's Copper Famine.—A correspondent of the *Daily Telegraph* in Rotterdam quotes an article in the German technical journal, *Die Metallborse*, on the subject of the copper supply, as follows :—"We can get a good deal of copper from the territories of our enemies now in our occupation. Other sources of supply are kitchen utensils and the cables of electric railways and tramways, some of which are not now running, such as that between Halle and Bitterfeld. Copper can be taken also from the tramways and telephones in Belgium. The material from these sources could be used almost immediately. We have sufficient copper for quite a long time."

Russia.—The Consul-General for Russia (30, Bedford Square, W.C.) is willing to receive inquiries from British firms respecting a manufacturer's agent who is now in this country from Russia. The said agent already represents several British firms there, and he wishes to secure further representations for aluminium, brass, brass wire, rubber thread, electric lamps, and fittings, &c.

Catalogues Wanted for Australia.—A firm of merchants and agents in Sydney wants catalogues and price lists of British arc-lamp carbons, metal conduits, and electrical accessories. These should be addressed to H.M. Trade Commissioner for Australia, 81, Pitt Street, Sydney, N.S.W.

Loaded Submarine Cables.—The German Patent No. 210,151 (British Patent No. 5,547, 1907), "Improvements relating to electric cables containing induction coils," has been before the German Patent Court at the instance of a well-known firm of submarine cable manufacturers who demanded its revocation on the ground of anticipations, but the decision was that these were not substantiated, and the patent was upheld in all its claims.

Fatality.—A Cambuslang miner, who was injured while working an electric coal-cutting machine in Gilbertfield Colliery, has died in the infirmary.

Patents and Alien Enemies.—Messrs. H. R. Witting and Partners have been granted a licence by the Board of Trade in respect of Patent No. 9,845 of 1911, owned by Messrs. K. & Th Möller, G.m.b.H.

Electro-Harmonic Society.—The next concert (Ladies Night) will be held at the Holborn Restaurant (King's Hall), on Monday evening, February 8th, at 8 o'clock, Capt. H. Riall Sankey, R.E. (ret.), M.Inst.C E., will preside. The preliminary programme is as follows :—Miss Caroline Hatchard (soprano) Miss Dorothy Webster (contralto) ; duettists, Miss Mabel Braine and Miss Jessie Reeve (in their delightful musical ensemble) Mr. Anderson Nicol (tenor) ; Mr. Heath Francis (baritone) ; Miss Edith Abraham (violin) ; Mr. Arthur Thomas (humorous entertainer) ; Mr. George Bolton (entertainer at the piano) ; solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

A Conduit Tramway Effect.—A correspondent, writing to the *Standard* recently, described a curious phenomenon on the Brixton Hill conduit tramway which occurred at the time of the recent snowstorm. Power had been cut off early in the afternoon, leaving the cars standing ; apparently about 7 p.m current was again switched on, and a brilliant light was observed, which seemed to be travelling down the hill.

The correspondent continued :—"The most probable explanation is that the snow and slush, together with the salt thrown down on the roads, collected in the tramway conduit and made a partial connection between the live rails under the roadway, the travelling of the flashes being due to the fact that as soon as a flash occurred at any point the heat dried the water out at that point, which would cause flashing to continue at the next wet section.

"The interest in the occurrence, to an electrical mind, consists in the fact that the flashing continued for such a considerable time before the current was sufficiently great automatically to switch off the power at the supply station. This actually occurred after a few minutes, but I venture to say that the actual conditions which caused the display might not occur once in a hundred similar cases."

Inquiries.—The Hydro-Electric Power Commission of Ontario (engineering department), whose headquarters are at Continental Life Building, Toronto, wishes to get into touch with British firms who have developed special systems of wiring, and who carry materials for standard house wiring in stock, as it is its intention to investigate thoroughly the merits and demerits of various standardised European methods. The Commission has in mind bare concentric wiring using a single central conductor, with a bare metallic sheathing forming an outer earthed conductor, metal-sheathed wires in which two conductors are enclosed in a light, but fairly strong, metallic sheathing, and the various weights of lighter steel conduits. Its chief concern at present is to look into methods which will cheapen the cost of wiring, and so bring electricity within reach of a larger number of people.

Makers of small house service meters, for 3 to 18 16-watt lamps, are asked for.

The Electrification of Hens. — The rapid growth of chickens subjected to high-frequency treatment has been demonstrated in this country (see ELECTRICAL REVIEW, December 19th, 1913). Now Mr. G. C. Newell, of Chicago, a Welshman by birth, who keeps 150 hens in his back garden, states (says the *Daily Call*) that last year he obtained from them 18,000 eggs. He found that they did not lay much in winter, as they went to roost earlier and got up later, so he installed electric light in their quarters, connected with switches in the house. He says : "At six in the morning I turn on the switch, and the fowls get up, thinking it is daylight. The lights are turned off at daylight, when the neighbours' fowls are just arising. At 4.0 the lights are turned on again, and they are kept going until 9.0 at night, when I turn all out except the 2-C.P. lamps. These give just sufficient light to give the appearance of dusk, and the fowls begin going to roost. I leave the small lamps lit all night, so that if any of the fowls want to get up at night to eat they can do so.

"Eleven days after the lights were installed the daily average jumped from 26 eggs to 83. During the moulting season under the old custom, when most of the food was going to feathers instead of eggs, I had only 11 eggs a day. Now I get 52 a day during the moulting season. By my method I keep the chickens thinking they are getting the same amount of daylight all the year round, and I am keeping them thinking all the time."

This sounds very satisfactory in a way, but it looks uncommonly like sweating the poor hens. In this country it would be impracticable, owing to the vigilance of the Trade Unions.

Municipal Authorities and Coal Supplies. — A correspondent says that great interest is being manifested in Lancashire and Yorkshire coal trade circles in the conference to be held to-day (Friday) in Manchester, convened by the Manchester and Salford Corporations to discuss the threatened coal famine, and to secure, if possible, the suspension of the Mines Eight Hours Act. Over a score of Lancashire and Yorkshire Corporations will be represented at the conference. Inquiries made amongst miners in various parts of South and South-East Lancashire coalfields go to show that any attempt to set aside the Eight Hours Act, even temporarily, will be strongly resented by the bulk of Trade Union miners, who contend that there is no fear of a coal famine occurring for the present, at any rate. Numbers of pits, they say, work only five days per week.

Appointments Vacant.—Charge engineer (30s.), for St. Albans Electricity Works ; switchboard attendant (27s.), for Morecambe Corporation electricity department. Particulars are given in our advertisement pages.

Water Softening by Electrochemical Methods.—Among the papers prepared for the meeting of the American Society of Refrigerating Engineers held recently in New York City was one by Mr. C. P. Landreth, of Philadelphia, calling attention to the fact that electricity will hasten chemical reaction and thereby improve the results obtained with boiler-feed-water softening compounds. To soften water it is analysed in the usual way and the chemical compound determined which will precipitate the scale-forming compounds present in the water. For instance, calcium hydroxide is used to remove calcium bicarbonate, sodium carbonate is employed to remove calcium sulphate, &c. After the softening compound has been added to the boiler-feed water, it is circulated past parallel electrodes which are placed close together in order that as much of the water as possible may be brought in contact with the surface of the plates. Because of its ionising property electricity will separate the compounds into their components, thereby hastening the recombination to form precipitates, which coagulate and are removed without difficulty.

Unaided by the addition of any energy, the reaction between calcium sulphate and sodium carbonate to form insoluble calcium carbonate and soluble sodium sulphate is ordinarily very slow, but if electricity be allowed to ionise the water containing these compounds the precipitate can be quickly removed. In a plant mentioned by the author of this paper, the calcium carbonate in solution was reduced to 3 grains per gallon, which is within 1/160,000 of the theoretical amount which would be held in solution, the electrolysis producing sufficient coagulation, so that the precipitate could be readily removed in filters. Ten million gallons of water per day was treated in this manner with a continuous power requirement of only 480 watts per 1,000,000 gallons. —*Electrical World.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Eccles Town Council is asked to confirm the appointment of Mr. H. Short, of Salford, as switchboard attendant, in the place of Mr. Glithero, resigned. Lance-Corporal Mulliner, the assistant electrical engineer, has been offered a commission as Second Lieutenant.

The Poplar Borough Council has been recommended to grant the following increases in the salaries of members of the staff of the electricity department:—Mr. F. Tait, assistant manager, £262 10s. to £275 per annum ; Mr. V. H. Cruickshank, station engineer, £237 10s. to £250 ; Mr. E. R. Ingram, mains engineer, £237 10s. to £250 ; Mr. C. E. Farrance, sales manager, £225 to £237 10s. ; Mr. C. A. O'Neal, assistant sales manager, £175 to £185 ; Mr. A. H. Vincent, junior clerk, £65 to £71 10s. ; Mr. P. C. G. Westlake, charge engineer, £175 to £185 ; Mr. W. E. Plowman, charge engineer, £175 to £185 ; Mr. J. Forsyth, £162 10s. to £175 ; Mr. C. W. Coppinger, charge engineer, £150 to £162 10s. ; Mr. A. E. Ricketts, sub-station engineer, £150 to £162 10s.

The Bermondsey Electricity Committee has received applications from the employés of the department for increases in salary, but has decided not to take any action in regard thereto, except in the case of Mr. J. W. Pendrey, mains foreman, who at present receives 60s. a week. In this case, the Committee recommends that Mr. Pendrey should be given a gratuity of £10, having regard to the extra amount of work he is called upon to perform while the mains superintendent is with the Forces.

Mr. J. C. Williams, deputy borough electrical engineer and tramways manager at Rotherham, has been appointed electrical engineer to the Erith U.D.C., at a salary of £350 a year. Mr. A. Coveney, his predecessor, will continue to act until Mr. Williams arrives, at a remuneration to be fixed.

Mr. Emerson, late assistant engineer of the Galway Electric Lighting Co., has been presented with a gold watch by the staff on leaving for St. Albans.

We are informed that Mr. W. A. Brown has resigned his appointment as distributing engineer to the St. Pancras Borough Council, after over 17 years' service, to take up a position with the Pirelli-General Cable Co., of Southampton, as manager of the underground cables sales department, and that he will be located at headquarters, 144, Queen Victoria Street, E.C., after the 1st prox.

The Keighley T.C. has decided, by 15 votes to 6, to advance the salary of the borough electrical engineer, Mr. H. Webber, from £325 to £400. Mr. Webber has a separate salary of £100 as tramways manager.

General.—Mr. A. S. Mann has resigned his position with the L.C.C. tramways, and has accepted a position as examiner in the drawing office, on the staff of Messrs. C. A. Vandervell and Co., of Acton.

A South African contemporary states that Mr. E. G. Izod has succeeded Mr. J. H. Rider as head of the engineering staff of the Central Mining–Rand Mines group.

Mr. Arthur J. Cridge has accepted a position with the British Westinghouse Electric and Manufacturing Co., Ltd. Since April, 1911, he has controlled the meter department of the Electrical Co., Ltd., but his new duties are connected with the sale of transformers. He will be at Trafford Park for some time in order to familiarise himself with the company's manufactures in this direction.

Mr. Frank Dudley Docker has been elected to a seat on the board of the Metropolitan Railway Co., rendered vacant by the retirement of the Hon. Francis McLaren, M.P., who has accepted a commission in His Majesty's Forces.

Mr. Joseph Tierney, College Green, Dublin, has been elected consulting electrical engineer to University College, Dublin.

Obituary.—Mr. T. H. Wells.—A link of unusual interest in the telegraph world has been severed by the death of Mr. Thomas Henry Wells, the late secretary of the Anglo-American Telegraph Co., Ltd. He entered the Electric and International Telegraph Co. (Incorporated 1846) in 1847, and when that company was taken over by the Post Office he joined the first Atlantic Cable Co., serving successively as traffic accountant, accountant and secretary, retiring in 1912 when the Anglo-American Co. was leased to the Western Union Telegraph Co., of America. He was thus identified with American cable companies from their infancy, and was for 65 years associated with telegraphy. Such long service is, we believe, a record. The advance in telegraphy, the ups and downs of cable companies, and the fight for control of Atlantic traffic during his secretaryship of 32 years of the Anglo-American Telegraph Co., brought him into very close acquaintanceship with Jay Gould, Cyrus Field, Bennett Mackay, the Marquis of Tweedale, Sir John Pender, J. S. Morgan, and many other prominent men, who have long since passed away. His knowledge of the history and working conditions of cable companies was profound and unique. A telegraph form of 1857 reminds us of the fact that in that year there were only four offices to take messages in Manchester, and three offices in Leeds and Liverpool. No message was delivered beyond half-a-mile without porterage, and no charge was made for names and addresses of either sender or receiver. A wag who had arranged to advise his friends in London of his safe arrival in Liverpool by tendering a form containing only his name and that of the addressee, found, however, he could not announce his safe arrival in that way for nothing. In 1856 there were only 340 telegraph stations in Great Britain and Ireland. Mr. Wells initiated and organised the stores department of the Electric and International Co., travelling periodically over the whole country in the late fifties. He was an elocutionist of quite exceptional power and used his remarkable gift freely in the interest of many and various charities. Annually for a long period an evening of "Readings and Recitations" was given by him on behalf of the Post Office Orphans' Home at St. James's Hall (Large Hall), London, when he appeared appeared before crowded audiences under the name of "Herbert Walton." In 1871 at the instance of Florence Nightingale he gave an entire evening at the same hall in aid of the Distressed French Peasantry. Charles Dickens attended on several occasions, and considered Mr. Wells's powerful renderings of his works were the finest studies and presentations of the scenes and characters of his books, notably the "Death of Quilp" scene. At the time of his decease Mr. Wells was still a director of the House Property and Investment Co., and vice-chairman of the British Equitable Assurance Co. He was a man with extraordinarily good health, absence from City circles for more than a day being a rare occurrence. A very brief illness preceded his death at 81 years of age. He was a widower for 17 years, and leaves a family of two sons and three daughters.

Mr. W. Edgar Allen.—We regret to learn of the death, which occurred on January 28th, of Mr. William Edgar Allen, who, as long ago as 1868, founded the firm of Edgar Allen & Co., steel manufacturers, Sheffield. In 1890 he turned the business into a limited company. Mr. Allen was a man of great enterprise, and he succeeded in building up business connections in all parts of the world, his linguistic attainments and commercial training assisting him greatly in endeavours to this end. He travelled in all parts of the world in the interests of his firm, which now has an annual wage-bill of about £200,000.

Mr. R. O. Ritchie.—The death occurred at Tollgates, Battle, Sussex, on January 29th, of Mr. Robert Ord Ritchie, electrical engineer. Deceased, who passed away suddenly from heart failure, at the age of 57 years, had resided at Battle since 19 8. He was a brother of the late Lord Ritchie, of Dundee, was a member of the Institution of Electrical Engineers, and was associated with the construction of electric tramways at Rome, Leeds, Huddersfield, and elsewhere. At Battle he had served on the Urban Council.

NEW COMPANIES REGISTERED.

Electric Lamp Factors, Ltd. (139,131).—This company was registered on January 27th, with a capital of £6,000 in £1 shares (5,000 pref.), to carry on the business of agents for, factors of and dealers in electric glow lamps or other lamps of any description, lighted by electricity, and any apparatus and appliance connected with the consumption and supply of electricity, &c. The subscribers (with one preference share each) are: M. H. Robinson, Struan, Fassett Road, Kingston-on-Thames, engineer; L. I. Robinson, 3, Staple Inn, W.C., electrical engineer. Private company. The number of directors is not to be less than two or more than five ; the first are M. H. Robinson and L. I. Robinson. Solicitors: Farrer, Porter & Co., 2, Wardrobe Place, Doctors Commons, E.C.

Elieson Electric Traction Co., Ltd. (139,120).—This company was registered on January 26th, with a capital of £1,000 in £1 shares, to acquire and turn to account any invention relating to the production, treatment, storage, application, distribution and use of electricity; to carry on business as motor car, landaulette, cab, omnibus and van proprietors, manufacturers of motors, motor vehicles, ships, boats, motor boats, launches, flying machines, submarines, etc. The subscribers (with one share each) are: C. P. Elieson, 24, St Mary Abbots Terrace, Kensington, W., electrical engineer; F. Mariaux, 66, Frith Street, Soho, W.C., director; L. E. Porel d'Angond, 28, Buer Road, Fulham, S.W., motor traction engineer. Private company. The first directors (to number not less than two or more than five) are C. P. Elieson, F. Mariaux and L. E. Porel d'Angond (life directors). Qualification, one share. Solicitors: Canwarden & Co., Gloucester Mansions, Cambridge Circus, W.C.

Sperry Gyroscope Co., Ltd. (139,126).—This company was registered on Jan. 26th with a capital of £2,000 in £1 shares, to carry on the business of manufacturers, importers and exporters of and dealers in gyroscopes and gyroscopical appliances and devices for steadying ships, boats, submarines, aeroplanes and all kinds of airships, mono-rail and other cars, carriages, wagons and vehicles, manufacturers of and dealers in electrical supplies, mechanical and electrical engineers, etc., and to adopt an agreement with the Sperry Gyroscope Co., of Manhattan Bridge, Plaza and Flatbush Avenue, New York City. The subscribers (with one share each) are: R. E. Gillmor, 57, Victoria Street, S.W., engineer; T. A. Morgan, 57, Victoria Street, S.W., engineer Private company. The number of directors is not to be less than three or more than nine; the first are E. A. Sperry, R. E. Gillmor, and T. A. Morgan. Solicitors: Hasties, 65, Lincoln's Inn Fields, W.C. Secretary, H. S. Jones.

A. Robinson & Co., Ltd. (139,142).—This company was registered on January 28th with a capital of £15,000 in £1 shares (7,000 pref.), to take over the business of mechanical and electrical engineers, founders, smiths, manufacturers and patentees of ships' telegraphs, nautical instruments and all kinds of signalling, indicating and recording instruments and appliances carried on at 3 and 3a, Knowsley Road, Bootle, Lancs., as "A. Robinson & Co.," and to adopt an agreement with P. R. Keppie. The subscribers (with one share each) are: P. R. Keppie, 3, Knowsley Road, Bootle, Lancs., engineer; E. A. Lambert, 47, Alexandra Road, Great Crosby, Lancs., engineer. Private company. The number of directors is not to be less than two or more than five; the first are P. R. Keppie and E. A. Lambert (both permanent managing directors, with £300 and £150 per annum respectively as remuneration). Qualification, £250. Solicitor: J. W. A. North, 15, Lord Street, Liverpool.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Thomas Kesnor & Co., Ltd.—A memorandum of satisfaction in full on December 30th, 1914, of mortgage dated December 29th, 1911, securing £250, has been filed.

Drake & Gorham, Ltd. (70,275).—Capital, £125,000 in £1 shares. Return dated October 22nd, 1914. All shares taken up, £85,000 paid; £40,000 considered as paid. Mortgages and charges: Nil.

Monte Video Telephone Co., Ltd. (27,208).—Capital, £160,000 in £1 shares (87,000 pref.). Return dated November 5th, 1914. 86,492 pref. and 72,680 ord. shares taken up. £159,172 considered as paid. Mortgages and charges: Nil.

East India Tramways Co., Ltd. (74,457).—Capital, £100,000 in £1 shares (15,000 pref., 35,000 ord., and 50,000 defd.). Return dated December 14th, 1914. 7,476 pref., 33,433 ord., and 50,000 defd. shares taken up. £1 per share called up on 7,476 pref. and 7 ord. shares; £7,489 paid (including £6 paid on 24 pref. shares forfeited), £83,426 considered as paid on 33,426 ord. and 50,000 defd. shares. Mortgages and charges: Nil.

CITY NOTES.

Yorkshire (West Riding) Electric Tramways Co., Ltd.

Sir Herbert S. Leon presided on January 22nd at the tenth ordinary general meeting, held at 31, Throgmorton Street, E.C. In proposing the adoption of the report, he said he was not in a position to say that substantial progress had been made by the undertaking during the year. Still, the results were very much better than the most sanguine shareholder had a right to expect considering the many adverse circumstances which the war had brought about, for the receipts were actually £81 in excess of the previous year. In 1912 they had what they then regarded as a boom year, and the traffics were up nearly £7,000. Up to the end of July, before the war commenced, they had beaten their previous record and were £1,264 to the good, and there seemed every likelihood of increased traffics during the remainder of the year. Then came the catastrophe of the war and they, like other tramways, suffered considerably, particularly during the earlier stages. He was, however, pleased to say that public confidence was speedily restored and their income, although varying from week to week, became on the average equal to the previous year. That was a remarkable achievement and demonstrated that the business they had made was solid and reliable and would be affected as little as any similar businesses through the war. The gross income was £74,110, which included for the first time an item of £275, Pontefract electric lighting. He stated last year that they had purchased the provisional order for lighting the town of Pontefract. They completed the installation of the necessary plant and commenced to supply in July. There had been little business since, as many of the prospective customers had deferred the wiring of their houses and business premises until more settled times. It always took some years to establish and bring to a paying basis an electric undertaking, and with that in their minds they arranged to purchase current in bulk for five years, and they hoped during that period to build up the business without incurring any serious loss of interest. The capital involved was about £12,000. It was yet too early to express any definite opinion, but he thought this would prove to be a nice paying little property yielding a satisfactory return in a few years time when things had again become normal. To return to the tramway undertaking, on a car mileage basis they had taken 10.001d. per car mile as against 9.938d. last year, an increase of 0.063d. That did not seem much, nor could it convey much to their minds, but tramways and light railways were worked on small margins, and every small increase of profit multiplied by the car mile unit meant a considerable gross sum. The tramway revenue had grown steadily but surely. In 1905 the receipts were £38,051, and the working expenses £19,963, leaving a balance of £18,088, whereas last year the receipts were £74,110 and the expenses £32,404, leaving a balance of £41,706. The working expenses last year were less by £937 than those of the previous year, which was very satisfactory seeing that they were paying higher wages and higher prices for practically everything they bought. Fuel had cost them more, but they had made a big saving of £1,096 in the upkeep of the permanent way as a result of their expenditure upon paving. From the day they commenced running the tramways they had improved them in every possible way, and to-day he thought their property was worth very much more than it was originally. They had spent considerable sums in renewals last year from the depreciation and renewals fund account in order to improve the undertaking, and not necessarily because the parts replaced were worn out. The big item in that account—£3,958—was due to the substitution of granite setts for York stone setts in Normanton and Castleford. They would have to face considerable further expenditure in a similar way where York stone was still in existence on the track. The working expenses per car mile last year were 4.373d., as against 4.476d. in the previous year, a decrease of .103d., and the percentage of expenses to receipts was 43.72 as against 45.4, a difference of 1.32 per cent. The reduction was due to the decreased cost of the maintenance of the permanent way. The balance of revenue carried forward was £41,706, and other items gave them a total of £42,061 to deal with. Debenture interest absorbed £11,406, and there was an amount of £577 interest on six per cent. bonds which appeared for the first time. It was found necessary in the course of the year to borrow £21,000, and they did so by the issue of six per cent. bearer bonds. There was no difficulty in raising the money among the stock-holders—in fact, if more had been required it could easily have been obtained without their going to the public. He might mention that 52 of their servants had joined the Forces and their places were being kept open for them when they returned, and during their absence the company was helping their dependents. After paying all expenses the balance remaining to be carried to appropriation account was £26,524, which was £787 less than the previous year owing to the payment of the bond interest. Adding £5,520 brought into the account, they had a total of £32,045 to deal with. They had paid the 6 per cent. dividend on the preference shares, which absorbed £12,808; £3,215 had been placed to the depreciation and renewals fund; £296 had been transferred to the accident reserve fund; and £5,000 to the general reserve, which left £10,725 to be carried forward. He hoped the board would not be accused of reckless finance when, for the first time, they had paid the preference dividend in full. He would like, however, to say that they would not strain the resources of the company in order to keep up the payment of that dividend if, owing to the war, there was going to be any serious decrease in the traffics. None of them could say what the immediate future had in store for them, owing to the war, and they could only hope for its speedy and victorious termination.

Mr. Ernest Remnant seconded the motion and the report was adopted.

Delabole Electric Lighting and Supply Co., Ltd.

An adjourned meeting of shareholders was held on January 18th at Delabole, Mr. M. Wells presiding.

Mr. F. C. Haughton (acting for the Secretary, his son, who is with the Colours) presented the second statutory report.

The Chairman pointed out that the report covered only six months and [illegible] as far as [illegible] that the consumers at Rockhead and [illegible] might have better light. He was pleased to say that the work had been passed by an expert as a [illegible] satisfactory [illegible] installation.

Mr. [illegible] congratulated the [illegible] on the report. [illegible] he hoped it [illegible] the company [illegible]. He did not [illegible] the [illegible] wanted dividends; but, as a consumer, he would like the light cheap.

The Chairman, in reply to observations, said the directors [illegible] would be [illegible] and with another £200 they would be able to present a clean sheet.

The report was adopted. At the instance of Mr. [illegible] the Old Delabole Slate Co. were thanked for freely providing the motive power.

Llandudno and Colwyn Bay Electric Railway, Ltd.

Mr. A. W. [illegible] presided on Jan. 22nd, at Basildon House, E.C., [illegible]. In moving the adoption of the report, he said that the profit for the year, after providing for operating and administration expenses, and interest on debenture stock, amounted to £5,144, as compared with £7,764 for 1913. The traffic receipts amounted to £15,672, a decrease of £2,039, which was entirely due to the interruption of the holiday season by the war. The outbreak of the war at the busiest period of the company's year was exceedingly unfortunate, as at the end of July, notwithstanding interruptions to the service in the earlier part of the year in consequence of doubling work, the figures showed a slight increase on those for the previous year. He was glad to state that since the close of the financial year they were able to record an increase in the earnings as compared with the same period last year, which was, to a certain extent, due to the presence of troops for training purposes in both Llandudno and Colwyn Bay. It was, of course, difficult to estimate to what extent the summer traffic of 1915 would be affected by the war, but it was reasonable to assume that it would not be so severe as that experienced last year. Miscellaneous receipts showed a slight decrease as compared with the previous year. On the debit side of the profit and loss account there was an increase of approximately £130 in the amount charged for power expenses. This was due to the fact that, in the early part of the year, track doubling operations were in progress which handicapped the working of the system to a certain extent, and, owing to the frequent stopping and starting of the cars, caused an increase in the number of units used. Other heads of expenditure showed decreases as compared with the corresponding figures last year, the decrease amounting to approximately £200 in respect of the item "general expenses." "Repairs and maintenance" would probably have also shown a decrease but for the fact that some exceptional expenditure was incurred upon maintenance of cars which had been put in thoroughly good order. The amount charged in respect of interest on debenture stock was somewhat larger this year, owing to the increased amount of stock issued to meet capital requirements. The track was doubled during the year from the end of Mostyn Avenue to St. John's Chapel, Llandudno (approximately 1⅓ miles). The benefits had already been felt, and would be still more appreciated during the busy seasons of the year. The doubling of the track was now complete practically from the centre of Llandudno to the outskirts of Colwyn Bay. This had enabled the company to facilitate considerably the traffic arrangements, and it would also assist them in more effectually combatting the competition which they had to face in the shape of motor 'buses. Turning to the balance sheet, they had expended during the year approximately £18,250 on additions of a capital nature, which consisted mainly of the cost of doubling the track and of expenditure in connection with the extension to Old Colwyn. The construction of this extension was now being carried out, and would be completed in a few weeks' time. The district of Old Colwyn was growing rapidly, and there was a fairly large settled population, so they had every reason to hope that this extension would prove remunerative not only in summer, but the whole year round. Owing to the present financial position created by the war they had been unable to place the balance of the debenture stock, but arrangements had been made with the company's bankers for a loan against the security of the said stock to complete the extension. It was only intended to carry out for the present such work as was necessary to open the line for traffic. They had also decided not to order any additional rolling stock for the moment, although the requirements of the system, having regard to the added length of line, would necessitate an addition to the rolling stock to cope adequately with the summer season traffic. They had also succeeded in obtaining the consent of the Board of Trade to the use of trailer cars, which would also assist them in dealing with rush traffic in the summer season. The balance available for distribution, after providing debenture interest and sinking fund, was £4,538, which it was proposed to apply as follows:—A dividend at the rate of 4 per cent. per annum (payable less income tax), which would absorb £3,976, and to be carried forward £562. The sinking fund instalments referred to were, in their opinion, sufficient to meet the depreciation of the system, and they had, therefore, not made any charge under the heading of "depreciation." The reserve account stood at £4,000, as before. He thought the shareholders would agree that the net result for the year might be considered satisfactory, and their thanks were due to the manager and staff at Llandudno.

Mr. T. Stoker seconded the motion, which was carried.

German Electrical Companies.

The *A.G. Carbidwerk Lechbruck*, whose carbide plant is leased to the Bosnian (Jaiee) Electricity Co., of Vienna, records net profits, after allowing for depreciation, of £3,600 for 1913-14 as contrasted with £1,900 in the preceding year. It is proposed to pay a dividend for the first time, namely 3½ per cent.

The *Süddeutsche Telephonapparate, Kabel und Drahtwerke, of Nuremberg*, whose share capital of £50,000 is held by the Felten & Guilleaume Co., report net profits of £173, after having placed £4,400 to depreciation in 1913-14 as compared with £5,300 in the preceding year. The balance has been carried forward; no profits were earned in 1912-13.

The *Bergmann Elektrizitats Unternehmungen, of Berlin*—the financial enterprise of the Bergmann Electricity Co., which decided some time ago to limit the former's activity to the conclusion of operations then on hand—reports gross profits of £15,000 for 1913-14, as compared with £6,800 in the previous year. As net profits the accounts show the sum of £9,500 as against £4,000, and the debit balance consequently becomes reduced to £27,000 on a paid-up share capital of £300,000.

The *Deutsche Sudsee Ges für Drahtlose Telegraphie, of Berlin*, which was jointly formed by the German Netherlands Telegraph Co. and the Berlin Wireless Telegraph Co. about two years ago to work a twenty years' concession for wireless telegraphy at Yap, Raboul and Apia, reports receipts of £12,000 for the year ended on June 30th, 1914. After meeting general expenses, depreciation, etc., the accounts indicate net profits of £2,800 on a share capital of £65,000. The loss incurred in the previous year has been extinguished, leaving £2,100 to be carried forward.

The gross profits of the *Wotan Werke A.G., of Leipsig*, are returned at £18,500 for 1913-14, as compared with £21,900 in the preceding year. The defrayal of general expenses and the appropriation of £1,900 for depreciation, as contrasted with £2,700 in 1912-13, leaves net profits of £8,100 as against £10,000. As a result of the war the directors state that the inland debts owing had been entered at specially low amounts, whilst the debts due from hostile countries had been entirely written off, although a large loss on them was not apprehended. The dividend recommended is at the rate of 15 per cent., this comparing with 20 per cent. in 1912-13.

The report of the *Elektro-Osmose A.G., of Berlin and Frankfort-on-Main*, which was formed in 1913 with a share capital of £150,000, states that the year 1913-14 was mainly devoted to developing the internal organisation, and the continuation of scientific experiments, which resulted in relatively high expenditure in Germany and abroad. As a consequence, the year closed with a loss of £29,000, but actual working operations are expected to begin gradually in the current financial year. The commencement of regular work at the china clay washery at Chodau, near Carlsbad, where work is to be undertaken according to the company's process, is to start next month. It has been decided to increase the share capital to £450,000.

The report for 1913-14 of the *Fabrik Isolierter Drähte (late Vogel), of Berlin*, states that the turnover in August and September experienced a considerable reduction as compared with the equivalent months in 1913 in consequence of the outbreak of the war. Including receipts from investments the gross profits amounted to £53,000, as against £52,000, and after setting aside £6,300 for depreciation, as contrasted with £7,000, and defraying general expenses, there remain net profits of £32,000 as compared with £31,000. The directors, who recommend the payment of a dividend of 13 per cent., as in 1912-13, add that the volume of business in the first three months of the new financial year shows a falling off owing to the entire cessation of the export trade.

The *Ges. für Stickstoffdunger, of Knapsack*, reports gross profits, which were realised almost entirely from manufacturing, amounting to £59,000 in the twelve months ended with June 30th, 1914, as compared with £57,000 in the previous year. After allocating £22,800 to depreciation, as against £22,600 in 1912-13, the accounts show net profits and balance forward of £25,000 as contrasted with £23,000, and a dividend of 6 per cent is in contemplation, as compared with 8 per cent. in 1912-13. The report states that the trade was subject to great fluctuations during the year in consequence of the considerable augmentation in the inland production and exceptional deliveries of foreign artificial and natural fertilisers and the rise in the prices of raw materials and of labour. Since the close of the financial year the slightly increased stocks had been cleared, and all departments were now in full operation, although much higher working expenses had to be reckoned with during the war. On the other hand the war had opened new scope of activity for the nitrogen industry which would possibly lead to a large extension of the plant.

Chatham and District Light Railways Co.

The directors' report for the half-year ended December 31st, 1914, states that the revenue was £27,503, and the expenses were £14,277, leaving £13,226; less rent of Rochester Corporation lines, £1,872; interest on debentures, £881; interest account, £525: leaving £9,949, plus £2,768 brought forward. £6,000 has been transferred to reserve for depreciation; £2,940 to preference dividend at the rate of 5 per cent. per annum; £2,650 to dividend at the rate of 5 per cent. per annum for the half-year on the ordinary share capital; £1,127 to revenue new account. The revenue shows an increase of £1,623, and the expenses an increase of £162, as compared with the revenue and expenses for the corresponding half-year of 1913. Three additional cars were purchased and put into service in August last. A large number of the employés have joined the colours since the outbreak of the war, and allowances are being made to the wives and dependents, involving a charge in the half-year's accounts of £390. During the half-year £4,000 debentures of the company have been purchased and redeemed.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June, 1913	14·98	4,669,151	£22,713	1·17d.	540 192	47
December, 1913 ..	14·98	5,210,322	£25 519	1·17d.	567,634	47
June, 1914	14·98	4,860,135	£23,214	1·14d.	573 243	47
December, 1914 ..	14 98	5,782,793	£27.225	1·13d.	560,519	50

Electrical and Industrial Investment Co., Ltd.

The directors' report for the year ended December 31st, 1914, states that the revenue account shows a profit, after payment of all management expenses and interest on debenture stocks, of £13,694 plus £7,282 brought forward, making a total available of £20,976. The directors recommend the payment of the dividend for the year on the 6 per cent. cumulative preference shares amounting to £6,000, and a dividend at the rate of 6 per cent. per annum on the 7 per cent. preferred ordinary shares for the period from March 26th, 1914, to December 31st, 1914, amounting to £4,599, carrying forward £10 377. The directors have continued to act on the principle of adding to reserve the profits made on sales of investments, and of charging losses on realisation against the reserve. The balance at the credit of reserve account is £28,298. The company holds 233 investments of the total book value of £676,928. Owing to the closing of the Stock Exchanges there were no market quotations for these investments at that date. The directors will, at a later date, when the position is better defined, make a special report to the shareholders in regard to depreciation of the investments.

The following table shows the classification of the investments according to the denomination of the securities :—

Debentures, debenture stocks, &c.	£324,832	47·99 %
Preference shares and stocks, &c.	176,765	26·11
Ordinary shares and stocks, &c.	147,685	21·81
Government and municipal loans	16 777	2·48
Other loans and syndicates	10,869	1·60

The following table shows the manner of distribution of the investments amongst different classes of undertakings :—

Electric power and traction (combined undertakings)	£183,577	27·12 %
Tramways and omnibuses	161,201	23 81
Electric lighting and power	126,052	18·62
Railways	69,631	10·29
Commercial and industrial	37,417	5·53
Government	16,231	2·40
Oil	13 624	2 01
Tea, coffee and rubber	12 663	1·87
Financial, land and investment	12,183	1·80
Iron, coal and steel	11,803	1·74
Breweries	7,964	1·18
Telegraphs and telephones	5,095	·75
Miscellaneous	8 619	1·27
Syndicates and Loans	10,869	1·61

Mexican Light and Power Co., Ltd.—The board announces that owing to the continued unsatisfactory condition of affairs in Mexico they have to defer the payment of the half-yearly coupon due February 1st next on the 5 per cent. first mortgage gold bonds. Representations have been and are being made on behalf of the company, not only through the British Government, but also to Washington, with a view to protect the interests of those holding the company's securities.

Barcelona Traction, Light and Power Co., Ltd.—With reference to the decision of last November to suspend payment of the half-yearly coupon of the 5 per cent. first mortgage 50-year bonds and the intention to prepare a plan for providing the necessary funds for continuing and completing the works under construction and for the adjustment of maturing interest, Messrs. H. F. Parshall, Robert Fleming, A. E. Baker, Gilbert Johnstone, James W. Bowhill, Charles D. Seligman and E. R. Peacock have agreed to act as a Committee in the interests of the general body of bondholders to consider the financial arrangements contemplated and submit proposals.

Buenos Aires Port and City Tramways, Ltd.—A circular issued by the secretary states that the financial position of the company will not allow of the payment of the interest on the first mortgage debenture stock, which falls due on the 1st proximo. The directors are in consultation with a Commiteee—consisting of large holders of this stock and of the first mortgage extension bonds—with a view to promulgating a scheme for the reorganisation of the debenture debt and share capital of the company.

Dublin United Tramways Co., Ltd.—The accounts for the year 1914 show that the amount available for division is £98,047. A dividend at the rate of 6 per cent. per annum, less income-tax, is to be paid on the preference shares for the half-year to December 31st, and a final dividend at the rate of 5 per cent. per annum, less income-tax, on the ordinary shares for the half-year, £18,000 being set aside towards renewal of permanent way, and £5,000 to reserve and renewals fund, £11,366 to be carried forward.

Yorkshire Electric Power Co.—The net profit for 1914, after payment of mortgage interest was £20,535, as compared with £15,401 for 1913. An interim dividend at the rate of 2 per cent. per annum was paid in July, and the directors do not recommend a further distribution, as they wish to strengthen the position of the company.

Central Electric Supply Co., Ltd.—The directors recommend a dividend of 5 per cent. on the ordinary shares for the year 1914, £6 being carried forward.

South London Electric Supply Corporation, Ltd.—The directors recommend, subject to final audit, a dividend on the ordinary shares for the year 1914 at the rate of 5 per cent. per annum, carrying forward £2,897, as against £728 in 1913.

Smithfield Markets Electric Supply Co., Ltd.—The directors recommend a dividend of 2 per cent. (2s. per share) for the year ended December last.

Metropolitan District Railway Co.—Parliament is to be asked to sanction the issue of £300,000 debenture stock.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange business has dropped into a jogtrot in most of the markets. Investment suffered a check by reason of the proposal to lower the minimum prices of Consols and other gilt-edged securities. It is rightly thought that, were this to come about, people would have the feeling that further reductions might be made, and accordingly investors would wait before putting money into markets. Another factor is the advent of a New South Wales loan, with its hint that there may be others to follow before long. The electrical markets are quiet, without much feature; and the most active department in the Stock Exchange, as might well be supposed, is that devoted to armament shares, of which Vickers and Armstrongs are the two favourites.

The Home Railway market cheered up on the declaration of an unexpectedly good dividend by the Lancashire and Yorkshire. The effect radiated to speculative stocks, but stopped short of those connected with the Tube lines. Nor have the latter been influenced by the important extension of the Bakerloo which is shortly to establish physical connection with the London and North Western. In ordinary times, this would have had a strengthening effect; but in days of war, it has gone for nothing.

Underground Electric ordinary touched 2 the other day, to revert later to the previous price of 1⅞. The company's 6 per cent. income bonds remain steady at 83, and a fear which was current some weeks ago as to a possible scaling-down of the interest on these bonds in respect of the past year, has been succeeded by confidence that such a step will not be necessary. As everyone knows, the London General Omnibus Company is doing splendidly, the Government paying well for the many vehicles that have gone abroad, while those at home are filled to their capacity hour after hour. The National Steam Car dispute with its men aroused the announcement that the company might wind up business and sell its omnibuses to ready customers, presumably in the provinces; if this came about, the people principally to benefit would be those who share in the profits of the L.G.O. Company.

The first of the electric lighting companies to declare its dividend is the St. James' and Pall Mall. As briefly stated here last week, the dividend for the full year is made up to 10 per cent., comparing with 12 per cent. for 1913. The present rate is the same as that paid continuously between 1906 and 1912. In the period 1897-1904, the annual dividends were 14½ per cent. The price is unchanged at 9, which compares very favourably with the average since 1907 to date. The highest "Jimmies" reached in recent years was 19½, in 1898, and they went down to 7 eleven years later.

The Smithfield Markets Electric Supply Co. has declared a dividend for the past year of 2 per cent., carrying forward £1,300. This compares with 2½ per cent. in the previous twelvemonth, and with 2 per cent. in 1912. Melbourne Electric ordinary stock was quoted ex rights to-day (Tuesday).

The changes on the week are insignificant, save for a recovery of 2 points in St. James' and Pall Mall debenture stock. Westminster preference are better at 5, though the ordinary shares further declined ⅛. City of London ordinary shed 5s. There remains a demand for County preference; the old and new shares, it may be remarked, are now on all fours. It is hoped that the forthcoming reports will furnish some information on the question of coal contracts. The rise in the price of coal is causing keen interest as to the price at which the companies have contracted forward, and still more as to the likelihood of their suffering from shortage as well as high prices. Parts of London were plunged into temporary darkness on the Zeppelin alarm of Monday evening, when, by the way, several thousands of special constables lost their dinners.

The L.C.C. have decided, after all, that their Electricity Bill shall not go to Parliament. It is tempting to turn round and say: "What did we tell you?"—temptation, however, which shall be sternly resisted, inasmuch as (now that the decision is arrived at) the result may be regarded as inevitable. Remains the London Electricity Supply Bill No. 2, promoted by nine out of the thirteen London companies, and having as its central idea an authority, which was the pivot of the L.C.C. Bill. We venture to predict the same fate for this second suggestion as that which has just befallen the first.

The four companies, which are not included in the No. 2 Bill, control an area many times greater than that governed by the nine undertakers; and it cannot be seriously supposed that Parliament will sanction a scheme opposed by the concerns serving not only a much larger field than the rest, but also embracing within that field great industrial centres in London to which the supply of cheap power will be vital. So once more we are "as we were," and the shrewd observer will have little difficulty in forming his own opinion as to what is likely to be the next, and the successful, development in connection with the pressing question of London's electric supply.

Appended is our usual list of stocks and shares in the electrical markets:—

HOME ELECTRICITY COMPANIES.

	Mean price. July 27.	Feb. 2, 1915.	Rise or fall this week.
Brompton Ordinary	9½	8⅞	—
do. 7 per cent. Pref.	8⅝	8⅝	—
Charing Cross Ordinary	5¼	4⅞	—
do. do. do 4½ Pref.	4¾	4½	—
do. do City Pref.	4⅜	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅞	4¾	—
do. 4½ Deb.	96½	92	—
City of London	16	14½	— ½
do. do. 6 per cent. Pref.	13½	12¾	—
do. do. 5 Deb.	116½	114	—
do. do. 4½ Deb.	100½	98	—
County of London	12	11½	—
do. do. 6 per cent. Pref.	12	11½	—
do. do. 1st Deb.	102½	99	—
do. do. 2nd Deb.	100½	97	—
Kensington Ordinary	7½	7½	—
London Electric	1 7/16	1¼	—
do. do. 6 per cent. Pref.	5 1/16	5	—
do. do. 4 Deb.	92½	90	+ ¾
Metropolitan	3⅝	3⅛	—
do. 4½ per cent. Pref.	4 7/16	4	—
do. 4½ Deb.	97½	91½	—
do. 3½ Deb.	83	80	—
St. James' and Pall Mall	9⅝	9	—
do. do. do. 7 per cent. Pref.	7	6½	—
do. do. do. 3½ Deb.	84½	82	+2
South London	8 1/16	8	—
South Metropolitan Pref.	1½	1⅛	—
Westminster Ordinary	8⅝	8½	— ⅛
do. 4½ Pref.	5⅛	5	+ ⅛

HOME RAILS.

	Mean price. July 27.	Feb. 2, 1915.	Rise or fall this week.
Central London, Ord. Assented	83	78	— 1
Metropolitan	37½	32	—
do. District	21¾	18½	—
Underground Electric Ordinary	2½	1⅞	—
do. "A"	7/6	6/-	—
do. Income	88	83	—

TELEGRAPHS AND TELEPHONES.

	Mean price. July 27.	Feb. 2, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108¼	106½	+1½
do. Def.	23	22⅞	+ ½
Chile Telephone	7⅜	7⅛	—
Constantinople Tel.	4½	3¼	—
Cuba Sub. Ord.	8¼	8¼	—
do. Pf.	16½	15½	—
Eastern Extension	12¾	12½	—
do. 4 Deb.	97½	94	—
Eastern Tel. Ord.	130½	127	—
do. 3½ Pf.	77½	71	—
do. 4 Deb.	96½	93	—2
Globe Tel. and T Ord.	11½	10	—
do. Pf.	12⅞	11¾	—
Gt. Northern Tel.	32½	28	—
Indo-European	59	55	—
Marconi	1 11/16	1 9/16	— 1/16
New York Tel. 4½	101	97	—
Oriental Telephone Ord.	2 5/32	2	—
do. Pf.	1 1/32	1 1/16	—
Tel. Egypt Deb.	98	97½	—
United R. Plate Tel.	6⅜	6	—
do. Pf.	5¼	5	—
West India and Pan.	1¼	1⅛	—
Western Telegraph	13⅝	13	—
do. 4 Deb.	96½	95½	—

FOREIGN TRAMS, &c.

	Mean price. July 27.	Feb. 2, 1915.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅞	4¼	—
do. 2nd Pf.	4¼	4	—
do. 4 Deb.	91	85	—
do. 4½ Deb.	98½	94	—
do. 5 Deb.	96	88	—
Brazil Tractions	66	56½	—2
Bombay Electric Pf.	11⅜	10½	—
do. 4½ Deb.	96	91	—2
Mexico Trams	70	40	—
do. 5 per cent. Bonds	84	60	—
do. 6 per cent. Bonds	76	50	—5
Adelaide Sup. 6 per cent. Pf.	5¼	5⅛	—
do. 5 Deb.	104	101	—

MANUFACTURING COMPANIES.

	Mean price. July 27.	Feb. 2, 1915.	Rise or fall this week.
British Westinghouse Pref.	1¾	1 15/16	+ 1/16
do. 4 Deb.	74½	70	—
do. 6 p. lien	102½	98½	—
Callenders	11⅞	11½	—
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2½	3¼	+ ⅛
Edison & Swan, £3 pd.	3/32	11/6	—6d.
do. do. fully paid	1½	2	— ½
do. do. 4 Deb.	59	60	—
do. do. 2 Deb.	63½	60	—
Electric Construction	17/32	13/6	+2/-
do do. Pf.	1/16	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	13½	—
do. 4½ Pref.	5	5	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	8½	—
Telegraph Con.	38½	36½	+ ½

The Telegraph market's principal move is an advance in both classes of Anglo-American stocks. The excellent yield afforded by these has attracted investment attention, and the preferred is now within 1¾ of the mean price at the end of July, while the deferred is only ⅛ from its July figure. Marconis eased off to 1 9-16ths. New York Telephone bonds have come in for a good deal of attention, but there is no change in the price. Americans are hard at 10s.; Canadians stick at 4s. 3d. Telegraph Constructions at 36½ are the fraction higher. Electric Constructions are good, a florin rise taking the price to 13s. 6d.; and British Westinghouse preference regained their small loss of the previous week. On the other hand, Edison and Swan of both kinds are easier.

No improvement has occurred in the Mexican group, and last week's falls in Mexico Trams have been followed up by another drop of 5 points in the 6 per cent. bonds. Brazil Tractions weakened to 56½, a decline of 2, and the Anglo-Argentine quintet remains dull.

Armament shares do little more than hold their ground, but they continue to attract much attention all over the country. The optimist's view is that, whether the war is a long one or not, Germany must be crushed, which will mean colossal profits for the armament companies for a long time to come. Some of them are working twenty-four hours a day, and work is being refused in certain cases, because of the impossibility of accepting further orders at present. Armstrongs and Vickers at their present prices yield about 6¼ per cent. on the money. The rubber market is steady, the price of the produce keeping about 2s. 2d. per lb.

MARKET QUOTATIONS.

OWING to the war, the prices given below are, of course, more or less nominal.

Wednesday, February 3rd.

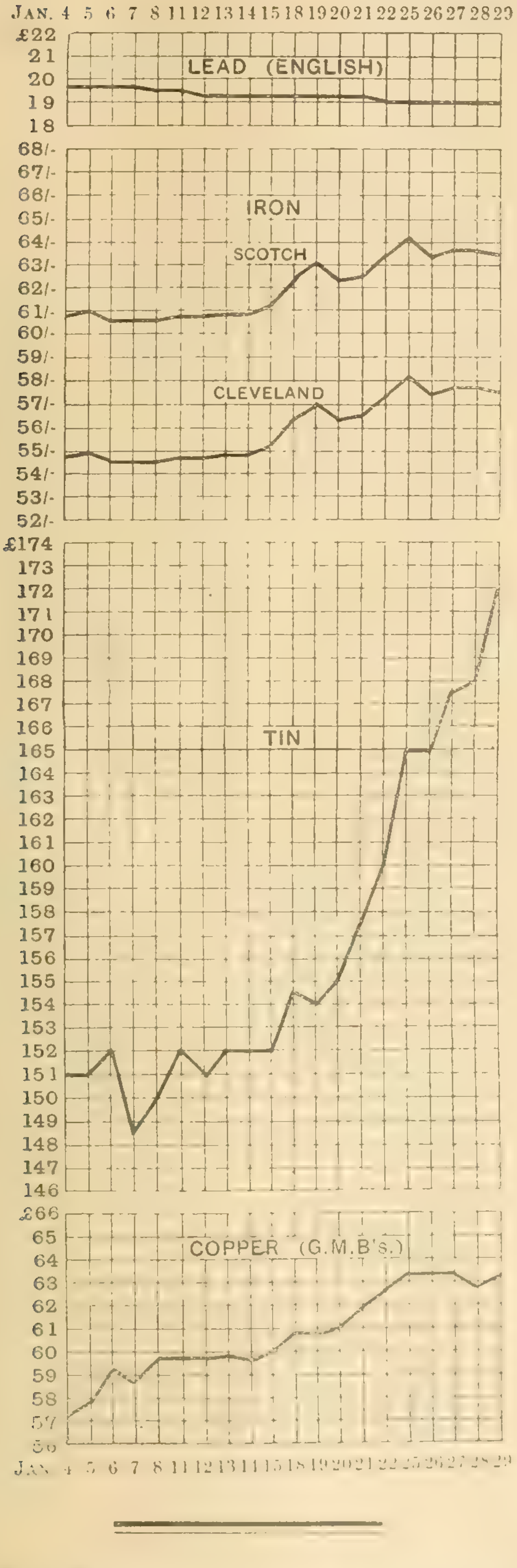
CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a „ Nitric	„	19/-	..
a „ Oxalic	per lb.	8d.	..
a „ Sulphuric	per cwt.	5/-	..
a Ammoniac Sal	„	£49	..
a Ammonia, Muriate (large crystal)	per ton	£49	..
a Bleaching powder	„	£8 10	..
a Bisulphide of Carbon	„	..	..
a Borax	„	£18 10	..
a Copper Sulphate	„	£26	..
a Lead, Nitrate	„	£35	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	6d.	..
a Potash, Caustic (88/90 %)	per ton	..	..
a „ Chlorate	per lb.	1/4	..
a „ Perchlorate	„	1/-	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£5 10	..
a Sulphur, Sublimed Flowers	„	£11 10	..
a „ Recovered	„	£8	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %)	„	£10 2 6	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	3¼d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£85	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£112	..
b „ Sheet, in ton lots	„	£112	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8¾d.	..
c „ Tube (brazed)	„	10d.	..
c „ „ (solid drawn)	„	9¾d.	¾d. inc.
c „ Wire, basis	„	9d.	..
c Copper Tubes (brazed)	„	11½d.	¾d. inc.
c „ „ (solid drawn)	„	11¼d.	¾d. inc.
g „ Bars (best selected)	per ton	£84	£4 inc.
g „ Sheet	„	£84	£4 inc.
g „ Rod	„	£84	£4 inc.
d „ (Electrolytic) Bars	„	£68 15	£7 5 inc.
d „ „ Sheets	„	£86 15	£7 5 inc.
d „ „ Rods	„	£74 15	£7 5 inc.
d „ „ H.C. Wire	per lb.	9 3/16d.	⅞d. inc.
f Ebonite Rod	„	3/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1 8	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/6	1d. dec.
j Iron Pig (Cleveland warrants)	per ton	56/6	3/- inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£16	..
g Lead, English Pig	„	£19 5	..
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e „ „ „ medium	„	3/- to 5/-	..
e „ „ „ large	„	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/1½ to 1/3	..
p „ „ rolled strip & sheet	„	1/2½ to 1/6½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£70	..
g Tin, Block (English)	„	£172 to £176	..
n „ Wire, Nos. 1 to 16	per lb.	2/4	1d. inc.
p White Anti-friction Metals	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

METAL MARKET.

Fluctuations in January.



A Swiss Financial Enterprise in South America.—The Columbus Company for Electrical Undertakings, which belongs to the Brown-Boveri group, was formed in 1913 for the purpose of acquiring the majority of the shares in the Compania Italo-Argentina de Electricidad, of Buenos Ayres, although its scope has been extended in the meantime to financial transactions in connection with other electrical enterprises in Argentina. According to the report for 1913-14, the company now holds over three-fourths of the capital of the Compania Italo-Argentina, and intends to advance to the latter the funds required for the extension of its supply works, for which a concession has been obtained until 1962. The company, which has also become interested in the supply companies in the towns of Dolores and Corrientes and in two companies in the city of Pergamino, earned net profits of £5 900 in 1913-14, which sum has been partly placed to reserve and partly carried forward.

A NEW NITROGEN ELECTRIC FURNACE.

At a meeting of the Society of Chemical Industry, held on January 4th at the Northampton Institute, London, E.C., Mr. E. Kilburn Scott described and demonstrated a new furnace which he has devised for the production of nitrates from the air. The furnace is at present in the experimental stage, but it is so inherently simple in design, sound in principle, and promising as a result of the tests so far made, that there is every reason to believe it will yield results superior to those attained in any of the existing types of furnace.

Introduction.—The development in England of a purely English process for manufacturing nitric acid and other nitrates is a matter of national, as well as purely industrial, importance, for these materials form the basis of explosives, to say nothing of their use in agriculture and the aniline dye industry, and it is, therefore, in a high degree undesirable that we should be dependent entirely upon foreign sources for materials of so important a character. It may be objected that cheap water power, such as exists in profusion in Norway, is indispensable for the profitable development of electric furnace processes of this character. This, however, is largely a delusion, for in more than one district of England steam power can be obtained for constant loads practically as cheap as water power in Norway (the cost of which will always tend to rise on account of increasing rents), and the advantage to England is altogether secured when one considers the cost of the double freights of ammonia to Norway, and ammonium nitrate or nitric acid back again to this country. That the fixation of atmospheric nitrogen will be sooner or later undertaken in England is a certainty; the question we have to consider at the moment is, can the Kilburn Scott furnace fulfil the necessary conditions of low prime cost, small depreciation, simplicity in control, and efficiency in working, which alone will enable it to compete successfully with the types now in use in Norway and elsewhere on the Continent? From the data we have at present at our disposal, it would appear that one is justified in giving an affirmative answer to this question.

Before one can appreciate the advantages claimed by Mr. Kilburn Scott for his furnace, it will be necessary to consider briefly the salient features of the three furnaces at present in use industrially—the Birkeland-Eyde, the Schönherr-Hessberger, and the Pauling.

Comparison of Existing Types.—All nitrogen fixation furnaces have electrodes of metal between which alternating current arcs are formed. These arcs are "blown" into flames by a magnetic field, as in the Birkeland-Eyde, or by an air blast, as in all the other types, including the Kilburn Scott. Into the arcs or flames the air under treatment is passed, and under the great heat evolved, and perhaps, too, induced by the electronic condition of the region of the discharge, some of the nitrogen and oxygen of the air combine to form nitric oxide, which must be removed to a cooler zone as quickly as possible to prevent its dissociation back into its constituent elements. It will be unnecessary to describe here in any detail the existing types of furnaces, as descriptions of them have frequently been published, and are readily available. It will suffice to state the ideal conditions which should govern the design of a nitrogen furnace, and indicate in what manner the several types fall short of the ideal.

These conditions are:

1. Highest possible temperature of flame (over 3,000° C.)—the higher the temperature, the greater the yield of nitric oxide.

2. To ensure a maximum supply of air to the arcs and a minimum expenditure of energy in raising it to the necessary temperature.

3. To draw off and cool the fixed gas quickly.

4. To minimise adjustments and renewals of the electrodes.

5. To ensure automatic regulation of current and continuity of working.

In the Birkeland-Eyde furnace (fig. 1) the arcs, which alternate at 50 cycles a second, rage between the rounded ends of two U-shaped copper electrodes, through which water passes. A powerful electromagnet produces a direct strong magnetic field at right angles to the electrodes. Consequently, when the alternating current flows the arcs are deflected outwards into the disc-like chamber in which they burn. As a result, a circular sheet of flame is produced. The way in which the air is brought into this flame will be clear from the figure without further explanation.

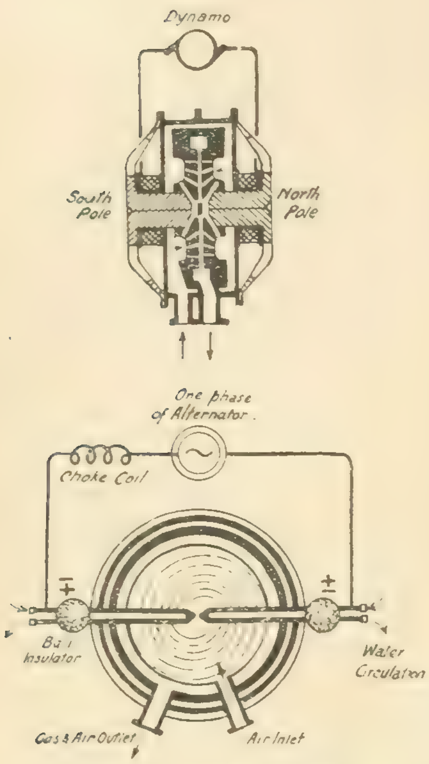


Fig. 1.—Birkeland Eyde Single-phase Furnace

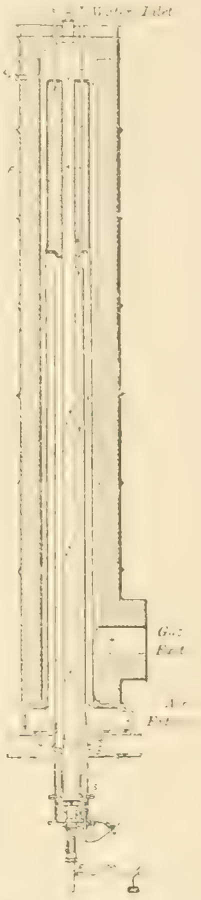


Fig. 2.—Schönherr-Hessberger Furnace

The criticisms which Mr. Kilburn Scott makes against this furnace are:—

1. The amount of energy required to energise the electromagnets (stated to be 10 per cent. of the total consumption).

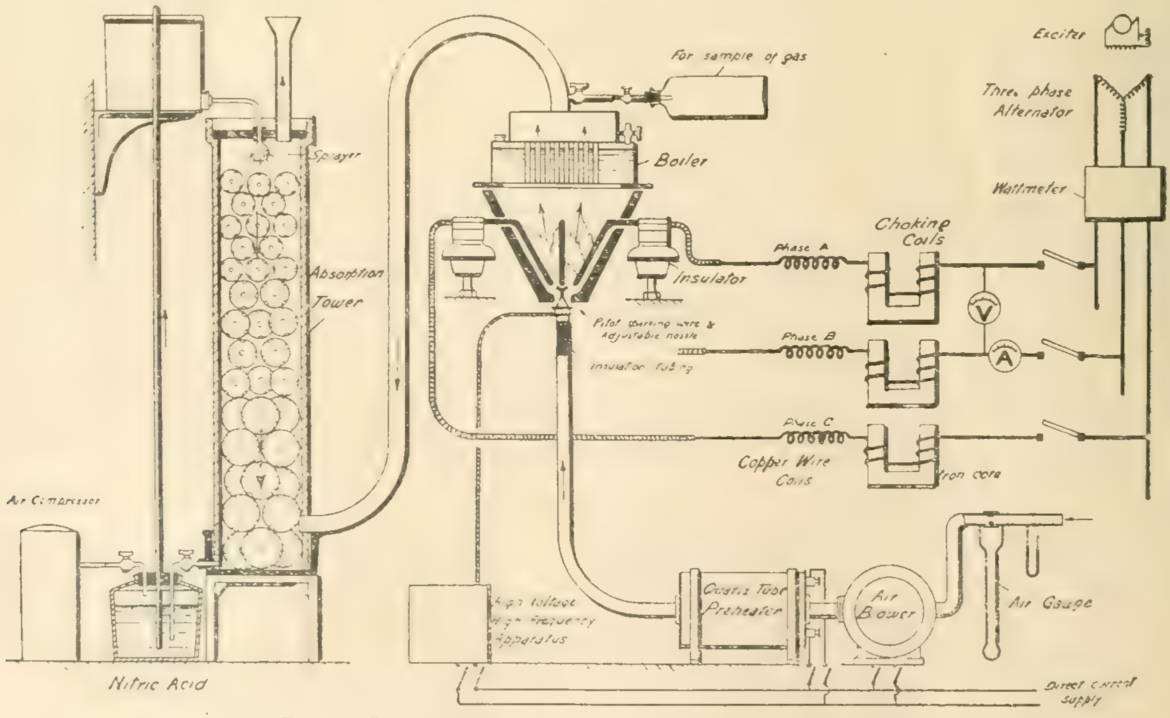


Fig. 3.—Lay-out of Kilburn-Scott Experimental Plant.

2. The impossibility of preheating the air before it passes into the flame.

3. If three-phase current is available it is not possible to utilise all the three phases in a single furnace. This point will be dealt with more fully presently.

It may be mentioned that at Notodden, in Norway, there are installed 32 Birkeland-Eyde furnaces of 600 to 1,000 kw. each, and at Saaheim there are eight each of 3,500 kw. capacity.

In the Schönherr-Hessberger furnace (fig. 2) a whirling draught of air maintains a standing arc flame inside the innermost of four vertical concentric annular steel tubes, the diameters of which range from 3 ft. to 6 in. The intermediate tubes allow the incoming air to be preheated, as will be evident from a glance at the diagram. The amount of preheat is stated to be under 500° C. As compared with the Birkeland-Eyde, this furnace has the advantage of using only one kind of electric current, and the energy required for a given output of gas is, therefore, less. On the other hand, the great height of the furnaces (varying from 15 to 30 ft. at the different installations) causes considerable difficulty in maintaining the long arcs, and this, together with the long and devious air-path, presents so many mechanical and electrical difficulties, that large units cannot be built, a drawback, both from the point of view of yield and capital expenditure. Further, it would hardly be possible to run three distinct three-phase arcs in one tube without their collapsing together. At Christiansand the Badische Anilin und Soda Fabrik have erected 12 furnaces, each of 450 kw., and at Saaheim there are 96, each of 1,000 kw. The largest Birkeland-Eyde units, be it noted, are of 3,500 kw.

The Pauling furnace is of the familiar horn lightning arrester type. Two electrodes diverge, leaving a fan-shaped space between them in which the arc plays. An air-blast causes the whole space to be filled with a sheet of flame. In the ordinary way the arc between such electrodes would travel upwards by the repulsion of the magnetic field, and finally snap out and break the circuit. So, for the flame to be continuous, the distance between the electrodes must be such that the normal voltage will allow a spark to jump across them and re-establish the arc at every half-cycle of the alternating current. The electrodes themselves being set several inches apart to allow the air supply to pass through, the sparking distance is diminished by fixing to the tips of the electrodes thin copper starting knives, which, of course, burn away, and are therefore gradually fed forward to preserve the arc. It will be gathered that the furnace is exceedingly simple compared with the two previous types, but the adjustable electrodes are a source of weakness. Mr. Scott is of opinion, and the same view is expressed in a Report published by the Department of Commerce and Labour of the United States, that of the three furnaces at present in use, the Pauling is certainly likely to prove the most successful. All the furnaces, however, share the defect that they are unable to operate with three-phase current in one furnace, and it is this defect which Mr. Kilburn Scott set himself to remedy.

Three-Phase Working.—The advantage of three-phase working is twofold. In the first place, the general use of three-phase systems renders it almost a necessity in the case of a furnace that is going to purchase from an existing centre its supply of electrical energy. Perhaps an even greater advantage than this is the higher temperature that Mr. Kilburn Scott has shown to be obtainable in a triple flame compounded of three separate alternating current arcs. This, as already stated, may mean a considerable increase in the yield of fixed gas per unit of electrical energy absorbed, and, provided only the thing is feasible and practical, this advantage should secure for a three-phase furnace an undoubted superiority over its rivals. It was predicted, not unnaturally, that a three-phase furnace would not balance well, would consume its electrodes unequally, and so forth. Experiment has convinced Mr. Kilburn Scott that none of these faults appear in practice, and certainly the little three-phase experimental furnace which can be seen working at the Northampton Institute operates as evenly and as steadily as can be desired.

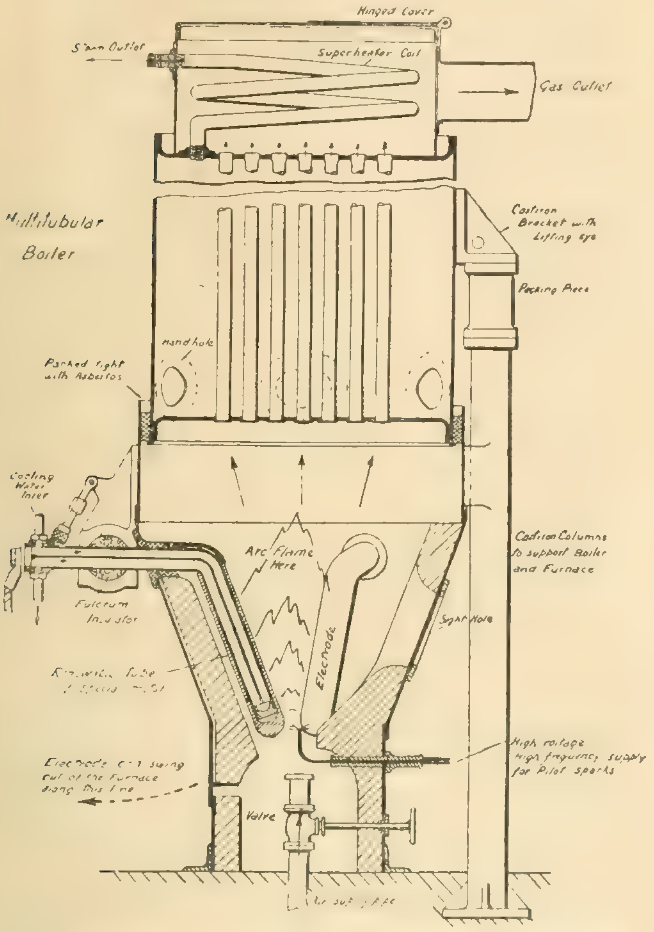

Hinged Cover
Steam Outlet
Superheater Coil
Gas Outlet
Multitubular Boiler
Castiron Bracket with Lifting eye
Packing Piece
Hand hole
Packed tight with Asbestos
Cooling Water Inlet
Arc Flame Here
Castiron Columns to support Boiler and Furnace
Fulcrum Insulator
Sight Hole
Electrode
High voltage high frequency supply for Pilot sparks
Electrode can swing out of the Furnace along this line
Valve

FIG. 4.—SECTIONAL ELEVATION; KILBURN-SCOTT THREE-PHASE FURNACE.

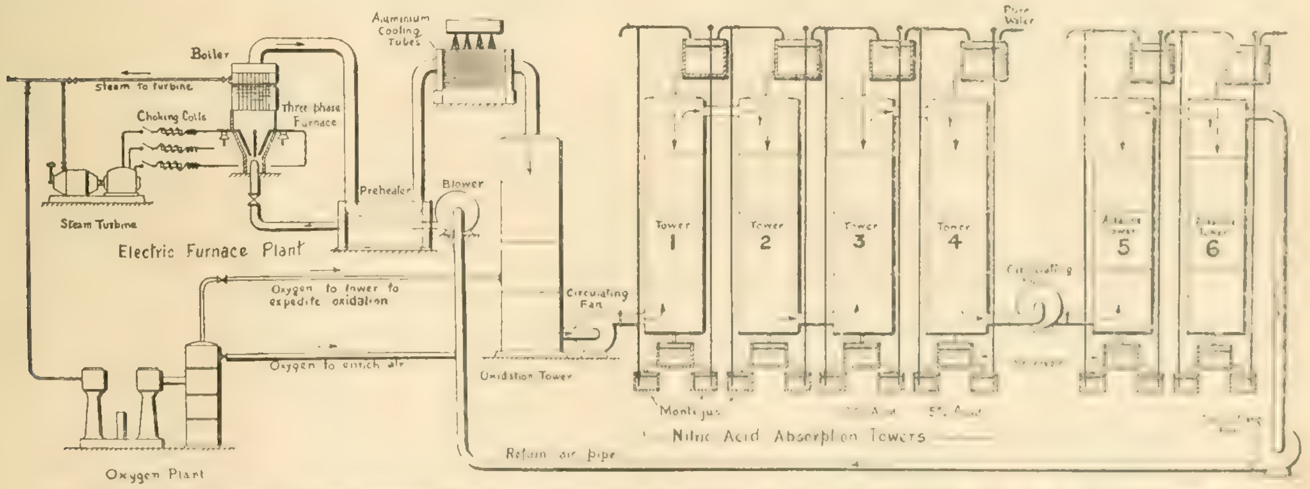


FIG. 6.—NITRIC ACID PLANT WORKING REGENERATIVELY WITH KILBURN-SCOTT FURNACE AND WITH OXYGENATED AIR ON CLOSED CYCLE.

The Kilburn Scott Furnace.—A sectional elevation of the small experimental furnace appears black in the centre of fig. 3. In general principle the furnace follows the Pauling type, except that there are three electrodes instead of two, and the starting device is simpler than the auxiliary electrodes of the Pauling furnace. In the small furnace, which was shown working at the meeting, the electrodes made of $\frac{1}{2}$-in. steel rod bent as shown in fig. 3, pass through holes drilled in a fireclay crucible which forms the furnace-chamber, and through the bottom of which the air under treatment is blown, after being preheated in a small electric tube furnace. Three-phase current at 2,000 watts, 25 periods, is applied to these electrodes, in series with each of which is a set of choking coils—necessary for steady working. When the current is flowing, and the air is blown through, the whole crucible is filled with a mass of roaring blue flame. The starting device will be described immediately.

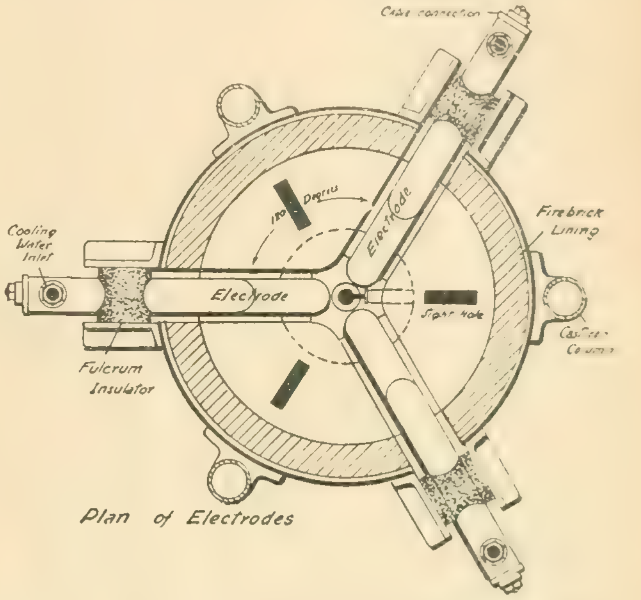


FIG. 5.—PLAN OF KILBURN-SCOTT THREE-PHASE FURNACE.

Figs. 4 and 5 illustrate the furnace as it would be constructed in practice. The electrodes here consist of steel tube divided longitudinally into two parts so that the cooling water travels up one side and down the other. A renewable tube of cast steel encases the electrodes; these, as they burn away, can easily be turned round, and finally renewed.

In the Pauling furnace new sections of tube have to be fitted in, a much more lengthy and troublesome procedure. The way in which the electrodes are fixed and insulated is sufficiently well indicated in fig. 4. The arcs are started by a high-voltage high-frequency spark which is emitted from the pilot sparking conductor (to earth through the electrodes), shown in close proximity to the bottom of the right electrode in fig. 4. These high-tension sparks continuously break down the air dielectric, and so maintain the three-phase main current. It is interesting to note that the two electrical circuits do not in any way interfere with one another. The necessity for the pilot spark enables the main current to be entirely put on or cut off by means of an ordinary tumbler switch which controls the primary sparking current. The ingenious method of maintaining the main arcs here described is a characteristic feature of Mr. Kilburn Scott's furnace, and unless any unforeseen difficulty should prevent its working on a large scale, it should prove a greatly superior method to the auxiliary copper electrodes used in the Pauling furnace. As the pilot conductor passes through a porcelain insulator into the furnace below the electrodes, where it is comparatively cool, there seems no reason to anticipate any special difficulties.

Another striking, and, indeed, a very bold feature of this furnace is the multitubular boiler placed immediately above the flames, as shown in figs. 3 and 4. The boiler, in fact, actually forms the roof of the furnace. The purpose of the boiler is, of course, to cool the gases as soon as possible and as quickly as possible after they leave the zone of reaction. Experience with the experimental furnace convinces Mr. Kilburn Scott that no difficulties will arise with the boiler in an industrial furnace. The nitric gases that play upon it will not yet be in the peroxide state, and one gathers that nitric oxide, even at a high temperature, will not attack iron. It will be necessary, or at least desirable, to employ in the boiler pure feed-water, and this, combined with the rapid circulation brought about by the very high temperature, is likely to minimise the formation of scale.

The steam raised in the boiler is to be used to generate electrical energy, as shown in fig. 6, so that the combination will be regenerative. Naturally, not the whole of the electrical energy required can be raised in this way! (The diagram is somewhat misleading in this respect.) As a matter of fact, the regenerative value of the steam so raised is likely to be some 15 per cent.

In fig. 6 are also indicated other regenerative features of the process; namely, the oxygenation of the air supply to the furnace, the cyclical working of the process, as far as the air supply is concerned, so as not to waste oxygen, and the way in which the preheating of the air entering the furnace is effected. With regard to the oxygenation of the air, this would best be brought about by linking up the nitric acid works with processes in which oxygen is a by-product, such as the manufacture of hydrogen for air-craft or for the hydrogenation of oils, or the manufacture of calcium cyanamide. These, however, are chemical aspects of the process, and, moreover, they are not peculiar to any particular type of furnace, so they need not be enlarged upon here. The same remarks apply to the working up of the nitric oxide into marketable products. In fig. 5 a series of towers are shown indicating the general form of the plant if it is desired to make nitric acid, the most useful and valuable of the nitrogen products. From this ammonium nitrate is easily made by direct contact with ammonia. At present it appears that ammonia is actually shipped to Norway for this purpose, and the ammonium nitrate brought back again here for the explosive manufacturer or the farmer. This strange state of affairs is a cogent argument for the establishment of nitric acid manufacture in this country on a scale commensurate with our needs. There is no valid reason on the electrical side, even if the prime source be not water power (it probably could be), why the electrical process should not work as successfully here as it does in Norway or elsewhere on the Continent, and if Mr. Kilburn Scott's claims for the increased yield of his three-phase furnace are realised on a large scale, and on the face of it there seems no reason why they should not be, his process will help greatly the development of a home industry of quite national importance.

THE TELEPHONE IN SURGERY.

A good deal of interest has lately been aroused in medical circles by a new development in the application of the telephone to surgery. It is more than 30 years since Graham Bell suggested, *apropos* of the attempts which had been made to locate the bullet in the body of President Garfield by means of the induction balance, that a simpler method would have been—he was speaking some months after the death of the President—to use a telephone, attaching to one terminal a fine needle, and to the other a plate of metal of the same nature. The plate would then be placed on the limb to be examined, and the needle thrust in where the bullet was believed to be. On its making contact a galvanic battery would be formed within the body, which would cause a click to be heard in the telephone, and would guide the surgeon to the position of the foreign body.

This device was employed by Dr. (now Sir) James Mackenzie Davidson in Aberdeen to locate a bullet in the head of a patient, and was afterwards used in a limited way during the South African war. Until recently, however, the condition laid down by Graham Bell, namely, that the instruments used for exploration must be of the same metal as the plate placed on the patient's skin, was thought to be essential to the success of the method.

In a communication made to the Medical Society of London on January 25th, Sir James Mackenzie Davidson stated that he had now discovered that this was not at all the case, and that the telephone attachment could be used with any metallic instrument at the surgeon's command. Finding that the dissimilarity of the metals did not impair the value of the result, he tried several pairs in order to discover which would give the most distinctive sound. The embedded metals for which the surgeon had usually to search were lead, nickel, copper, iron, and some of the iron alloys used in shell manufacture, while the surgeon's instruments were usually steel, silver, or nickel-plated. With any of these instruments attached to one terminal of the telephone, he found that on contact with any of the above-mentioned metals, the loudest sound was elicited when a plate of carbon, such as was used in an ordinary bichromate cell, was attached to the other terminal. The currents generated were, naturally, small and of low pressure, and it was necessary to reduce the resistance of the body by using as large a plate of carbon as possible, and to increase the conductivity of the skin by moistening it with salt solution. He found that a cheap telephone of 60 ohms resistance, costing only a few shillings, detected these small currents better and gave a louder sound than the more expensive high-resistance telephones used in wireless telegraphy.

Sir James demonstrated his method of procedure, which consisted in the use of a telephone with double receivers for attachment to the surgeon's head, one terminal of the telephone being brought to the carbon plate, and the other to a disinfected silver wire which was bound round or clipped on to the knife, probe, needle, forceps, or whatever instrument the surgeon might wish to use. The instrument, on first contact with a bullet, gave rise to an unmistakable click on the telephone, and, when a rubbing contact was made, to a distinct microphonic rattle, and under this guidance the embedded metal could be extracted.

The lecturer added that he had found no special advantage result from the introduction of a battery into the circuit. One modification which might be employed, in the case of a surgeon whose hearing was not acute, was to pass the current, not through the telephone, but through a suitably wound galvanometer, when the movement of the galvanometer needle would indicate contact with the metal, or the arrangement could work as a relay, and a bell could be made to ring every time the bullet was touched by the surgeon's implement.

Sir James, whose demonstration obviously impressed his fellow surgeons, prophesied that a time would come when no surgeon would attempt to remove a deeply embedded metallic body without having this telephone attachment at hand.

THE SHAPE OF THE PRESSURE WAVE IN ELECTRICAL MACHINERY.

Part I, by S. P. SMITH, D.Sc., A.M.I.E.E., and R. S. H. BOULDING, B.Sc. Part II, by S. P. SMITH, D.Sc.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *January 14th*, 1915.)

IN Part I the electromotive force induced in windings is determined analytically, and the effect of flux-swinging is investigated. The importance of the winding factor is emphasised. Experimental confirmation is given wherever possible. (No attention must be paid to the relative magnitudes and phase displacements of the oscillograms here reproduced.)

In Part II an attempt is made to amplify and illustrate the analytical results obtained in Part I, by means of the vector diagram and by examples. Also the advantages of using the vector diagram of the fundamental for studying the circuits in a double-layer commutator winding are shown, and simple rules for obtaining the positions of the various phase tappings and connections are given.

One of the greatest advances that have been made in the development of electromagnetic machinery during the present century is the approach in the shape of the pressure wave to the ideal sine curve. Several reasons have combined to bring about this result. Thus the wide extension of the three-phase system with star-connected generators has removed from the interlinked or line pressure the third harmonic, which is sometimes considerable in the phase pressure. Again, the adoption of the non-salient-pole construction for the rotors of turbo-alternators has made it possible to obtain a flux distribution which remains nearly sinusoidal under all conditions of load. Finally, the designer has also learnt what refinements are necessary in order that the pressure curve may be free from ripples.

Although there are cases where the shape of the pressure wave is not important, there is no doubt that the pure sine curve is best for general alternating-current working. Thus, the troubles occasioned by earthing the neutral, which is now common practice in central-station working, are mainly due to the existence of a third harmonic in the phase pressure. Cases arise also in the parallel working of synchronous machines where the interchange of wattless currents due to the higher harmonics becomes excessive. As an instance, a case may be cited of a six-phase rotary converter working direct off a six-wire, three-phase generator, where, owing to the harmonics, the current taken when the converter was running light was equal to the normal full-load current.

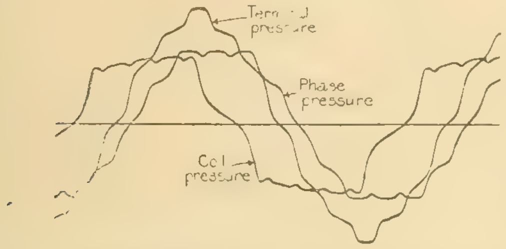


FIG. 1.—OSCILLOGRAMS SHOWING SPACING RIPPLE IN PHASE AND TERMINAL PRESSURES OF THREE-PHASE SALIENT-POLE ALTERNATOR, HAVING SIX SEMI-CLOSED SLOTS PER POLE.

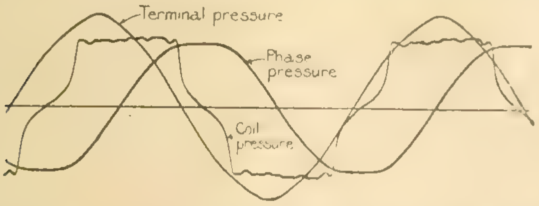


FIG. 2.—OSCILLOGRAMS SHOWING SUPPRESSION OF SPACING RIPPLE—DUE TO FRACTIONAL NUMBER OF SLOTS PER POLE—FROM PHASE AND TERMINAL PRESSURES OF THREE-PHASE SALIENT-POLE ALTERNATOR. OPENED WAVE WINDING—108 SLOTS (SEMI-CLOSED); 16 POLES; 6·75 SLOTS PER POLE.

Numerous other factors of varying importance, such as low losses and high power factor in the system, safety in high-tension working, freedom from disturbances to telephones, and from resonance, &c., all demand an absence of harmonics. Also, when a four-wire, three-phase system is used for a lighting supply, the use of a pure sine wave results in the ratio, phase pressure to star pressure, being constant.

The sine curve is the most natural standard, and it is generally attainable, which would not be the case with other wave shapes. Also, the majority of our simple calculations and vector diagrams are only possible on the assumption that the quantities in question vary sinusoidally.

In Sec. 1, under the head of "Classification of Windings," the authors show that where the number of slots per pole is an integer, and a normal arrangement of slots and poles is adopted, the effect of the teeth on the wave form will be greatest (fig. 1). When the poles or slots are skewed in such a manner as to make the conductors occupy all possible positions in the field, the winding is equivalent to a uniformly distributed winding, and the effect of the teeth is *nil*. When the pole-shoes are displaced, or the number of slots per pole is fractional, the equivalent distribution of the winding is increased (fig. 2).

In all cases where there is an abnormal arrangement of the field or armature system, or a fractional number of slots per pole, it is allowable in practice to regard the winding as uniformly distributed.

In Sec. 2, a general expression for the electromotive force induced in a coil is obtained. When a coil moves relatively to the flux, an electromotive force of motion or rotation is said to be induced in it, whilst if the flux itself varies, an electromotive force of pulsation is induced. With continuous-current excitation the flux is steady, except in so far as pulsations are set up by the teeth or by armature reaction. It is here assumed throughout that the machine is unloaded. It is shown that the curve of electromotive force induced in each side of a coil is identical in shape with that of the flux distribution, but the two pressures are only in phase when the coil spans a full pitch. The coil-span factor can effectively suppress certain harmonics in the induced pressure. For instance, if the coil spans two-thirds of a pole-pitch, the third harmonic disappears.

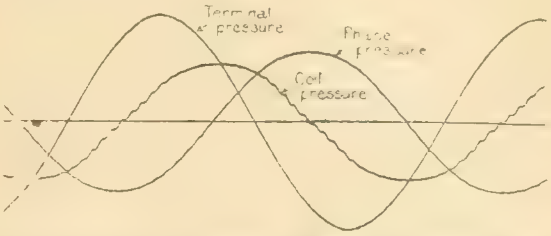


FIG. 3.—OSCILLOGRAMS SHOWING EFFECT OF ROTOR TEETH OF NON-SALIENT-POLE TURBO-ALTERNATOR, 24 STATOR SLOTS, NEARLY CLOSED; 40 ROTOR SLOTS CLOSED WITH CAST-IRON WEDGES, 14/20 WOUND; 2 POLES. ROTOR SLOTTED UNIFORMLY OVER WHOLE PERIPHERY.

In Sec. 3, the electromotive force induced in a circuit of a winding by rotation in a steady field is investigated in detail, and tables of distribution and reduction factors for various windings are given.

Incidentally it is shown that there can never be a third harmonic in the line pressure of a star-connected three-phase generator, nor in the alternating pressure of a three-phase rotary converter, nor in the phase pressure when each phase extends over two-thirds of the pole-pitch, nor in the pressure of a single-phase alternator with two-thirds of the periphery wound. This also holds when the winding is placed in slots instead of being uniformly distributed. In a similar way, when the spread of winding equals two-fifths or four-fifths, no harmonic which is a multiple of 5 can appear in the pressure curve.

The effects of the slots in the rotor and stator are considered, and it is shown that when the numbers of slots per pole-pair on the stator and rotor are equal, or only differ by two, a very pronounced ripple of a high order may appear in the pressure (fig. 5)

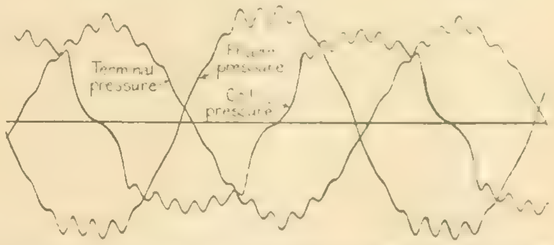


FIG. 4 —OSCILLOGRAMS SHOWING TOOTH RIPPLE DUE TO FLUX SWINGING IN THREE-PHASE SALIENT-POLE ALTERNATOR WITH A WHOLE NUMBER OF SLOTS PER POLE. OPEN SLOTS.

The spacing ripple in salient-pole machines is chiefly important with two or three slots per pole and per phase, and unless one of the several methods for making the winding factor very small is used, it is generally advisable when a smooth pressure wave is needed, to round off the pole tips so as to reduce the harmonics. With non-salient-pole machines, the number of stator slots per pole is generally larger, and the chief care must be taken to avoid clashing with the number of teeth on the rotor.

The effect of flux pulsations due to teeth is dealt with in Sec. 4. Since most of the flux is carried by the teeth and very little by the slots, there is always a tendency for it to move as the teeth enter and leave the pole-arc. When the magnetic path in the gap has a constant reluctance but variable position, the flux will swing to and fro; when the reluctance varies, the flux will change in amount. It is probable that both these movements take place to some extent in all slotted armatures, though the former is alone of importance, as a rule.

Unless the whole magnetic circuit is well laminated the change in the flux can never be very large, since there will always be a tendency for oscillations in the magnitude of the flux to be damped out by eddy currents and currents induced in the exciting winding. Both experience and experiment confirm this view.

The E.M.F. ripple due to swinging of total flux is of much greater importance, since with laminated shoes there is comparatively little hindrance to the flux swinging. In the worst case the magnitude of this swing would equal the flux of one tooth, and from oscillograms it is often found to exceed one-half of this amount (fig. 4). The larger the number of teeth per pole the smaller the possible swing.

The amount of flux swinging depends largely on the constructional details of the machine, such as the number of slots per pole, the ratio of slot-opening to gap, the skewing of the slots or pole-shoes, &c., and by suitable design it can be made fairly small. The commonest method for reducing the swing is to use nearly closed slots.

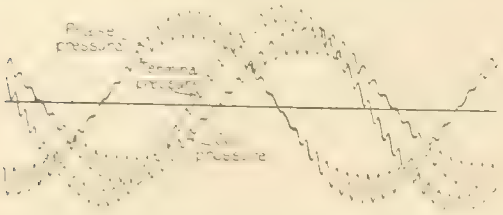


FIG. 5.—OSCILLOGRAMS SHOWING COMBINED EFFECT OF TOOTH RIPPLE AND SPACING OF ROTOR SLOTS IN THREE-PHASE NON-SALIENT-POLE TURBO-ALTERNATOR. STATOR: 36 SEMI-CLOSED SLOTS; ROTOR: 34 SEMI-CLOSED SLOTS WITH BRASS WEDGES, 14/17 WOUND; TWO POLES. ROTOR SLOTTED UNIFORMLY OVER WHOLE PERIPHERY.

Fig. 5 shows the effect of an unsatisfactory choice of numbers of slots. In fig. 6, instead of only having the required number of slots, namely, 144, there were 150. The machine had open slots. As we should expect, the pressure induced in a conductor reveals a fairly strong tooth ripple, thus proving that the flux was swinging. In the coil pressure, the ripple is already reduced, owing to the fact that the electromotive forces are not identical in phase; whilst the phase and terminal pressures are quite smooth.

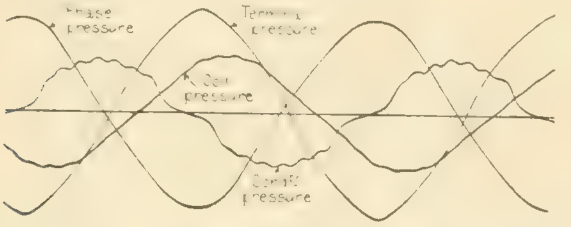


FIG. 6.—OSCILLOGRAMS SHOWING SUPPRESSION OF TOOTH AND SPACING RIPPLES FROM PHASE AND TERMINAL PRESSURE OF THREE-PHASE SALIENT-POLE ALTERNATOR WITH A FRACTIONAL NUMBER OF SLOTS PER POLE. 150 SLOTS (OPEN); 16 POLES; 9·375 SLOTS PER POLE.

There are external methods of suppressing the tooth ripple from the terminal pressure. For example, a method that has found favour of late years has been the use of a resonance circuit across the terminals of the machine, adjusted to resound with the frequency of the tooth ripple; though in most cases the addition of one or two extra slots would certainly be a much cheaper and an effective way of preventing disturbances in telephones.

Regarding the effects due to the slots and teeth, it is obvious that in general it is possible to build machines nowadays in which all such effects are eliminated from the pressure wave.

DISCUSSION IN LONDON.

DR. S. P. THOMPSON said the paper formed a brief account of the state of affairs, as known and added to by the authors, at the present time. No doubt many of the things mentioned had been touched upon by previous investigators; but the authors had succeeded better than any before in investigating the effect of ripples, and it would be as well to provide some adjective to distinguish between ripples due to stator and rotor slots. Amongst other things, the authors had given them a new definition of "circuit" which it would be difficult to apply generally. The authors enumerated the advantages of the pure sine wave, but also reminded them that they should have the flux form a pure sine curve, as then there would be no need for devices to correct it. The non-salient form of pole properly wound was better for flux distribution, and was better from the mechanical point of view. He thought it would be advantageous to simplify the mathematics for those who would make practical use of the paper in the future, and as it stopped short of certain matters, perhaps the authors would follow it up.

MR. BURGE said, with the exception of turbo-alternators, pole slots could not be slanted, as they were usually laminated. He wished the authors had not set aside the question of wave form on load; he mentioned this in regard to the proposal to use alternators with poor regulation instead of reactances.

MR. C. C. HAWKINS said the authors had not mentioned the use of the mid-coil arrangement for suppressing certain harmonics; it was not right to be satisfied when the harmonics were reduced to very small proportions, as they might give rise to very serious effects. The authors were rather uncertain on certain matters regarding flux swinging; he thought it was agreed that with fringing the conditions were reversed. He thought it was necessary to have the whole circle of polar fringe in order to make reliable deductions as to swinging.

MR. A. R. EVEREST said the salient-pole rotor could be made to give just as good an approach to the sine wave as the drum type. He thought it was obviously impossible to adopt irregular slotting or spacing of coils on a large scale for manufacturing reasons; a fractional number of slots per pole was a good method. He believed the American Institute allowed as a standard any harmonic not to exceed 10 per cent. of the main wave, but a newer standard was proposed.

DR. HOWE emphasised his belief in the correctness of fig. 19 in the paper (in regard to which it may be mentioned that an alternative unsymmetrical figure had been discarded as being doubtful). It ought to be quite clear whether reference was made to ripples or to the harmonics into which they were divided.

MR. JAKEMAN did not think it practicable to use an extra slot as suggested, except for single-phase machines, and taking all points into consideration he thought higher harmonics might still be present if extra slots were used.

The **AUTHORS**, in replying, said the effect of load was now being considered. **DR. SMITH** explained that they were not advocating anything in particular, and were investigating everything that came along. He had not yet arrived at a conclusion as to the correctness or otherwise of the unsymmetrical edition of fig. 19.

DISCUSSION AT MANCHESTER.

PROF. MILES WALKER said the authors were to be congratulated upon having given a solution of what had always been regarded by designers as a very troublesome problem. Present-day engineers had found from experience the desirability of keeping down the ripple in the E.M.F. wave as much as possible. Some engineers even inserted a clause in the specifications regarding the percentage ripple allowable, and this might be 1 per cent. or over. The main difficulty with the designer had been to predetermine the amount of ripple; it was a comparatively simple matter to take the E.M.F. of a single conductor in a machine and so determine the field form, but it was quite another matter to deduce from the field form the final E.M.F. wave form. This was the problem the authors had solved. The tables given enabled the designer to predetermine without any trouble the value of any harmonic in the final E.M.F. wave form. It was to be hoped that the authors would pursue their investigations and give the results of full-load working in addition to the no-load results recorded in the present paper. The paper was an admirable case of applied mathematics producing tables of real commercial value.

MR. K. M. FAYE-HANSEN, speaking from the point of view of an alternator designer, said that most of the conclusions were known to the specialist designer, but they had never been brought forward in such a clear manner and arranged so that the result of higher harmonics could be easily predetermined. The employment of fractional windings was a useful expedient and gave excellent results, but sometimes there were economical reasons against it, the chief of which was the use of parallel connections.

PROF. FIELD said that the extent to which a slight ripple might be of great practical importance was illustrated by the fact that purchasers' specifications usually limited the no-load value, whereas the value of vital importance was the full-load operation; it was very hard to specify that, because it was necessary also to specify the nature of the load. In the case of a machine which it was required to delta-connect, it was of great importance to investigate the matter in advance and see that the third or seventh harmonic would permit delta-connection without serious circulating currents. Unless special precautions were taken, serious trouble might arise from the ninth harmonic. In the case of the New York Edison Co. and several other stations in the U.S.A. the original operating voltage was 6,600, but the plant was arranged for ultimate conversion to 11,000 volts; in consequence the large generators were arranged to be delta-connected. In most cases the turbo-alternator had been wound with a two-thirds coil pitch, which completely eliminated the third and ninth harmonics. He took exception to the authors' statement to the effect that on alternator work a full-pitch winding was usually employed. In the States it was more common than otherwise to have a chorded winding on alternators, particularly turbos. In order to illustrate the comparatively big effect of a very small harmonic, he cited the case of a machine with the winding chorded not quite two-thirds, but two-thirds plus or minus one slot. The effect would be almost completely to wipe out the third harmonic, the only effective amount being due to the discrepancy of one slot. The value of the third harmonic might have been considered too small to be of any account, but the ultimate burning-out of windings in slots where the coils crossed was found to be due to this circulating third harmonic current together with the extra losses due to high frequency.

DR. G. W. WORRALL, in a written communication, said that his general impression was that the authors had not sufficiently considered the individual ripple E.M.F.'s generated; the ripples in the conductor might be considerable, although the wave of terminal pressure was quite smooth. When several conductors were connected in parallel, the ripple E.M.F.'s sometimes produced circulating currents which caused unequal local heating of the machine. The ripples also caused vibration of the teeth, and serious breakdowns were by no means uncommon, which were without doubt due to this cause. There must, of course, be a certain amount of looseness in the stampings to allow the vibration to take place, but such looseness might not be due to defective manufacture in the first instance. During the past few months two machines broke down in this way, one, a slow-speed alternator, after a few weeks' running, and the other a high-speed turbo-alternator after eight years' running. It was, therefore, of the utmost importance to suppress the ripples as far as possible in each conductor, and not merely cancel them out in the aggregate.

Mr. R. S. H. Boulding, in reply, said the only way to get rid of ripples was to avoid swinging, which could be approximately carried out by the method mentioned in the paper. Whilst the paper was confined to no-load effects, the same method applied to full-load considerations, and the results were to be regarded as qualitative rather than quantitative.

Dr. Smith, in reply to Mr. Faye-Hansen, said considerable difficulty was experienced with the shops in regard to cutting extra slots. No doubt it was a commercial question. The question of parallel circuits was very important; in the case of a two-pole machine it was practically hopeless, but with a four-pole machine two extra slots across a diameter were easily added. Generally speaking, it did not cost as much to have two extra slots as to chamfer the pole-pieces. Prof. Field mentioned the case of machines which did not have identical circuits; the whole paper went to show that identical circuits were necessary. Unsymmetrical windings were not to be advocated, and there was no reason for departing from this excellent rule.

ELECTRIC HEATING AND COOKING.

At the last meeting of the "Point Five" Association, held in London on January 15th, Mr. Hefford, of Leeds, was elected a member.

Mr. **Harold Gray**, of Accrington (the Chairman), an abstract of whose remarks we give, said that in many undertakings there are other users of equal or greater importance than those in the domestic field. A suitable domestic tariff has been formed and established, and it is time that the efforts of the Association were concentrated on reclaiming another field, the trading class of property covering shops, hotels, etc. The enormous variation in the rateable value of this class of property depending on its position is a serious drawback to the elaboration of a rateable tariff.

A rate based on a sliding scale of percentages on rateable value and a fixed price per unit worked out as the result of combined experience, is a tariff which could be utilised advantageously and with profit to all concerned. The higher rated premises would have a lower percentage charge on the rateable value than the smaller ones. The general lines of the tariff being arrived at, it could be pigeon-holed until an opportune time arrived to put it into force in a particular district. There are now a number of big shops which use artificial light in their interiors for all the working hours of the day and for many months in the year, for which where a flat rate of charge is in force gas illumination is employed. This would at once be rectified if a tariff on the above lines were in force.

The writer communicated with leading manufacturers asking them to state how their sale of apparatus compared in "Point Five" undertakings and others; the replies without exception indicated that for a given size of undertaking the demand for appliances is considerably in excess of that in flat rate districts. This explains why Association members are given favourable buying terms and why the suggestions of its members for improvement or alteration in apparatus are at once put in hand and often made their standard selling line.

On the subject of apparatus, if the result of sales is an index, the hot bar fire is rapidly superseding the lamp radiator as a heating medium except in special cases. There is the advantage in the former that toasting and grilling in a "Dutch" oven, etc., can be effected and the renewal of sections is cheap.

While on the question of heating, mention might be made of a somewhat interesting experiment carried out a few weeks ago. The congregation in a church suffered on Sundays from a severe down draft, and the electrical department were asked to put the matter right. It was handled as follows:—A ring of hot bar strips covered with expanded metal with occasional gaps was run round the nave of the church at a height of 21 ft. from the floor and 15 ft. from the top of the main aisle. The total loading of the heaters was 20 kw., the switching arrangements being such that either 10 or 20 kw. could be applied. This circuit is turned on first thing in the morning with the ventilators in a definite position to create an upward current, and thus get rid of the humid atmosphere in the building, and the writer is assured that the trouble has now been cured. A development of this application would produce quite a useful Sunday morning load.

The type of vacuum cleaner most suitable in a particular class of house still appears to be an open question. For big houses the use of a central permanent installation with pipes run to various points and flexible hose pipes and appliances coupled from these points is probably the only entirely satisfactory arrangement. The machine of the carpet sweeper type in which the motor is wheeled along is convenient in use in that it has no flexible hose-pipe to handle, but it is not very handy for cleaning under low furniture. This type almost invariably collects the dust in a bag, and it is noticeable that in some cases the exhausted air is not as pure as one could desire. The other type in use is that in which the cleaning apparatus is carried to a convenient stationary position and flexible hose-pipes and attachments worked from the machine in this position. This type has the advantage that cleaning can be done effectually under very low furniture and on walls, etc., without much trouble, but the heavy flexible hose-pipe is rather awkward to manipulate.

As regards electric cookers, a thoroughly reliable article can be obtained at a reasonable price provided all elaborations are excluded. A cooker built on similar lines to a gas cooker, of cast-iron, having removable fittings, with hot plate and grill on the top of the oven and without circuit indicators, thermometer and inspection window, etc., appears to give satisfaction in the majority of cases (*i.e.*, its operation is better than a gas cooker) and perhaps generalising, the simpler the machine the less trouble it will give in the long run.

For better class work where the customer will pay an increased price, useful elaborations are much valued; thus there appears a tendency where there is room to have the griller and boiling rings removed from the oven and put on one side. The oven can, of course, in this case be raised to a more convenient height. Indicating lights to show which circuit is in use are also useful and a thermometer, once its value is tested, is invaluable. There does not appear to the writer any valid reason why the simpler class of cooker mentioned above could not now practically be standardised in order that quantities could be manufactured in big batches and the selling cost reduced.

The standardising of hot plates might present difficulties; it is probable that the radiant heat (red hot) plate will be ultimately the most satisfactory type. Rapid operation can never be effected if the heating element has to heat up an iron plate as a preliminary to the heat being passed on to the cooking vessel.

The question of the pressure of supply to heavy current consuming devices is now becoming important. Should a consumer put a balanced load on the distributor (*i.e.*, on the outers of a D.C. network or three-phase on an A.C. network) or should he have an ordinary lighting service? Simplicity certainly dictates the latter course, and in thickly supplied areas consumers demands can be fairly well balanced, but in our district, in one or two isolated cases we have adopted the former course to avoid objectionable effects on the local lighting.

It is interesting to find that in the Accrington district more appliances have been connected to the system during the last three months than in any preceding quarter of the history of the undertaking.

Discussion.

Mr. **Pickvance**, who opened the discussion, said the objects of the Association were, according to the Articles, simply to foster the consumption of electrical energy for domestic purposes. Without any reconstruction of rateable value tariffs, but simply by means of an active business propaganda amongst the shopkeepers, the Chairman could, no doubt, have a higher percentage of shop lighting consumers than he possessed at present. Shop lighting did not need the aid of a special body of engineers for its development. A plain flat rate, with a reduction according to quantity consumed, should meet with a favourable reception, especially if followed up by a proper system of business development. He disliked the differential percentage charge; any variation of the fixed charge, according to the size of the rateable value, seemed to be a most unorthodox way of applying the rateable value system. Although strongly in favour of this tariff for domestic purposes, he did not see how it could be applied to shop lighting and business premises generally. They would certainly have trouble with the different classes of consumers. As regarded that class of consumer who used artificial light during the daytime, this was met in Wrexham by a very simple tariff which provided that the amount used beyond a certain number of units per 8 c.p. or 30-watt lamp, per quarter, should be charged at a reduced figure, less than half the amount of the ordinary flat rate. It worked remarkably well as regarded hotels and large shops, and was automatic in this application, particularly as regarded those few shopkeepers who used the electric light principally for window lighting and had gas at the rear of their premises.

Mr. **Allen** did not see how the rateable value system could be applied to shops, but thought the objects of the Association were quite sufficiently definite, and that it had an enormous field in front of it in domestic supplies and appliances, and that it was unnecessary to widen the scope of the Association to take in other classes of supply. In his opinion it was better to tackle one thing and do it thoroughly. He had carried out some useful experiments with nichrome No. 2 wire, and mentioned that after maintaining a coil of wire at red heat for two months in oxygen no sign of oxidisation could be seen. He did not believe that the present time was a suitable one to attempt standardising cookers, as the development was so rapid and might turn along totally different lines to the present.

Mr. **Barham** considered that for new domestic supplies a two-rate system was all that was required. He emphasised the drawback to the industry of the want of hiring powers.

Mr. Grogan also considered that it was impossible to apply the rateable value system to shops, and advocated a sliding scale method of applying the rateable value system to residences in some districts. Mr. Grogan made some useful remarks on the heat distribution in ovens, and gave a description of a large electric restaurant in Derby at a cinema palace. He gave the working details of the restaurant, and added the information that the proprietors were entirely satisfied with the result.

Mr. Shaw (Ilford) considered that a suitable tariff for shops was the well-known maximum demand system, which he had found quite satisfactory, the rateable value system not being applicable. He also pointed out that it was impossible to push heating and cooking apparatus, even with a low tariff, if the electric supply authority was not in a position to hire out the apparatus. He found that amongst his consumers the hot-bar type of heater was far and away the most popular.

Mr. Roles (Bradford) found that in his district the demand for lamp radiators had dwindled to practically nothing. As regards the hot-bar type of heaters, the trouble had been to get them from the makers, not to sell them. Mr. Roles referred to the fact that in Bradford many consumers were utilising hot-bar heaters for other purposes than heating rooms, namely, for making toast and for warming in connection with the preparation of food.

Mr. Nevill (Wakefield), one of the most recent "Point Fives," gave some interesting figures showing the great increase in his business since the Point Five tariff was instituted for heating and cooking. He also referred to the considerable increase in the use of electricity for heating shops; and mentioned that his peak load had not been affected by the increase in heating and cooking. It was the same amount in kw. that it had been for over ten years. He also mentioned that he had been inquiring for a long time for a manufacturer who could provide a satisfactory equipment for heating the type plate of a box side branding machine. Suggestions had been made on one or two occasions, but not of a nature likely to prove satisfactory.

Mr. Cooke (Luton) urged the flat ½d. for all heating and cooking without any annual charge, and gave interesting figures from his own district in support of his contention that this was a paying business proposition.

Mr. Beauchamp (West Ham) referred with appreciation to the Chairman's method of preventing down draughts in public buildings, which he had also found to be successful and economical. He also drew attention to the use of electric heating stoves which consisted of a combination of radiant and convecting elements, pointing out that by the use of either or both features the maximum economy and comfort in heating rooms could be obtained. Referring to Mr. Cooke's remarks on heating in shops, Mr. Beauchamp drew attention to the fact that shop-heating in general could not be expected to have the same high diversity as domestic-heating, and whilst, like domestic-heating, it was to a great extent winter business, yet a large proportion of it might be expected to come on across the winter peak, a consideration the importance of which would, of course, vary with the undertaking supplying energy.

Mr. Tapper (Stepney) gave his experience that the maximum demand system met the requirements of nearly every class of consumer. One explanation was that, owing to his consumers being chiefly long hour users, they obtained low average rates. If he made any change in his tariff for domestic purposes to meet the cooking and heating business he should carefully consider, first of all, the two-rate meter system.

Mr. Long (Norwich) hoped to qualify before long for membership of the "Point Fives," and was seriously considering the adoption of this tariff. The point he was most concerned about was whether it was safe to give a flat rate of ½d. for radiators used in shops without any addition to the fixed charge. He was satisfied that this could be done in the case of private houses as the diversity factor was very great, and comparatively few would be on at the peak, but in shops one would expect the majority to be in use then. He was interested to know from several speakers that in their experience the use of radiators in shops was, as a rule, reduced in the afternoon before the peak load. In Norwich the fixed charge for shops and business premises was based on the estimated maximum demand for lighting.

Mr. Shaw (Worcester) was very busy converting lamp heaters to hot-bar, which could be remodelled at a very small cost, thus converting them from obsolete appliances to quite up-to-date ones. Speaking on the life of cookers, he mentioned that some flour mills in Worcester had a cooker for baking and testing bread, which they had had in continual use for nearly 20 years. It was made by a Chelmsford firm.

Mr. Shaw stated that if an electric soldering iron, with cheap renewable elements, for industrial purposes could be put on the market, which would be satisfactory, and which he could recommend to his consumers, there would be a use for 900 to 1,000 in one canister factory alone.

The Hon. Secretary agreed that the domestic field provided a sufficiently large one for all the energies of the Association. All undertakings have a residential area as well as a business area, and, therefore, all stations had an interest in developing domestic supplies. Besides, electric power was well [illegible] it [illegible] standard and was extremely [illegible] both as regards apparatus and tariffs. For premises other than residential he thought the Hopkinson tariff with an annual charge plus a small secondary rate per unit met all the requirements, and he could not agree with the Chairman that shop lighting, hotels, etc., was a more difficult class to handle than the residential business. He was rather surprised no members had referred to the new method of heating rooms by thermostatic control. The effect of this would be largely to reduce the current consumption and put electric heating within the reach of many who could not afford it at present. He gave an example of a large thermostatically controlled electric hot water system which had been installed at Oxford Circus convenience for wash basins. The cost at present was slightly lower than for gas, and he could see his way to reducing the cost still further by at least 20 per cent. He mentioned a block of flats being erected in his district that were being cabled for heating, cooking and lighting by the builders. Electrically-heated hot water was also being installed, and the estimated consumption per annum of this block of flats was one million units, or 2,500 units per head of population. One was accustomed to looking to a block of flats of this size for 50 or 60 thousand units per annum as a maximum, and this example alone showed the enormous field still untouched for domestic supplies.

BREAKDOWNS IN COLLIERY ELECTRICAL PLANT.

By LLEWELLYN FOSTER.

(*Abstract of paper read before the* Association of Mining Electrical Engineers (Lancashire Branch)).

Generally speaking, breakdowns of mining electrical plant may be divided into three classes:—(1) Those caused by lack of proper attention and care, including want of systematic periodical opening out of the machines for inspection, cleaning and general overhaul. (2) Those due to the machines being quite unsuitable for their work and situation. In mining work particularly, open or protected-type machines are often used when they meet the requirements of the Regulations, whereas, on account of the surrounding dust and dampness, the enclosed type should have been used. (3) Those due to faulty design, defective material and workmanship.

It is very seldom that we find any system of periodically taking machines apart for overhaul; if the windings were kept clean and varnished occasionally, a number of breakdowns would be prevented. At one colliery in the north of England there are seven Hopkinson coal-cutters in use, and the machines are only allowed to work in the pit for three weeks continuously. After that period each machine is brought to the bank to be overhauled.

One of the most frequent sources of trouble in electrical plant in mines is due to the fact that a machine is left running as a single-phase owing to one of the three fuses having melted, or possibly to there being a defective circuit on one of the three phases. Fuses that are large enough for the starting current of a squirrel-cage motor are usually too large to be any real protection when the motor is running. It would seem, therefore, that having two sets of fuses and switching over from "starting" to "running" fuses would be a simple solution of this difficulty.

A considerable proportion of breakdowns occur in the commutating parts of continuous-current machines, viz., commutators, brush-gear, etc., and sparking at these parts does not receive the careful attention it requires.

Fractured conductors, fractured commutator spokes, and flats on commutator bars are mostly due to vibration, and through consequent chafing and pounding of the insulating material "earth" faults are caused.

Regular measurements of the radial air gap should be taken and recorded, as well as the test of lifting the shaft in its bearings. Any movement in the bush or of the bush in its housing should be carefully observed. When the machine cannot be stopped, the condition of the bearing can be fairly well ascertained by inserting a pencil or rule in the oil well and letting it rest on the shaft, when any slackness will be noted by a movement of the pencil apart from the bearing housing or casting. The lighter the load the more positive will be the movement.

The switch blades and contacts of the stator circuit, and the fuse fittings and contacts require regular and systematic examination. All ends of cables, connections, etc., should be soldered to prevent the danger of the machine running on incomplete phases. When installing an "in-bye" motor, means should be provided for access to all parts of it. Some pits are naturally very wet, and breakdowns frequently occur through dampness percolating into the windings of the motors and to the starting gear. This causes "earthing" of the winding, and the trouble generally occurs at the end of the slots in the armature or rotor core. The percentage of breakdowns due to this cause would be considerably reduced by making properly constructed motor rooms, with the foundations laid out in such a manner that when the motor was installed on its bed it would be, say, 6in. or 8in. above the floor level.

Breakdowns on underground plant are frequently due to bad foundations, etc., which set up excessive vibration. Many armature breakdowns are due to mechanical defects in the driven machinery.

On some colliery plants where originally protected-type motors were installed, these have been converted into totally-enclosed machines, but without any reduction of the load. The reduced rating of a motor when totally enclosed is often lost sight of by the manager, who is usually responsible for having the motor made totally enclosed.

In the earlier days of electrical work in collieries, a bed built up of rolled-steel joists was fairly frequently met with, but the cast-iron box bed has quite superseded it. In cases where the rolled-steel joist beds are still in use it is important that they should be securely held down and well grouted in. There should be a holding-down bolt close up to each side of each bearing pedestal and each stator foot. The greatest vigilance should be exercised to prevent any of the bolts connecting the frame together from slackening back. Care should also be taken that the steady pins go right through the flange of the joist, and these steady pins should be frequently examined.

Machine-cast steel wheels should always be used for the first reduction from the motor, and should have their pitch circles marked so that they can be properly meshed. The use of "machine-moulded gearing" for such work as this is not likely to prove economical.

A 100-H.P. three-phase motor drove a haulage through gearing. The rotor and stator came into contact, and one coil in the stator was "earthed." The radial air gap was regularly measured twice a week by the colliery electrician; apparently it had not appreciably varied for many months, and on the day before the failure the gap was 0.03 in. at the smallest part. On investigation it was discovered that the motor had its greatest load when the pinion was running towards the spur wheel, thus tending to wear the top halves of the bushes. It is obvious, therefore, that a rotor may be perfectly central whilst at rest but not necessarily so when running. The makers should so design their end covers that the radial air gap can be watched whilst the machine is at work. The writer strongly recommends two "inspection doors" in the back end cover for every type and size of A.C. and D.C. motor, as this would very considerably aid in clean-special care and attention.

TRADING AND INDUSTRIAL METHODS IN GERMANY.

Below are given some extracts from a report on the trade of Germany by Sir Francis Oppenheimer, H.M. Commercial Attaché in Germany, which has recently been issued by the Government. The report itself may be obtained from Wyman and Sons (Cd. 7620-14, price 5½d.)

The Growth of Syndicates.—Germans, in every stage of society, are prone to combination; in Germany there is hardly a branch of manufacture or of trade, however special, which has not its own organisation and probably its own journal. Manufacturers all over the Empire, producing the same goods, are brought into touch either personally or in print. The conditions of the whole home market are thus disclosed; its chances are weighed and scrutinised. The more a works specialises (and the tendency owing no doubt to the very keen home competition is all towards specialisation) the more must it co-operate with, and the more has it to rely upon, other branches of manufacture; their trade conditions have to be watched in turn. The specialist is brought into contact with the outside world. News from abroad is published and carried into distant workshops. The profusion of trade and professional papers can be gauged from their catalogue numbering 300 closely printed pages. That no branch is forgotten may be gathered from the fact that there figures among them a fortnightly magazine dealing with the interests of the foremen of platelaying gangs on the Prussian State railways (founded in 1906)! The keen competition among trade papers has produced a high standard. Much ingenuity and care is spent upon the reports of the industrial weather, with the result that no man need be taken unawares by a change of the tide.

Above all, it is the syndicates that exercise a steadying influence. This side of syndication has repeatedly been explained. Syndicates control production and sales, and, when the home market is satisfied, help towards directing merchandise abroad. In an atmosphere of industrial depression syndicates are seen to their greatest advantage—at least by their members. It is then not surprising that in 1913, and to a greater extent in the early months of 1914, syndication—the renewal of old syndicates and the foundation of new ones—should have been one of the most frequent subjects discussed in the commercial Press.

There is no doubt that after each successive boom the desire for syndication is strengthened and, at the same time, its accomplishment is rendered more difficult. The desire is strengthened because every boom gives the members of the various industries a chance of extending their works and raising their capacity of output—which means an increased production and, in consequence, an increased competition during a slump. In the first quarter of 1914 prices of unsyndicated goods reached what seemed to be the lowest possbile limit. Yet the cry for syndication became louder as the depression progressed.

The difficulties of syndication are augmented because every boom gives a further advantage to the giant works which have virtually concentrated the various stages of manufacture under one roof. They have little interest in the various syndicates controlling the respective stages of manufacture unless they are granted preponderant figures of participation, more especially in the final stages. As the smaller works, whether syndicated or not, are greatly at the mercy of these giants, they naturally prefer a state of syndication which guarantees their existence, checks competition, secures steady prices in the home market, and provides export bounties for foreign orders. For the giant concerns, syndication means financial sacrifices; but these sacrifices are expected of them as they are the princes of industry, the pillars of Germany's economic life. Their concerns have become world concerns. They embrace so many branches of manufacture, they command so many markets, that they reach above local industrial tides. The rise of such works, although it has been greatly assisted by the modern developments of German banking, is chiefly due to the application of science to manufacture. These leaders have increased their profits by carrying the science of by-products to its utmost limits, and they have thus very materially reduced their cost of production. They are generous and indefatigable where scientific research is concerned. A succession of booms has made these mammoth concerns financially independent.

Their Influence at Home.—The financial power to which they have attained is used for, amongst other objects, the acquisition of their own means of transport. The reason is that all the world over the item of transport is gaining an additional importance in the faculty of competition. Some powerful mining-shipping combinations are an example of this development.

The most recent development in the matter of concentration is perhaps the most interesting of all. To guarantee a steady sale of their vast output some of the big works began to effect a financial combination with their own consumers, thus following on an extensive scale an example set by the electrical industry. An important works, manufacturing machines for use on railways, has bought up a company letting out railway machinery; the firm of Krupp has bought up two shipbuilding yards; a leading factory producing electrical appliances and machinery has obtained control of an electrical power supply company.

These gigantic concerns exercise a steadying influence upon the country's economic life because their interests are world interests. Whatever the industrial tide may be at home, they are vast employers of labour; in many communities they are the backbone of local finance; together they contribute colossal revenues to the public funds. It is not unnatural, then, that such concerns obtain facilities from the Government which would be denied to the smaller fry. These privileges in turn strengthen their position and give them an additional lead. They obtain the aid of the diplomatic and consular service and the financial support of the banks, so much craved by our manufacturers.

Effect on Export Trade.—The necessities of the German export trade have always enjoyed the special goodwill of the authorities. Under special export railway tariffs, practically all consignments below 5,000 kilos, and most consignments above, are carried to the coast or to the frontiers at reduced rates if intended for export. In some cases the rate is as low as 1.5 pfennig (¼d.) per ton-kilom. As under the terms of these through tariffs the German export must be carried in the ships of certain German lines, they constitute, in addition to the indirect export bounties, also indirect shipping subsidies. Early in 1914 a new postal convention was signed between the German and Swiss authorities, granting additional facilities to the German-Swiss and German-Italian parcel post service; it will also indirectly benefit German consignments in post office parcels to Spain, South America, and the Dutch Indies.

The German exporter has gained considerable advantage from the German shipping companies, who appear willing to initiate services with little prospect of profit in the immediate future. This policy accounts for the increasing proportion of trade directed to such smaller countries as Chile, Colombia, Siam, Morocco, the Philippines, Venezuela, Bolivia, Uruguay, etc. The North-German Lloyd was rumoured to be about to start a direct line from Germany to New Zealand. Many manufacturers, merchants and shippers interested in the same markets, have clubbed together to form special societies for nursing these markets so as to be able to lay their respective wishes with greater weight before the Imperial Government. Early in 1914, all these German foreign societies formed a union among themselves. The leading firms in certain German industries (metallurgical, electrical, chemical, construction) have become world institutions, with branches established as separate companies, in many foreign parts; as witness the German-capitalised electrical concerns in Russia and in South America, where the D.U.E.G. is probably, with the exception of the Bagdad railway, the largest German foreign enterprise. From a mercantile point of view, there can be little doubt that so far the benefit which Germany has derived from [illegible] outweighs the benefit which [illegible] political [illegible]

[illegible] production, the price policy pursued by the [illegible] some of the finishing industries in the home market, will help to explain the record figures of the German export trade in 1913. It will help to explain also why there is hardly a report published by the various Chambers of Commerce throughout Germany which [illegible] remark as to the unsatisfactory prices, the small profits, the price concessions which had to be made abroad to secure the necessary contracts. More particularly [illegible] 1913 onwards the necessity of a larger German export seemed uppermost in the public mind—the whole Press suddenly overflowed with articles of Germany's economic mission abroad, of what is called Germany's *Weltwirtschaft*. Again and again it was pointed out that among the three leading industrial countries of the world Germany found herself by a long way in the least favourable position. The [illegible] Kingdom had her vast colonial empire as a natural national market; the United States had a whole continent, while Germany, as the last comer, had no such privileged territories. As her colonies could, at best, be regarded in the light [illegible] sources of supply for various raw materials, she must regard the world as her trading empire and rely exclusively upon her energies and enterprise to conquer it. Sometimes the limits were drawn somewhat more closely, and South America, Asiatic Turkey and the Chinese Empire were pointed to as her special trading areas.

[illegible] commercial expansion abroad has been tackled, as is usual in Germany, both scientifically and practically, and, as might have been expected, called forth also two scientific institutions, and a new publication, *Greater* [illegible]

The Government's paternal care for Germany's foreign trade has found a noteworthy expression in connection with the foreign loans placed upon the German market. Pressure has so long been brought to bear upon the leading banks that it has now become a recognised practice that, before a foreign loan is taken over, the Ministry of Commerce is consulted to [illegible] a desirable one for commercial reasons, though some financial quarters object very strongly to this novelty of what they call a financial protec[illegible] than has been obtained abroad. The practice has already become so firmly established that something of an apology was published early in 1914, when part of the Bosnian loan was taken over by German banking houses without commercial concessions having been obtained. The Budapest municipal loan brought [illegible] industrial demands in connection with the Bulgarian loan, which were [illegible] the German money market was the only one available at the time, were greatly responsible for the failure of the negotiations on the original basis.

[illegible] machines. The change has not been without its effect upon the traditional spirit animating German manufacture. At one time it was the pride of German manufacturers that they entered more willingly than others into a customer's special intentions. No doubt the inclination still holds good to some extent—yet a careful student can discover a change; the scramble is becoming more and more one for orders of standard patterns; difficulty is beginning to be experienced in finding manufacturers willing to accept those stray orders for [illegible] the older school cease to be available.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

[illegible]

[illegible] January 18th. (Convention date, January 23rd, 1914, Australia.) (Complete.)

[illegible] (Complete.)

831. "Stray-wave protective devices for electric circuits." Siemens-Schuckert [illegible] January 20th, 1914, Germany.) (Complete.)

[illegible] steam, or gas." S. Willoughby. January 19th.

[illegible] Grafton & W. D. Cairney. January 19th.

[illegible] January 19th.

882. "Dynamo-electric machines and installations." Soc. Anon. des Etablissements L. Bleriot. January 19th. (Convention date, February 7th, 1914, [illegible]

[illegible] (Convention date [illegible] 10th, 1914, United States.)

891. "Electro-magnetic levitating apparatus." E. Bachelet. January 19th.

[illegible] Sir A. T. Dawson & J. Horne. January 19th.

[illegible] apparatus." Sir A. T. Dawson & J. Horne. January 19th.

900. "Distribution fuse boxes for electrical circuits." Midland Electric Manufacturing Co., Ltd., & W. L. Barber. January 20th.

901. "[illegible] switches." Midland Electric Manufacturing Co., Ltd., & W. L. Barber. January 20th.

913. "[illegible]" F. Reason. January 20th.

924. "Moving coil voltmeters, ammeters, and the like for direct currents." [illegible] January 20th.

937. "Electric light prepayment apparatus." H. S. J. Booth & W. Miller. January 20th.

939. "Circuit arrangements for telephone systems." O. Imray (Siemens & Halske Akt. Ges., Germany). January 20th. (Complete.)

942. "Dry battery." H. E. Hughes. January 20th.

945. "Electric switch and fuse service boxes." H. F. Reason. January 20th.

982. "Electrical apparatus for effecting the chemical combination of gases." C. C. [illegible] January 21st. (Convention [illegible] January 23rd, 1914, United States.) (Complete.)

986. "Means for selecting one or more punches (in a keyboard perforator) with one punch-selector." S. J. Anderson. January 21st.

1,006. "Register circuits for telephone [illegible]" O. Imray (Siemens & Halske Akt. Ges., Germany). January 21st. (Complete.)

1,007. "Means for obtaining periodically-interrupted currents of electricity." W. H. Grinsted. January 21st. (Complete.)

1,016. "Electric signalling, especially applicable to collieries." S. G. Leach & E. G. Brown. January 21st.

1,076. "Heating-unit or resistance element for electric heating apparatus." A. Slatter & G. Wilde. January 22nd.

1,085. "[illegible] and the application thereof to weighing machines." Stothert & Pitt, Ltd., & E. S. Franklin. January 22nd. (Complete.)

1,087. "Telephone systems." J. E. Cooley. January 22nd. (Convention date, January 23rd, 1914, United States.) (Complete.)

1,088. "Methods of exhausting incandescent lamps or similar envelopes." British Thomson-Houston Co., Ltd. January 22nd. (General Electric Co., United States.)

1,090. "Electrical terminals." Sterling Telephone & Electric Co., Ltd., & T. D. Ward-Miller. January 22nd.

1,091. "[illegible]" Sterling Telephone & Electric Co., Ltd., & T. D. Ward-Miller. January 22nd.

1,093. "Regulation or control of electric currents." J. Stone & Co., Ltd., & A. H. [illegible] January 22nd.

1,119. "Electrical alarm apparatus for mines and like places." J. P. O'Donnell. January 23rd. (G. D. Hodges & D. Smith, Transvaal.)

1,124. "Electro-magnetic apparatus." British Thomson-Houston Co., Ltd., & W. [illegible] January 23rd.

1,126. "Electrically-driven starting [illegible] internal-combustion engines." H. Lucas & W. C. Turner. January 23rd.

1,139. "Supply of electrical power." W. A. [illegible] January 23rd.

PUBLISHED SPECIFICATIONS.

[illegible]

1913.

[illegible]

22,575. [illegible] 6/12/14

[illegible]

27,114. [illegible]

[illegible]

1914.

[illegible]

[illegible] 24th. (January 25th, 1913.)

[illegible] Co.). April 3rd.

9,594. Automatic Fire or Temperature Alarms. A. G. Pemberton. April 18th.

10,565. [illegible] Dynamo-electric Machines. [illegible]

11,120. Antennae for Wireless Telegraphy and Telephony. [illegible]

THE
ELECTRICAL REVIEW.

VOL. LXXVI. FEBRUARY 12, 1915. No. 1,942.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: February 12, 1915. [No. 1,942.

Page
Standardisation of Cooking and Heating Apparatus 201
Engineers and the Technical Press 202
Lead 202
The International Aluminium Industry 203
The Swiss Electrical Industry 203
Modern Wiring Work, Particularly in Bad Situations, by H. C. Tofield (*illus.*) (*continued*) 204
Reviews 205
Half-watt Lamp Fittings, by "Research" 206
Notes from Canada... 207
New Electrical Devices, Fittings and Plant (*illus.*) 207
Legal 208
The Röntgen Society 209
The Engineering Trade and the Press 210
Correspondence—
    The British and Overseas Trade 210
    Electricity Supply on the Large Scale 210
    A.C. *v.* D.C. for Lighting 211
    Street Lamps in Chicago 211
    The City and Guilds Exams. 211
    Electric Lighting Authorities and the Law of Rating ... 212
    The Acquisition of Enemy Patent Rights... 212
    Consulting "Engineers" 212
War Items 212
Business Notes 213
Notes 221
City Notes 224
Stocks and Shares 225
Electric Tramway and Railway Traffic Returns 226
Electricity on the Rand 227
Russia's Importation of Electrical Goods 228
Trade Statistics of Canada 229
Cables 230
3,000-volt D.C. Electrification of the Puget Sound Lines of the Chicago, Milwaukee and St. Paul Railway (*illus.*)... 231
Electric Steel-making Furnace, by T. D. Robertson (*illus.*) ... 233
New Patents Applied For, 1915 236
Abstracts of Published Specifications 236
Contractors' Column ... ... Advertisement page xviii

THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

FOREIGN AGENTS:
ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: The Mining & Engineering Review, 30, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto I, 307.
SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).
1915 EDITION
IN THE PRESS.
H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

STANDARDISATION OF COOKING AND HEATING APPARATUS.

AMONGST the various matters of interest which claimed attention at the recent meeting of the Point Fives, we notice that the Chairman's suggestion that the simpler class of cooker could now be practically standardised, to facilitate manufacturing in quantity and reduction in selling cost, met with little response.

Any suggestion of this sort usually meets—as this did—with the reply that the time is not ripe for such a move, as improvements are constantly being introduced, and so on; and there the matter ends for the time.

But let us face the facts. Those blissful conditions of domestic life in which the electric cooker is to play such an ambitious *rôle* will never be attained while electric cooking apparatus is beyond the means of the average householder—"point five" tariffs notwithstanding—and we must admit that the technical advantages likely to be derived by allowing the designer of apparatus absolute freedom in his efforts will not necessarily be translated into commensurate economies in manufacturing, with which we are mainly concerned.

We are reminded that some meritorious inventions might never have seen the light of day, had not the ruthless commercial man cut short the process of perfection on which the inventor was engaged and applied his ideas then and there to some practical purpose, and we fail to see why the electricity consumer of to-day should be denied the benefits of organised production in order to provide future generations with a more perfect edition of what is already an efficient apparatus.

At the present time each manufacturer standardises his own products, as far as possible, apparently without prejudicing experimental development, and what is required on the part of the central-station authorities and manufacturers is some agreement fixing standard lines of development, and standard dimensions and ratings, and aiming at some degree of interchangeability of parts.

This is obviously a matter in which the Point Fives could set the ball rolling, and which the recently-formed Electrical Development Committee of the I.M.E.A. could investigate through a technical sub-committee, with a view to presenting a report for discussion at the annual convention. Such a report, if it only reviewed the position at the moment, would be instructive and, no doubt, would lead to some explanation of the considerable divergencies in design which at present exist.

Take, for instance, the following data for what we may call—only from the resemblance in outward shape—"gas-stove" type electric ovens by four well-known makers. The cubical capacities of the ovens, which are apparently intended for cooking for an "ordinary household," vary from 5,500 cb. in. down to 3,600 cb. in., while the maximum loadings are ·54, ·59, ·44 and ·66 watt per cb. in., from large to small size. Another widely used oven of a different type, of 4,250 cb. in. capacity, has a maximum loading of only ·37 watt per cb. in.

In the matter of boiling plates makers are equally at variance, a few lists showing 7-in. plates with loadings of from 800 to 1,000 watts, and 8-in. plates with loadings of from 800 to 1,200 watts (each individual maker having his own rating for each diameter), while a glance at the particulars of hot-water urns leads to the assumption that some makers are prodigal in their ratings, or that the others possess the secret of efficiency to an extraordinary degree.

Making allowance for certain technical differences, which can be readily explained, there still appears to be scope for some standard lines of development along which the ingenuity of the designer should be directed for preference, at the earliest possible moment. It is fair to assume that the electric cooker will be placed in the hands of neither more nor less skilful users than is the case with the gas cooker, and that the latter gives a reasonable degree of satisfaction will be granted, despite the filthy conditions which often prevail, and discount any approach to the efficiency in use which the designer presumably intended. The only efficiency which counts is that obtained by the user, and progress in this respect is only deferred, so long as the apparatus is generally out of reach.

Engineers and the Technical Press.

THE greatness of Manchester as an engineering centre is unquestionable, and in consequence it has good reason to be proud of the large army of engineers of all kinds who follow their callings in the district. And Manchester being smaller and more compact than London, and possessing a frequent and convenient tramway system, which takes you in from the outer manufacturing districts right to the heart of the city where hotels and other such public meeting places are to be found, its engineers, both professional and trade, have succeeded in establishing a very useful institution known as the Engineers' Club. Here excellent opportunities are afforded for social intercourse, for "talking shop," and for comparing views on engineering matters of the moment. Amid such surroundings it is possible to conduct proceedings with greater freedom and less formality than would be considered becoming at a full-dress discussion at a dignified institution. But even at an Engineers' Club if you want a successful gathering there must be a good subject and an author who, by practical experience, is able to deal with it authoritatively. The Manchester Club is not confined to technical engineering matters, indeed sometimes it aspires to scale the heights to far loftier regions. It has comparatively recently brought its weight to bear by discussing measures for giving a stimulus to the Board of Trade, so that it may represent engineering and other industry more worthily in these trade-capturing days and in the future when pruning hooks and ploughshares have succeeded to less peaceful contrivances. Of the Club in this connection we say more power to its elbow! Still more recently it has had a discussion on "The Engineering Trade and the Press." Unfortunately, when the Board of Trade was under fire every nail of criticism that was driven home must drive into that one Board—it could not point to any other culprit; but when the Press comes in for critical attention, everybody finds the cap to be—well, a misfit. Now, everybody who has not been on the Press knows perfectly well how it should be run, and it has not been unknown for the Press even to suggest measures for the more enterprising conduct of some branches of engineering industry. How far the engineer is capable of running the Press, and how far the Press is able to assist the engineer, would be a most excellent subject for a Club debate. Our own view, after having had something more than an average experience in both capacities, is that their functions and operations are mutual and co-operative. The technical Press depends upon the engineering employer because he is an advertiser, and upon the professional engineer because he is a reader, and very often a most acceptable writer. The engineering employer and professional engineer alike depend upon the technical Press, because it informs them upon many matters, tells them of developments that will bring them business, and if they advertise takes their names to the uttermost parts of the earth—if it goes there. Now seeing that the Press has ventured to make suggestions to the engineer, nothing is more natural than for the engineer to desire to assist the Press to increase its own efficiency. Whereat we, of all Editors, shall be the last to take offence. Indeed, we welcome any movement that engineers and the engineering trade may think fit to institute, for inquiring as to which out of the scores of journals published in these days of trade-expansion efforts meet their requirements most satisfactorily. Where there are large families there may not be so much to go round as where there is one petulant spoilt child, unfettered, and licensed to go its own way, but there may be a spirit of self-help and independence engendered by sheer necessity. It may be so in respect of the Press. There may be a large family, but only the members that are able to give evidence of proved ability to assist profession and industry are allowed to survive for any length of time, unless manufacturers and traders, the while they grumble because there are so many of us, open their hand with indiscriminate generosity. When the Manchester Engineers' Club held its discussion a week or two ago, it was fortunate in having as the opener of its debate, Mr. Frank Nasmith, editor of the *Textile Recorder*. We congratulate the club upon having such a high standard of journalistic practice put before it, and the author upon having the courage to express his views. As a general rule, we prefer to let our pages speak for themselves concerning the store of valuable material that very carefully considered and very definitely adopted policies lead us to publish; we also prefer, on the whole, to let manufacturers' own correspondence and order books tell them where our REVIEW circulates regularly every week—not once now and again when the fit takes us. But it is as well that occasionally an editor should meet the representatives of the industry as Mr. Nasmith did at Manchester, and bring before their notice how much they owe to the technical Press when it carries on its operations in such a way as to win the life-long attachment of its readers by publishing the information that they require but can obtain in no other way, and by exercising a spirit of independence and fairness in maintaining a high standard of editorial policy.

Lead.

THERE has been a very satisfactory business done in lead during the last few weeks, and while there has not been any elasticity shown in prices, there has nevertheless been a steady tone in the market. Much of the selling witnessed came from agents for the Convention who, at times, appeared anxious to keep down the price, probably in order to prevent America getting a fresh foothold here. American lead has on more than one recent occasion proved a bugbear, and the leading interests here have an antipathy to material being offered from across the Atlantic because it spoils their market.

There has been a good deal of metal coming to hand from abroad, and this has resulted in the market being pretty well supplied with material. The natural sequence to this is that there has been a weakening in the price of spot and early delivery material compared with forward, but the discount does not amount to much, though the fact that there is a discount is worth recording. For the most part everything which is coming forward appears to be wanted, but there has been a falling off in the demands met with from Russia, which country has for a long time now been one of the mainstays of the lead position. Not only have considerable quantities of lead been shipped from England to Archangel, and also from Australia direct to Vladivostock, but sales have also been made for shipment from New York to the latter port. Attempts have been made also to ship direct from Spain, but the shipping difficulty seems to have proved insuperable in this case. With the approach of the spring it is to be expected that the Vladivostock route will lapse into disfavour, because Archangel is much handier.

The main consumption in progress is undoubtedly in connection with the supplies of ammunition required by the forces in the field, and the demands experienced on this account can hardly undergo any important abatement for some months to come, or at least until the war has entered upon a new phase. There is considerable dislocation still in the Broken Hill region of Australia, but taken all round output appears to be quite sufficient for all practical purposes. Mines and smelters are partially at work and under the restrictive conditions affecting general consumption as distinguished from consumption for war purposes, there is apparently plenty of lead available.

The position in North America is rather uncertain. For one thing the remarkable advance in the price of spelter has put this metal into an altogether false relation to lead, and this tends to have an unsettling effect upon markets, while in Mexico chaos continues to reign undisturbed. It is quite possible that if only the congestion at the docks abated and lead were to be got out of arriving steamers with something approaching reasonable expedition, there might be a small further reduction in the price of early deliveries, but so long as congestion reigns undisputed, something near to-day's level of prices seems likely to be continued, always supposing that no unforeseen new factor comes into play.

The International Aluminium Industry.

A SCHEME is being promoted in Germany for the purpose of rendering that country independent, if possible, of the quotations for various metals which are given on the London Metal Exchange, on the return of normal conditions after the conclusion of the war. A subsidiary exchange for copper has already been in existence for two or three years in connection with the Berlin and Hamburg Stock Exchanges, and the Exchange Committee of the former has now been asked to extend the scope so as to include quotations and contracts for spelter, lead, aluminium, and antimony. The question as it affects the four metals has been set forth in a memorandum, an extract from which, concerning aluminium alone, may, perhaps, be of interest. As is well known, an international aluminium convention or syndicate was in existence down to the outbreak of the war. The sole object of the syndicate was to regulate the production of the works and prescribe minimum prices, and, in the absence of a sales organisation, the business with consumers was generally conducted through a number of merchants. According to the experience gained in recent years, the price which consumers have had to pay has differed in many cases from the particular charge which was fixed by the syndicate. During periods of great demand the merchant price has rapidly risen above the syndicate minimum, but at other times, when large quantities of aluminium have been in the possession of the merchants, the prices actually realised by the latter have been much below those of the syndicate, so that it may be said that the actual course of prices has been probably influenced on wide lines by the syndicate, although not settled individually by the combination. The world's production of the metal increased from 8,200 tons in 1903 to 68,200 tons in 1913, and a further large augmentation is expected in the future. The memorandum states that this fact, taken in conjunction with the circumstance that next to the United States Germany has the largest consumption, renders it desirable that the latter country should secure the important position in the world's market to which it is entitled, by the establishment of a German Exchange. The idea is that by the creation of such an exchange aluminium could be delivered both as original works' material and as remelted metal; the former in ingots, bars, and sheets, and the latter in ingots, having a percentage of from 98 to 99 per cent. of pure metal. It is further suggested that in addition to Berlin the places of delivery should be Hamburg, Rotterdam, and Antwerp, and that a reduction of 5s. per cwt. in the contract price should be made for remelted material. As the aluminium works have always concluded long term contracts and have granted to purchasers the right of calling for delivery in from six to eight weeks, it is proposed that the quotations on the exchange should be for one particular month and the 11 succeeding months. As bearing on the present situation of the international market, Norwegian newspapers report that a company at Stavangar recently purchased aluminium in the United States of the value of £54,000 owing to the European market being closed. In Norway itself the productive capacity is undergoing a great expansion. The Anglo-Norwegian Aluminium Co., for instance, is credited with having now completed its works at Vennersla, where 2,000 tons per annum are to be made; a second company, having French working capital, is said to have acquired the undertaking of the Hardanger Electrical Iron and Steel Co. for the purpose of constructing cables of aluminium, and the Norwegian Nitrite Co., of Eydehavn, is also declared to have erected a large works for the output of the metal.

The Swiss Electrical Industry.

A FURTHER contribution on the subject of the situation of the electrical industry in Switzerland is contained in the December issue of the publication issued by the Swiss Credit Anstalt. The report states that during the first half of 1914 the industry was very well employed, and also had an abundance of orders in all branches at the close of June. Despite the complaints which were being made at that time in various countries as to the course of business, it was confidently expected in Switzerland that the results for the electrical industry would be favourable for the whole of 1914, but every estimate was upset by the outbreak of the war. It has to be borne in mind that Swiss firms have to depend upon the export trade for the greater portion of their business; the inland market alone could not have kept them employed even if trade in Switzerland had not experienced a decline through the war. On the outbreak of hostilities the foreign trade was at first completely tied up, and at the present time it can in no way be foreseen when, and to what extent, a revival will probably take place. The demand on the part of different countries has undergone a very material shrinkage, apart from the many obstacles in the way of transport to destinations, whilst the collection of payments from abroad is a matter of greatest difficulty. There is also uncertainty as to whether or not the Swiss industry will be brought gradually to a complete standstill owing to the hindrances to securing the delivery of raw materials, and considering the whole of the facts, the report concludes that the only course is to await developments.

Electrolytic Production of Oxygen.—Several factories in St. Louis, Mo., are now engaged in the electrolytic production of commercial oxygen gas. The electrolyte used is a 10 or 15 per cent. solution of either caustic soda or caustic potash. The oxygen given off at one electrode is collected and compressed, while the hydrogen given off at the other electrode is allowed to escape.—*Chemical Trade Journal.*

MODERN WIRING WORK, PARTICULARLY IN BAD SITUATIONS.

By H. C. TOFIELD.

(*Continued from page* 169.)

An installation carried out with C.T.S. wires is not intended to compete with thin, close-joint, slip-conduit and foreign V.I.R. cable. Cheap conduit installations frequently entail considerable expense in repairs owing to subsequent breakdowns after being installed a short time, while the use of slip conduit is prohibited under the rules of the Institution of Electrical Engineers, by the Fire Insurance Companies and a large number of Supply Authorities.

Where a system of wiring is to be installed in a wet or corrosive situation and is expected to successfully withstand these conditions, the best material must be used, and cost is not usually such an important point as the provision of a first rate job. In fact, cost is often taken as the most unimportant item in a first rate job, such as where one occasionally finds contractors who have been given the maintenance charge of jobs in severe situations, as acid factories, but prefer to stick to other systems of wiring, however useless they have been proved, so long as they can say the consulting engineer specified it originally. It is difficult to imagine what is the reason for such conservatism, but it is quite clear that a maintenance job is a *very* useful one in slack times.

It is in such cases as these that the C.T.S. wiring system has its special advantages over any other method of wiring, for it will provide a satisfactory installation under most circumstances with a minimum expenditure.

The best insulated wires are of little value in bad situations if the fittings do not protect the ends of same as efficiently as the wires themselves are sheathed, and in order that they shall be fully protected, several fittings have been specially designed for corrosive situations as previously mentioned, and some further details of these may now be given in conjunction with the classes of work dealt with.

The types of buildings usually met with in which it is proposed to instal electric light or power may be divided into three classes, in much the same way as the fire insurance companies differentiate between "hazardous" and "non-hazardous" risks.

Where the installation would be called upon to carry out its functions under severe conditions, it might be termed a "hazardous" risk (see Class "A" below) not of course from the fire insurance point of view, but from the fact that the wiring would be more liable to breakdown, and therefore, extra precautions would have to be taken in carrying out the wiring of the installation and in the choice of accessories, while in cases where conditions were normal (as in Class "C") a thoroughly satisfactory job could be provided with the type of accessories commonly met with. From which it will be seen that while C.T.S. wires are of the same quality in all cases, different types of fittings must be used for various classes of installations in order to suitably protect the ends of the wires according to the positions in which they may be installed. The different types of installations may be divided as follows:—

Class "A."—All buildings such as chemical works, salt works, dye works, powder works and magazines, bleach works, paper mills, tanneries, soap works, oil and petrol stores, bacon factories, laundries, baths, washhouses, cold stores, breweries, stables, jetties, also workshops and factories where damp or corrosive conditions exist, and rolling mills, collieries, and other places where fittings would be subject to mechanical damage in addition to corrosive action.

Class "B."—All new buildings in ferro-concrete or brick and unplastered, where the wiring is to be concealed throughout and wires sunk in walls and ceilings ready for making good. All ceiling fittings, switches, distribution boards, &c., to be fixed when the decorations are completed.

Class "C."—Private houses of every description, banks, offices, shops and all similar places in which it is desired that the wires shall be concealed throughout, or partly or wholly run on the surface as occasion may demand. All workshops and factories which are clean and dry, the wires being run on the surface of the walls and ceilings.

Cables.—The types of C.T.S. cable obtainable for wiring are as follows:—

Single-core circular.—This is suitable for all classes of concealed wiring and for surface wiring.

Twin or multicore circular.—This is also suitable for Classes "A," "B" and "C," and particularly so for all long runs and for main and sub-main cables feeding distribution boards, also for laying direct in the ground, as for instance, for garage lighting supplied from house, or outbuildings from factory.

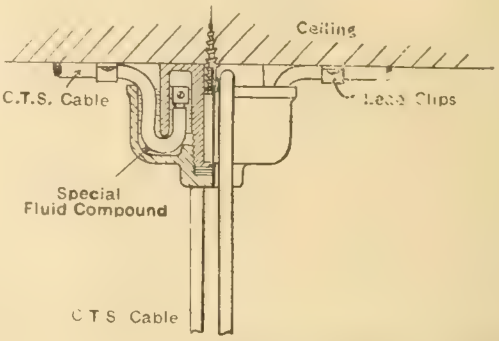


Fig. 1.—Part Section of Corrosion-Proof Junction Box.

Flat section twin and three-core.—This is most suitable for Class "C," also for surface wiring and concealed work in dry situations.

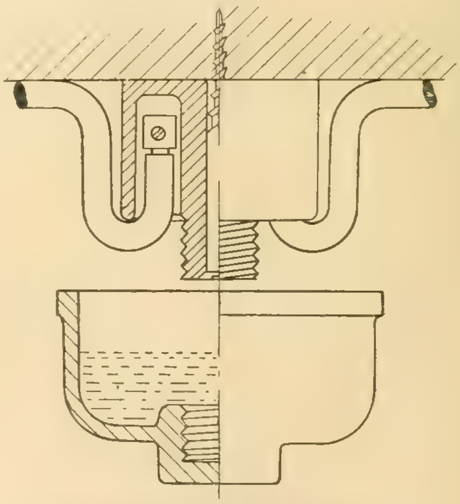


Fig. 2.—Parts of Junction Box.

Fittings.—Special fittings, such as junction-boxes, distribution boards, switches and lampholders are only required in connection with work carried out in places similar to those enumerated under Class "A."

For Class "B" all ordinary switches, distribution boards, &c., can be used.

For Class "C" a neat junction box is utilised, as it is invariably used in clean and dry situations. As twin flat and three core flat wires are employed under Class "C," the use of this box will obviate loops to switches, &c., and so considerably simplify the method of wiring and save expense. Any kind of switches, &c., may be used.

Corrosion proof fittings for Class "A." Ceiling type junction box (White's Patent).—This fitting is made of porcelain, and allows the cable ends to dip into the inner sealing chamber, divided by partitions to separate the poles. The chambers are filled with a semi-liquid material of an insulating and waterproof nature so as to effectually keep out moisture and corrosive vapours or gases. (See figs. 1—3.)

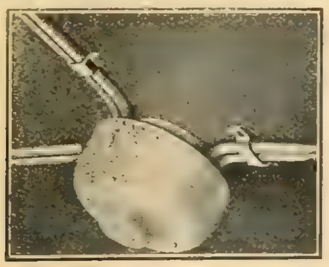


Fig. 3.—Ceiling type Junction Box in Position.

The fitting is easily fixed, and by filling the outer cup with the sealing liquid before screwing it up, the whole is completely sealed. It forms either a two or three way connector box, and allows the ordinary "loop in system" to be carried out, while it also acts as a "ceiling rose" from which the C.T.S. leads are taken to the corrosion proof lampholder.

Wall type junction box (White's patent).—The method of sealing is on the same principle as the above, but the box is adapted for fixing on the wall.

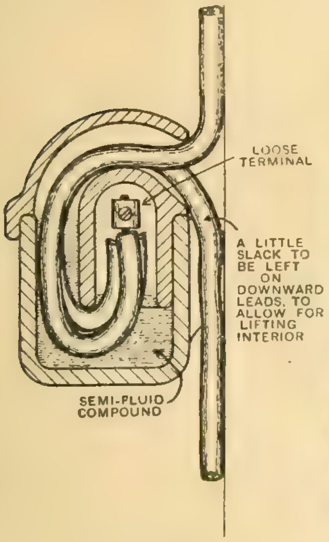

LOOSE TERMINAL
A LITTLE SLACK TO BE LEFT ON DOWNWARD LEADS. TO ALLOW FOR LIFTING INTERIOR
SEMI-FLUID COMPOUND

Fig. 4.—Section.

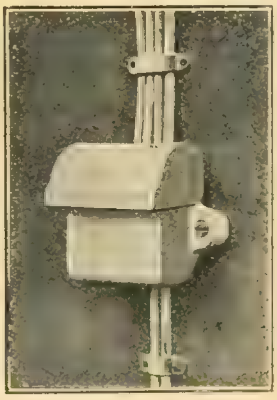


Fig. 5.—Box in Position.

Wall-type Junction Box.

The leads, up to three per way, may be brought in or taken out in any direction. The downward leads must have a little slack allowed so that the interior may be lifted out when required.

(*To be concluded.*)

REVIEWS.

Motion Picture Operation: Stage Electrics and Illusions. By H. C. Horstman and V. H. Tousley. London: S. Rentell & Co. Price 8/6 net.

This is intended to be a practical handbook and guide to electricians employed in theatres, kinemas and stage illusion work, and the authors have attempted, with some measure of success, to compile a reference book which should contain as full information as possible relative to the matters with which such employés would come in contact. Where possible the authors have avoided the use of technical expressions, so that such non-technical men as managers and stage carpenters can readily understand the text. A slight working knowledge of electricity has naturally been assumed on the part of the reader, however, but there is no attempt to elaborate this, consequently the book is of a severely practical character. In it are two special chapters, "Portable Stage Equipment" and "Theatre Wiring," which have been arranged so as to be particularly valuable for reference, and the authors say that these chapters embody all the practical knowledge that has come to their notice during many years of actual experience with theatrical work.

In perusing these chapters, it has to be borne in mind that they were primarily written for American readers, and there are consequently terms and allusions which sound strange to English ears. Also there are a number of extracts from the National Electrical Code which are not likely to prove of any value to a reader in this country. Nevertheless, the chapters are full of information which is of value and should go far to improve the quality of the work carried out by stage hands who are not fully qualified electricians.

One of the features of the book is the number of diagrams given, but in connection with these it would be well to include new blocks in future editions, as several of those used have evidently seen much service. In fact, for an American publication, the illustrations, particularly the half-tones, are poor.

Perhaps the most useful part of the book is that devoted to the motion picture machine or bioscope. A number of types are described and illustrated, full and complete directions for working are given, and a special chapter is devoted to general hints on the installation, operation and care of machines. The book can be recommended to everyone engaged in the picture theatre business, although it is not so certain that it would be of great value to electricians engaged in the English theatre or music hall world.

G.B.B.

Electric Cooking, Heating, Cleaning, etc. By "Housewife" (Maud Lancaster). Edited by E. W. Lancaster, M.I.E.E. London: Constable & Co. Price 3/6 net.

Under the above somewhat unwieldy and comprehensive title, a very useful and interesting compilation has recently been published. Though not particularly novel in its contents, it is still worthy of the attention of central-station engineers and all those interested in extending the use of electricity in the homes of the people. It serves both as a handy collection of various data and also as a book for recommendation to potential users of electricity for purposes other than lighting. Works of this nature are scarce, there being but two others which give anything like similar information—and one of these is written in the German language.

On the other hand it is not a book that would appeal to the average housewife. This is disappointing, for judging from the *nom de plume* of the writer one would expect some really practical information from the housekeeper's point of view. In style it is somewhat laborious and lacks freshness and vivacity.

If it is intended as a book of reference, the absence of an index largely militates against it. A full list of contents is given, but it is essentially clumsy and difficult of reference.

Approximately two-thirds of the book deals with electric cooking, and it is this portion which is the more masterly in treatment; the remainder is rather weakly tackled, apparently from the lack of practical knowledge on the part of the authoress and her editor. Of course there are comparatively very few persons who really have any extensive experience of domestic applications of electricity in other fields than lighting and cooking. An especially valuable feature of the early pages consists in a brief discussion of the scientific principles underlying the art of cooking—information concerning which is normally very difficult of access, for the usual cookery manual does not deal with this aspect. From this it is proved that *slow* cooking, at temperatures which are perfectly under control, is the ideal method. This, as it happens, is the distinctive characteristic of electric cooking. Thus the overwhelming advantages in favour of electricity as a cooking agent are clearly substantiated in a manner that many of its advocates do not fully realise, otherwise they would make their case even stronger. If the ordinary housewife understood these principles, the introduction of cooking by electricity into the home would be far more rapid. However, notwithstanding the analysis of these principles, the authoress does not seem fully to comprehend the efficiency, economy, and general advantages of the so-called fire-less or stored-heat cooker. It is true that a number of examples are cited, but they are indiscriminately mixed up with ordinary electric ovens.

Descriptions are included of a bewildering list of electric cooking apparatus, but very little practical assistance of real value is given to help a novice in making a wise selection.

To find a "housewife" inditing a homily to central-station engineers is somewhat amusing; perhaps, however, this is due to the influence of the mere male editor, whose name in this capacity is associated with that of the authoress on the title page. Nevertheless, a good point is arrived at in the suggestion that every central-station engineer should equip his own house electrically, so that he at least may gain experience at first hand—if he won't do this his committee or his directors are to insist upon it.

For some unfathomable reason a selection of oven temperature curves is inserted in the middle, instead of at the beginning or the end, of the description of every oven concerning which the authoress could obtain particulars. One of these diagrams is particularly noteworthy, for it deals with the comparison of a bright unlagged sheet metal oven and a lagged oven—to the disadvantage of the former. This collection of graphs is interesting, for it is probably the first time that such a number has been published together, and some enlightening comparisons can be drawn from it. Of course all these diagrams emanate from a biased source, with no particulars as to how the temperatures were measured, and there is no more ticklish job than deciding what is the actual temperature of an oven. Further, any results are immediately upset when a joint is put into the oven.

Some thirty-eight pages are very wisely devoted to descriptions of large electric cooking installations in hotels and restaurants. This is the sort of thing that assists in convincing people as to the practicability of electric cooking, for if it pays commercially it must be within the reach of private persons. Moreover, such a section will be most useful when discussing the subject with architects and restaurant keepers, for so much in this country goes in accordance with precedent.

Some costs of cooking are interlarded with descriptions of electric cookers, and other particulars are sandwiched in after a discourse on domestic power applications. Though the authoress states that she has an electrically equipped home, she does not appear to draw as she might upon her own experience. If she had done so, it would have added much more to the value of the book, for after all, what everyone is looking for to-day is tangible practical records.

The heating of water and the warming of rooms are dealt with in the same characteristic catalogue style as in the case of electric ovens, and readers are left "to judge for themselves which method would best suit their individual requirements."

Again, electric vacuum cleaners receive their meed of attention, but here also practical pointers are lacking. For example, it might be anticipated that a reader would like to know under what circumstances a blower-type cleaner is preferable to a pump or bellows pattern.

As electrically driven washing machines are not yet employed to any extent in this country, the descriptions in this book of American appliances are well worth attention. The machines themselves are very much lighter in construction than the standard type of this country. Whereas the heavy English machine requires a 1-H.P. motor to drive it, the American pattern only needs ⅛ to ⅓ H.P. A mistake has been made in asserting that the cost of operation is 1d. per hour at 1d. per unit. By this would naturally be understood a 1-H.P. motor working at full load, whereas much smaller motors are fitted, as above stated. So much may also be gathered from an inspection of the illustrations.

An incorrect illustration has been inserted in the case of the "Magnet" electric iron (p. 275), which is one of the best on the market. However, no attempt is made to distinguish the qualities of any one iron from those of another.

The attempt to deal with domestic applications of power is somewhat futile. All the apparatus illustrated is only suitable for hotel or shop use, with the single exception of the Electric Maid-of-all-work, which is briefly referred to on page 282. The illustration which should accompany this is given on page 287. The authoress is apparently not aware of the Westinghouse utility motor, the Alexanderwerk equipment or the Electric Mary Ann. Undoubtedly the ultimate development for domestic uses will be along the lines of some such design. Certainly the average household will not be able to afford more than one or two electric motors.

The tables on pages 290 and 314 to 333 are rather striking examples of incompleteness.

In conclusion, the work is so much data without sufficient sequence. The beginning promises well, but its quality is not sustained, and the book has no conclusion. It lacks both originality and imagination throughout. As to the illustrations, they are generally overdone, often having little to do with the text, and sometimes not appearing to be fully comprehended by the authoress herself. They are all, with the exception of a few diagrams, very familiar to those who have had occasion to look at manufacturers' catalogues. Finally, the book is well got up, with clear type—though many of the blocks have seen use before, and the proof-reading has been done a little carelessly. But after all, one must not expect too much when 338 pages can be obtained for the sum of 3s. 6d., and certainly the book is worth this amount.

HALF-WATT LAMP FITTINGS.

By "RESEARCH."

The restriction of lighting in so many towns has retarded the extensive use of half-watt lamps, but still they are getting increasingly popular. Whilst the design of the lamp itself leaves little room for improvement, this does not apply to most of the fittings supplied by the manufacturers. Dealing first with the lampholder, owing to the large current taken by the lamp the Edison screw cap was adopted. The lamp must be screwed up tight or otherwise there is heating, and ultimately arcing, taking place at the top contact. Now, in some types of fittings, the long stem of the lamp is pushed up through a small hole in the reflector, and the person screwing in the lamp cannot see what he is doing and must take hold of the bulb to screw the lamp by. The writer has known several lamps to be broken by the person thoughtlessly putting too much pressure on. Again, it has been found where lamps are suspended from tramway poles that vibration has caused the lamp to unscrew slightly, causing arcing at the top contact and the lamp to be welded to its holder.

Where the lamp is used for interior lighting, probably the best results are obtained with the indirect lighting system. It shields the eye from the glare, but an important advantage is that the lamp is freely exposed to the air and does not get too hot. The heat given off by these half-watt lamps is surprising, and when the lamp is enclosed in a fitting and globe, ventilation becomes an important problem. For outside illumination the lamp must be completely protected from rain, as a drop of water on the globe, which is at a high temperature, cracks the glass at once.

The manufacturer of fittings must therefore aim at two things: first, protection from the weather; and, secondly, a very free circulation of air past the lamp to keep the temperature down. The second item is the most difficult, and some makers have treated it as of little importance. It is most important for several reasons. The lamp is not so likely to have a long life if the heat generated cannot escape. Any copper on the fitting is discoloured by the heat, and enamel or paint used for reflecting purposes is turned brownish, and therefore does not serve its purpose. Sweating takes place on the upper part of the fitting, and the drops of moisture formed have been known to drop on the lamp and crack the globe. The first cost of these lamps being unavoidably high, it is essential that every device should be adopted to enable them to last a long time. Moisture cannot be prevented from forming on the interior of the fitting, and therefore any such moisture should drain away from the glass of the lamp.

One other point that requires consideration is the position of the filament in relation to the reflector. In one type of fitting that the writer is acquainted with, the illumination is spoilt by the filament coming too far through the reflector. The ideal arrangement would be to have a lampholder so fitted that it could be raised or lowered as desired by simply slackening a screw. The best illuminating effect could be experimented with for a given height of pole, and all lamps similarly placed could then be adjusted in the same manner.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

Reference has been made before in these notes to the growing tendency to employ underground cables in Canada. It has recently been announced that the town of Outremont, Quebec, has just installed a new lighting system which is fed throughout by underground cables; all the lamps are nitrogen filled, which makes the town unique in both respects. It is noticeable that the appearance of a number of busy streets in the heart of Toronto is steadily improving, due to the gradual removal of overhead wires, and the demand for underground construction is becoming more insistent in all the larger cities.

In Montreal the electrical companies, telephone, telegraph, tramways and lighting, are working together to form a "Safety First" league. The "Safety First" idea has "caught on" over here, and is being boomed in all quarters, not without good reason either, seeing the immense numbers of accidents which occur, most of them, of course, preventible with the exercise of a little care and foresight.

The Montreal Light, Heat and Power Co. are organising a section of the Home Guard and will supply the arms, &c. Most of the large firms here have acted similarly.

The City of Quebec is seeking power to raise a loan with which to buy out the Dorchester Electric Co., Quebec; the reported price is $1,000,000.

At St. John's, Quebec, the Canadian Hart Accumulator Co. has erected a plant and is now seeking orders for storage batteries.

Although there is a good deal of unemployment here many firms are being kept busy on large orders from home, though, unfortunately, there is not much in the electrical line. The Dominion Steel Co., in Sydney, N.S., is making large shipments of wire and rails, and is employing more than two-thirds of the full complement of men; several firms have received large orders for shrapnel shells.

The idea of municipal ownership is travelling far in these days; in Dawson City the authorities are considering the installation of municipal electric light and telephone plant which is estimated to cost about £33,000.

The Grand Trunk Pacific Railway has recently completed the telegraph connection between Winnipeg and Prince Rupert, B.C., the distance being about 1,279 miles; very many places, hitherto without, will now have the benefit of a telegraph service.

The Western Canada Power Co. is trying to arrange for the sale of $1,000,000 worth of bonds in England.

At Edmonton, Alberta, the Edmonton North-Western Radial Railway Co. want to run an inter-urban railway from the city to Pembina River.

Within the last few years a good deal of electrical equipment has been installed in Canadian mines; there is one, that of the Mountain Park Coal Co., situated about 200 miles from Edmonton, which is operated entirely by electricity. Rather more than 500 H.P. of generating plant is now in use.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Extensible Swing Brackets.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have sent us particulars of two new brackets which they have introduced recently. The bracket illustrated in fig. 1, which is the subject of a patent (No. 15,607/13), has an extension adjustable between 8 in. and 32 in., with a horizontal swivelling action within a semicircle; the angle of reflection is adjustable, as shown by the wing nut provided. By means of the curved extension of one of the arms of the lazy-tongs, the light can be raised to a fixed point 27 in. above the normal position. The fitting is made of polished brass, and is suitable for use in business offices, drawing offices, &c.

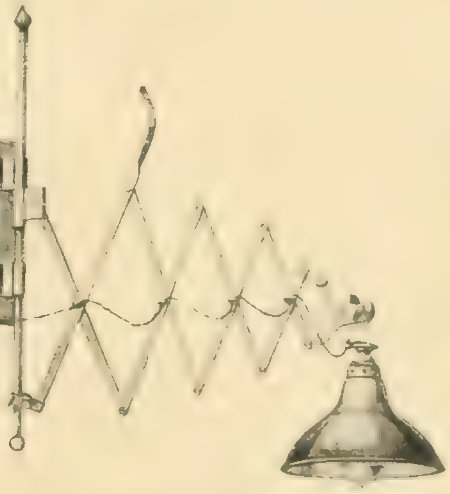


Fig. 1.—Lazy-Tongs Extensible Bracket.

Fig. 2 shows a simple bracket (Patent No. 10,814/13), in which the horizontal arm is telescopic, giving a range for the lamp of from 24 in. to 42 in. By means of the wing nut connection for the lampholder and reflector the angle of reflection can be adjusted. The horizontal arm terminates in a tee-piece specially cut away in its lower half, so that the weight of the arm causes the tee-piece to grip firmly the upright on which it slides. No binding screws are required, and the arm can be moved instantly up or down or swung round in a vertical plane. Generally one wall plate only is necessary, but if the up and down travel desired is long, additional rigidity can be secured by the use of a top wall

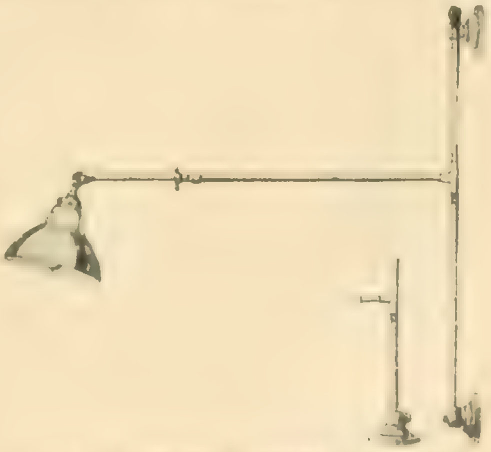


Fig. 2.—Telescopic Extensible Bracket.

plate. This bracket may also be used as a fixed standard by changing the position of the base-plate, as shown in the illustration. "Superlux" enamelled steel reflectors and Osram lamps are recommended for use with these brackets.

Ironclad Distribution Fuseboards.

MESSRS. SIEMENS BROTHERS & CO., LTD., Woolwich, have recently put on the market some fuseboards specially designed for power distribution purposes in large works where it is becoming general practice to use ordinary multicore lead-covered paper-insulated cables for motor and other circuits.

These boards are designed with detachable trifurcating boxes, which can be fitted either above or below the board. Each main fuse-box is arranged for two three-phase circuits and forms with its bus-bar chamber and dividing boxes a complete unit. The bus-bar chamber ends are covered with plates, the special feature of this arrangement being that additional sections can be added to either end, and extensions made at any time. The bus-bars are of copper tube and are also easily extended. The fuses are of the Home Office porcelain shrouded type, and liberally designed for contact area.

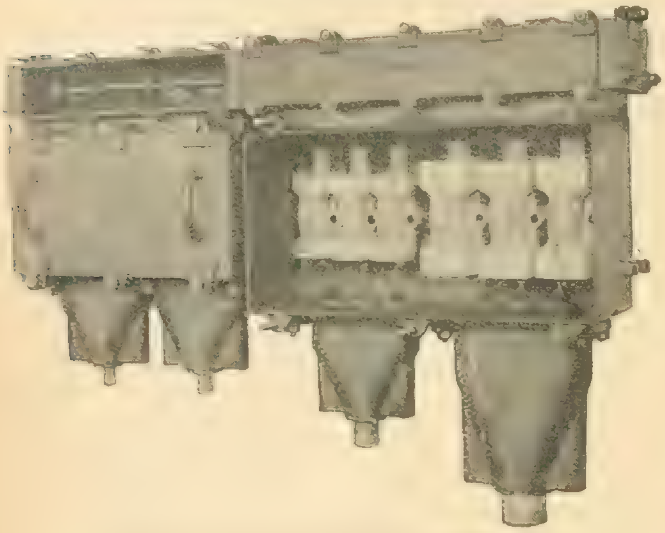


FIG. 3.—IRONCLAD DISTRIBUTION FUSEBOARD.

Details of these fuses are shown in the firm's catalogue No. 521, which will be sent on application.

"Presto" Hand Lamp.

THE FULLER ACCUMULATOR CO., LTD., of Wick Lane, Bow, E., are placing on the market the "Presto" electric hand-lamp, which we illustrate in fig 4. This lamp has a neat parabolic nickel-plated reflector and a bull's-eye lens, and is fitted with a high efficiency metal-filament bulb, and attached by means of a swivel bracket to an ordinary dry cell or portable accumulator, as shown. A convenient carrying handle is provided, and a lamp switch at the back of the reflector. Lamp and dry cell complete weigh 5 ounces.

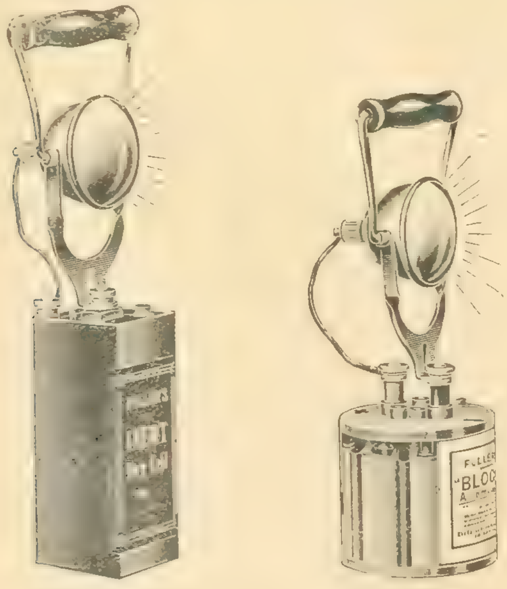


FIG. 4.—TYPES OF "PRESTO" HAND LAMP.

Simplex Radiators.

In a new electric heating list recently issued by MESSRS. SIMPLEX CONDUITS, LTD., of 116, Charing Cross Road, W.C., a variety of luminous radiators and convectors is illustrated, the former having from one to six lamps. Fig. 5 shows a handsome pattern in gilt brass. A special feature of these radiators is the wiring between the switches and the lampholder, which is carried to convenient screwed terminals in the base. The convectors operate on the Simplex strip system, the resistance ribbon being wound on mica plates, and the whole enclosed in a steel frame.

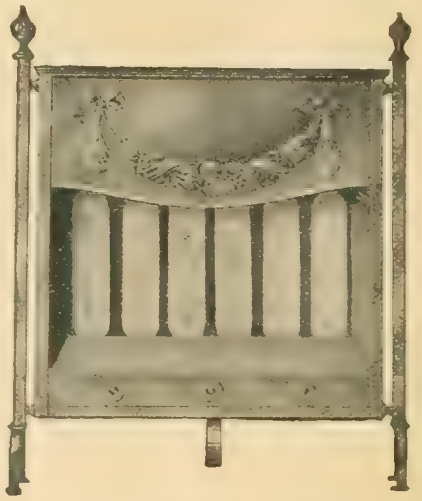


FIG. 5.—SIMPLEX RADIATOR.

LEGAL.

SEEAR v. GENERAL ACCESSORIES CO., LTD.

IN the Shoreditch County Court on Thursday, before his Honour Judge Cluer, a custom of the trade was pleaded by a plaintiff, under peculiar circumstances. The plaintiff was Edwin Chas. Seear, trading as Messrs. Seear, Page & Co., London, E.C., agent for manufacturers of electrical accessories, and he sued the General Accessories Co., Ltd., London, E.C., manufacturers of electrical fittings, to recover £26 12s. 11d.

Mr. Hicks, barrister, appeared for the plaintiff, and Mr. R. S. Barnes was counsel for the defence.

COUNSEL explained that the order was for 100 gross of wooden blocks for electrical fittings. It was a custom of the trade to supply these in bags, when unfinished, but if finished in imitation walnut, teak, or white enamel, then they were in cases or boxes. Usually the unfinished sold at 5s. to. 5s. 6d. a gross, and the finished at from 7s. to 7s. 6d. At no time before the war were these sold at less than 6s. a gross, finished, and therefore defendants could not have imagined them finished at 5s. 3d. a gross.

JUDGE CLUER said at the moment he could not agree with that contention, as plaintiff was anxious to sell, as he sent out a circular to that effect, and the defendant might reasonably think he had got a bargain. The original circular of the plaintiff had the word "unfinished" in it, but a bad copyist had left that out. That might have been a mistake, but, taking himself as an example, he should have expected to get the finished article.

MR. HICKS: My contention is, that if the defendants had not known positively at the time that they were unfinished they would have asked the colour. As to the circular, I know I have to stand by it, but bags are invoiced. I rely on that as a custom of the trade, and because no one in the trade would dream of getting the finished article at 5s. 3d., the price of these.

JUDGE CLUER said they were called "Round, recessed wood blocks," and in law that meant the finished article. What surprised him was that when a blunder had been made by a clerk the plaintiff chose to go to law about the matter.

PLAINTIFF, in his evidence, said that he had never sold at such a price as 5s. 3d.

JUDGE CLUER said it was clear that a mistake had been made, and he would have taken them for finished himself. His verdict would be for the defendants, with costs.

The costs of expert witnesses, in the electrical trade, who were to have been called to prove the custom of the trade, were allowed to the defendants.

BRITISH THOMSON-HOUSTON CO., LTD., v. DURAM, LTD.

IN the Court of Appeal on February 4th, before Lords Justices Buckley and Pickford, the hearing of the plaintiffs' interlocutory appeal in this pending action against an order of Mr. Justice Neville for discovery took place. In the action the plaintiffs claim an injunction restraining the defendants or their servants from infringing the plaintiffs' Letters Patent No. 21,513* of 1906, and No. 17,722 of 1911; damages, or at plaintiffs' option, an account of profits, and the delivery up of articles or things made in infringement of the letters patent. The plaintiffs claim to be the registered legal owners of the letters patent for an invention of processes and apparatus for the treatment of metallic tungsten and for the manufacture of electric lamp filaments therefrom, and also of Letters Patent No. 17,722, granted to John Thomas Henry Dempster for improvements in methods of wire drawing.

The defendants do not admit that the plaintiffs are the registered legal owners of the letters patent in question. The defendants, under Sec. 25, Sub-Sec. 2 (*b*) of the Patents and Designs Act, 1907, rely as a defence upon the fact that all the processes and manufactures described and claimed in the specifications filed on application for the Letters Patent 21,513*, 1906, are, and have since the date of the letters patent been, carried on mainly outside the United Kingdom—that is to say, in the United States of America by the General Electric Co., of Schenectady, in the State of New York; by the Westinghouse Electric and Manufacturing Co., of Pittsburg, in the State of Pennsylvania; by the Franklin Electric Manufacturing Co., of Hartford, in the State of Connecticut; in Germany, by the Allgemeine Elektricitäts Gesellschaft, of Berlin; by Siemens & Halske Aktien Gesellschaft G.m.b.H., of Berlin; and by the Deutsche Gasglühlicht Aktien Gesellschaft, of Berlin; and in Holland by the Philips Metallic Glow-Lamp Works, Ltd., of Eindhoven.

Mr. Walter, K.C., for the appellants, said the point raised was a very important one. The plaintiffs could not be attacked through people over whom they had no control. His clients knew nothing about the firms mentioned by the defendants, and had no means of ascertaining anything about them. The order made by the Controller that a patent must be proved to have been mainly or exclusively used abroad, was not sufficient. The order of Mr. Justice Neville meant that the whole of his clients' branches relating to their manufactures were to be open to rival traders.

Lord Justice Buckley: Do you go so far as to say that a defendant, before he can have a general order for discovery, must call witnesses to make out a *primâ facie* case as to the manufactures abroad?

Mr. Walter said he did, and that was what Mr. Justice Parker had held. No one was entitled to have a roving permission to inquire into a man's affairs.

Lord Justice Pickford: You must base your appeal on the ground of oppression.

Mr. Walter said he did. A general order for discovery was far too wide. The order should be limited or restricted.

Mr. T. Terrell, K.C., for the respondents, submitted that the order was a proper one and was necessary for his clients to prepare their defence.

Lord Justice Buckley said there appeared to be two actions. One was for the infringement of a patent; the other was how much business had been done in this country and other countries.

Mr. Terrell said they could not be called two actions. He did not ask that the plaintiffs should disclose all their books. What he wanted was the disclosure of any documents in their possession showing what they manufactured in this country, and how much they imported from abroad. He added: We know what we are fighting about. The plaintiffs have been importing these goods and not manufacturing them.

Mr. Walter: So you say.

Mr. Terrell: I have a right to make that statement. I do not ask for the names and addresses of their customers. Let the discovery be limited to quantities. If that is oppressive, then discovery is oppressive in every case.

Lord Justice Buckley said the defence as to foreign manufactures was in the nature of a counterclaim. It was surely more than a mere defence.

Mr. Terrell: It is a defence the Legislature thinks should be allowed in the public interests.

Mr. Walter declared that the defendants' interrogatories were fishing ones. Perhaps he would have to apply for discovery to ascertain the extent of the defendants' trade.

Mr. Terrell: I will give you that now. I say the number you manufacture in England is infinitesimal compared with the quantity imported.

Lord Justice Buckley asked if an order for discovery as to what the plaintiffs directly or indirectly imported, and what they themselves manufactured, would be agreed to.

Mr. Walter objected.

Lord Justice Buckley, after further argument, said that, in his opinion, the two matters in dispute were totally different and distinct. One arose merely in an ordinary action for infringement; the other was very different, raising a point as to foreign manufactures. The latter was a defence that might succeed, notwithstanding that the patent was a perfectly valid one, because the defendants said that under the Statute the plaintiffs were not entitled to any relief. The defendants claimed that they could not be proceeded against successfully if they could show that the patented article was manufactured, or its manufacture was carried on, mainly or exclusively, outside the United Kingdom. The question, he thought, was how far the order for discovery should go; there were alternative courses which might be suggested, but he did not think they would be convenient. He considered that a modified order would meet the case. There would, therefore, be an order for discovery of all documents in the possession or power of the plaintiffs in the usual form relating to all goods imported directly or indirectly by the plaintiffs from the firms and companies mentioned; and discovery of all documents in the possession or power of the plaintiffs showing the amount of manufactures of the plaintiffs in this country, but in all cases without disclosing the names of customers. That, said his Lordship, could not be called oppressive. Lord Justice Pickford concurred.

Electrical Vacuum Cleaners' Infringement Action Fails

Mr. Justice Warrington, in the Chancery Division on Thursday February 4th, gave judgment in an action brought by G. Scammell and Nephew, Ltd., Fashion Street, Spitalfields, against the Galsworthy "Otovacum" Co., Ltd., Newman Street, W., and the Sturtevant Engineering Co., Ltd. Queen Victoria Street, E.C., for an injunction to restrain the defendants from infringing plaintiffs' trade mark "Otovacum," and from passing off defendants' electrical turbine vacuum cleaners as the plaintiffs' goods.

The defendants denied the allegations. The Galsworthy Co. said that the right to use the word "Otovacum" as part of their title, and also the right to sell "Otovacum" cleaners, was transferred to them by the original company, and consequently they were entitled to say that they could get such cleaners made by the Sturtevant Co. so long as they told their customers that fact.

His **Lordship** said the answer to the plaintiffs' claim that their trade mark had been infringed was that they were not entitled to the trade mark at all, because the company in whose name it was registered never transferred or assigned it. The Sturtevant Co. had contended that they had acquired the right to make the cleaners for the Galsworthy Co., and he thought that was so. As to the claim of "passing off," his Lordship said that "passing off" meant representing to a person that the goods one was going to sell were the goods of somebody else. Such a claim in the present case broke down. The first defendants were entitled to use the word "Otovacum" in their title, and the action was dismissed with costs.

Stolz Electrophone Co. (1913), Ltd.

In the Chancery Division last week Mr. Justice Eve heard an action taken by Mr. W. H. Adams, claiming a declaration that a prospectus of the above company, issued in June, 1913, contained mis-statements of material facts by which he was induced to subscribe for 400 £1 shares. After several days' hearing his Lordship, who described the case as a deplorable one, gave judgment for the plaintiff for £300, with interest and costs.

THE RÖNTGEN SOCIETY.

At the meeting of the Röntgen Society on February 2nd, a paper was read by Mr. **Sidney Russ**, D.Sc., on some measurements of radiation he has been conducting on the new Coolidge and other X-ray tubes in clinical use. Mr. Russ was appointed by the Dosage Committee of the Society to find out whether the radiation emitted from X-ray tubes running at the same spark gap in various London hospitals was essentially similar and to what extent any differences were important. Several electroscopic measurements were made, and while two out of the four tubes examined were similar in the character of radiation emitted, the others were wholly dissimilar from each other and from the other two. The reason for the large differences was not apparent, but Mr. Russ suggested as worthy of note, without putting it forward as a satisfactory explanation, that of the two bulbs showing the widest variations, one was fitted with a light anode which soon became red hot, and the other had a heavy anode, which was kept cool by a metal radiator. The radiation from the former was very soft, and from the latter very hard. The Coolidge tube, which is a new departure in X-ray tube construction, owing to its high degree of exhaustion and to the fact that its cathode consists of a tungsten spiral which is raised to a white heat by means of a current from a few storage cells, has proved, according to the experiments of Dr. Russ, to have radiation of a heterogeneous character, and to show variation in character, but not considerable, with any alteration of the heating current. The yield of X-rays with this tube was largely increased by a small increase in the heating current, and this increase was relatively larger in the "hard" than in the "soft" radiation.

In the course of the discussion, Professor A. W. **Porter** suggested that possibly the difference between the results with regard to the homogeneity of the rays emitted by this particular Coolidge tube and the results published by Mr. Coolidge himself might be due to the fact that the tubes which were being put on the market commercially in this country had not had the air so thoroughly removed as Mr. Coolidge removed it.

Dr. **Finzi**, giving his personal experiences of the tube, said that if only care were taken to have a current of air round the tube enormous currents could be passed through it without [illegible] the [illegible].

Mr. [illegible] [illegible] experiments which Dr. Finzi had made, utilising selenium as a basis for the measurement of X-ray energy, said that he had been surprised to hear that anybody had produced selenium which was [illegible] [illegible]. He had himself spent a great deal of time in trying to find selenium which was definite in action, but it always varied. Ordinary selenium, he found, varied in resistance from year to year, and finally gave up work.

Mr. Russ said in reply that the selenium he had used had been registering for a few months, but this was not very long to go, and he was anxious to see how its resistance did vary with time.

THE ENGINEERING TRADE AND THE PRESS.

The Engineers' Club of Manchester recently debated the above subject. The matter was opened by Mr. Frank Nasmith, editor of the *Textile Recorder*, and an abstract of his remarks appears below.

After demonstrating the difference between the daily and technical Press in their relation to the trade, Mr. Nasmith said that the total number of technical trade journals published regularly during 1914 dealing wholly or partly with the engineering industries was 97; of electrical journals alone there were published no less than 20, a considerable proportion of the whole. The list given includes trade journals published in relation to such branches of the industry as are concerned in buildings, railways, general engineering, gas engineering, ironmongers, mining, textile and timber. It will, however, be gathered from the figures given that the engineering industries are well catered for as regards technical literature, and when one adds to the foregoing the occasional pages—and supplements—of our better class daily papers, it will be gathered that much information of a varying degree as regards value is published throughout the year.

Now, as regards the value of a technical trade journal to the engineering industry. The following leading heads may, it is thought, be said to cover the field:—

1. The diffusion of knowledge.
2. Record of interesting events, changes, etc.
3. The direction of public opinion.
4. Means of advertising new methods and machinery.
5. The ventilation of grievances.
6. Source of information in query form.

Dealing with the different heads the technical trade Press provides the only means for publishing certain matter which otherwise would never be placed on record. The advertiser—whom some of us pretend to ignore, but without whom we cannot live—does not only get the presentation of his advertisement to a large body of directly interested people among whom are a number of potential buyers, but he also helps to carry on a noble educative work, and is therefore a philanthropist in disguise.

The successful journal as a rule enjoys a wide circulation, and in many cases a much wider reading public. The assiduity with which some members of the Club scanned the new contracts and invitations to tender columns of technical trade journals was referred to. At the same time, it must be agreed that a deal of matter which would otherwise remain unpublished is distributed to the right quarters by our technical trade Press. Information on all topics relative to the engineering trade, critical and analytical articles by experts, descriptive matter about new plant and undertakings, abstracts of the more important patents, innumerable notes, etc., etc., all go to make up the weekly or monthly issue of the standard engineering journals. The technical Press extending, as it does, now over many years, forms a record of engineering progress of a quite invaluable kind. Even a hasty perusal of the pictures alone in the back numbers of some of our leading journals will demonstrate the rapid strides we have made and the way we have reached our present advanced position. As a means of reference old volumes of engineering journals should be more frequently consulted, and if they were it would be found that many so-called new ideas were tried—and often discarded—years ago. In patent actions the engineering journal often plays an important part, and cases have been lost through a careful perusal of early issues.

As a means of bringing before potential buyers new ideas in machinery, the technical trade Press is pre-eminent. The engineering editor of the daily Press in the main holds himself aloof from the mere descriptive matter relative to a new machine, which usually finds a ready place in the pages of the majority of our technical trade Press. He—the daily Press expert—is precluded from mentioning the maker's name, and naturally the maker, looking for a little cheap advertisement, cannot see the value of a description without his name attached to it. At the same time, one cannot but think harshly of those journals which publish what are technically known as "puffs." Unless the new or the improved machine possesses novel features, a description of which will interest and educate the reader, an editor should not be asked to insert a notice. A practice which I have always deprecated and looked upon with disgust is for the literary matter to follow the advertising, or, to put it in plainer words, for the advertising canvasser to dictate what the editor shall insert. The better class journals would rather lose advertisements than pursue such a practice. To come back to our particular head. It will be generally conceded that the technical trade Press do provide the potential buyer with information relative to new machinery and enable him to keep abreast of times which are often extremely rapid.

The technical trade Press, especially where journals have been established for a number of years, has at its command a remarkable fund of information, and as this is at the command of enquirers, it performs a very useful work as a technical information bureau.

"There is one thing the technical trade Press suffers from—and unfortunately, from our point of view, it is growing—that is what I may term subsidised competition. It is no use burking the fact that we all live by our advertisement revenue, and although it can be clearly proved that a well established journal gives good value for the money paid for advertising space, the fact remains that firms support Association journals that have a comparatively small circulation. Such journals publish—in the great majority of cases—only reprints of papers and do not give the great mass of useful and general information contained in the high-class technical trade journal. Now firms only set aside a certain sum yearly for advertising purposes, and if these subsidised journals get a share there is naturally less for the independent self-supporting journals. In a way such competition is unfair, and in my opinion no journal should be published by any parties who are directly concerned in the trade amongst which it circulates."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The British and Overseas Trade.

The long and interesting letter from the New Zealand correspondent in your current issue commends itself to me particularly as it endorses, almost word for word, my letters on the same subject which you were so good as to publish from September 7th last and onward.

It has occurred to me that if the Colonials care to bother with the matter (for the last time, perhaps), a final shot might be made at our home manufacturers by important Colonial buyers, after due consideration, issuing a declaration as to what British firms *must* do and conform to in order to retain a fair share of Colonial business. Make the declaration mandatory and very definite in tone, and give the Britisher, say, one year from the close of the war to speed-up, get efficient and modernise. The Press (both technical and lay) would, I feel sure, give the matter wide publicity here, and the importance of the movement might be further driven home by pointing out that Canadians have largely gone over to American and German goods (the latter, of course, before the war), and Australia in due course will, as things are going, be forced to do the same. The Colonials would have to avoid making the declaration through any of the big trade associations here, as these strange organisations seem to be taken up with proceedings which are the negation of the most embryonic intelligence, or if they miss this development they are so slow that they only figure as useless and costly babblers. What are needed in respect to the overseas business are actions which correspond to assertions.

I would like to add that the much appreciated space which you afforded some of us for the discussion of "Advertising and Character" received a very wide publicity apart from your influential journal, as the opening of the subject was alluded to in *The Advertising World* for January, while the *Advertisers' Weekly* for January 23rd reproduced the major part of my letter from your issue of the 8th, adding a favourable editorial comment. As I know from much experience what an important part genuine publicity work plays in the opening up and development of overseas trade, I may be excused for this apparent digression.

Arthur Mallord Turner.

London, S.W., *February 8th*, 1915.

Electricity Supply on the Large Scale.

I have perused with interest your leading article on the lecture by Mr. Charles H. Merz to the students of the Institution of Electrical Engineers, in your issue of February 5th.

If it is a fact that the inter-connection of large adjoining areas for the purpose of supplying electricity is "essential to reliability combined with economy," the economy is not apparent to the shareholders of the companies operating on the North-East Coast, with which Mr. Merz is closely identified. The commercial results after eight years' working of one of these groups of businesses are not a penny dividend to the ordinary shareholders, plus £58,000 arrears of preference dividend, besides a loss of some hundreds of thousands written off capital account in 1910. It is unfair to your readers that you should give an impression of successful development that has not been achieved, so far as the North-East Coast supply of electricity in the Cleveland and Durham area is concerned.

The group of electric power companies operating on the North-East Coast exercise large Parliamentary powers, but they evade Parliamentary obligations regarding the publication of statistics. If these companies would frankly publish, as all the London electric supply companies and all municipal electrical authorities do, their statistics as to working costs per unit, price received, total units sold, etc., it would be more useful to the consumer, the investor, and the general public, whom the Electric Lighting Acts were meant to protect, than any startling figures Mr. Merz may give to a meeting of students when there are no means of verifying the statements made.

Could Mr. Merz explain why the results of the Cleveland and Durham group of power companies have been so disastrous to the shareholders under the waste-heat scheme and the inter-connection of large areas, and why the profits have been so very far short of the profits which were estimated to accrue without waste-heat?

The success of any particular system of development of an electricity supply undertaking and the reliability of its service to the public cannot be assured by any logical process that leaves out of account the question of commercial result and financial stability. In fairness to your readers I ask the insertion of this letter in your journal.

Andrew Gemmell

(*A Shareholder*).

Ovingham-on-Tyne, *February 8th*, 1915.

A.C. v. D.C. for Lighting.

I have great pleasure in replying to Mr. Hall and to Mr. Wardle regarding the question of A.C. versus D.C. for lighting. I note their comments to my letter on this matter in your issue of February 5th.

Mr. Hall states that the source of supply does not determine the number of live wires which one has to contend with, say, from a distribution panel or box. There is a considerable difference between a three-phase distribution panel and a three-wire D.C. panel, which he will probably find out for himself at some future time if he comes to deal with the sources of supply I have mentioned.

He seems to be under the impression that an earth return means a return by earth itself, as, for instance, in magneto, or battery call, telephone earthing; such, however, is not the case in lighting or power work, in which the return conductor must be insulated if carrying above five amperes, B.O.T. regulations. The fact that he is under this impression is verified in his statement, that if an earth return is used, which is rather unsatisfactory (he here makes no mention of the three-wire D.C. system) the low-voltage alternating current would be less troublesome than the D.C. current of electrolytic propensities.

Regarding the cost of installation of electric lighting, Mr. Hall will some day have the fact brought home to him, perhaps rather unpolitely, that cable costs money. No matter how small the installation may be, the firm who employ him expect him to use discretion in the matter of cable. With due regard to mechanical strength of cables, this point is governed by the method of wiring adopted, and only in such places where the cables are exposed, and liable to be much handled, or repeatedly moved about whilst loaded with current, need the question of mechanical strength be taken into consideration. In ship repair work, or on large plant work where temporary cables are slung about anyhow and regarded more or less as so many ropes, the doubling of the ampereage by the halving of the voltage is a serious point which must not be overlooked when taking into account their selection, having regard to capacity and strength.

I wonder what gave Mr. Hall the impression that my experience had been with the older squirted filament lamps, and not with the modern tungsten drawn-wire lamps also. I can assure him that I remember the introduction of both types of wire lamp, and have used a few of each during past years. I certainly did not say in my letter of the 29th January that the drawn-wire lamps were extremely fragile.

He seems to be under the impression that the filament of the 110-volt lamp is of a greater diameter than that of the 230 to 250-volt lamp. During my experience I have not noticed any difference in the size of the filament in the respective lamps I have just mentioned. I paid particular attention to this point whilst inspecting the construction of drawn-wire lamps at our largest lamp works in London about a month ago. Traction or supported-filament lamps are made in any voltage as required. The thickness of the filament is only increased as the candle-power is raised and the size of the bulb enlarged. I was unaware that I had attempted any hedging in my letter, and, although I mentioned accumulator charging as being in favour of D.C. supply, I did not expect it to be made a point of argument by Mr. Hall. Perhaps he will tell us what he means by the phrase "general handiness for lighting purposes."

It is, of course, only natural that electricity supply companies, for whom I take it our friend is working, should endeavour to push A.C. lighting. Most Corporations now generate high-tension three-phase current which is transmitted to the outlying sub-stations to be converted to working pressures for local distribution. Apart from the expense of running rotary converters to obtain D.C., there is the difficulty of generating H.T. D.C. Static transformer losses are very small, hence the advent of A.C. supply for lighting and power. Experience with both classes of current enables me to speak with some slight knowledge of their respective merits.

Re Mr. Wardle, I am pleased to say that I quite agree with him as to the feasibility of the bonded earth return of the A.C. lighting circuit. Seeing, however, that the sheathing whilst carrying current in a wet position may come in contact with a better earth than that provided already, a leakage may easily lead to a serious fire without any means of breaking the arc. If, however, the fourth or earth wire be also insulated the danger is lessened accordingly.

The system of supply mentioned by Mr. Wardle means that instead of the supply being across two phases of a three-phase transformer, he is across one phase only and one earth conductor, which eventually terminates at the centre of the star connections of a three-phase alternator stator. As the B.O.T. regulations compel the supply company to insulate the earth conductor of the mains leading up to a building, it seems strange that they should overlook the bare sheathing return which, if ruptured, would cause an arc and probably a severe burn out. I should fancy this is a point for insurance people to deal with. It is evident that you could not use such a system for power or heavy lighting circuits above five amperes. Private plant power and lighting is always across two phases, and not one phase and earth. At least, this has been my experience personally, and also what I have noticed on other plants.

Hoping that Mr. Wardle will treat my reply to him in the same spirit as I have received his, and that my letter may be instructive to other readers of the "E.R."

Henry Fowler,

Electrician-in-Charge.

Liverpool, *February 6th*, 1915.

Street Lamps in Chicago.

In the October 9th, 1914, issue of the ELECTRICAL REVIEW (London), page 504, under the heading "Notes," there was an abstract of an article in the *Electrical Review and Western Electrician* (U.S.A.), entitled "Half-Watt Street Lamps From Chicago." I wish to call your attention to a serious error in this abstract. In the last paragraph, a statement is made as follows:—

"The arc lamps which are to be replaced are 450-watt flame type arcs numbering some 10,000 which were adopted as a standard rather more than two years ago."

If you will refer to the last paragraph on page 512 of the original article in the *Electrical Review and Western Electrician* on September 12th, 1914, you will note that the gas-filled lamps (so-called half-watt lamps) are to replace 10-ampere direct-current open arcs and 7-ampere alternating-current enclosed arcs, the enclosed flame arcs remaining as installed. Such errors are inexcusable.

S. C. Rogers,

Arc Lamp Eng. Dept., G.E.C.

West Lynn, Mass., *January 9th*, 1915.

[We may remind our correspondent that a sentence simultaneously appeared in the leading columns of our contemporary, which reads as follows:—"The most striking feature of the Chicago installation with the new 300-watt lamps is that they will be used as a standard unit in place of the 450-watt flame arcs that were adopted a little over two years ago and of which some 10,000 have been put in service." The article in question set forth the merits of the 600-C.P. half-watt lamp as against those of the flame arc, describing experiments carried out in Chicago to the advantage of the former; we regret that the paragraph quoted by Mr. Rogers was overlooked, but in view of the strong editorial comment of our contemporary which we reproduce above, and the tenor of the whole article up to the last paragraph, we feel that our impression was not unjustifiable.—EDS. ELEC. REV.]

The City and Guilds Exams.

I have had my attention called to the fact that the City and Guilds of London Institute, in its examination papers on electrical engineering, is still asking questions of this type:—

You have N cells, each with an electromotive force of e volts and a resistance of r ohms. How would you arrange them, S in series and N/S in parallel, so as to make them send their greatest possible current through an external resistance of X ohms."

And, as the rule taught even in the latest text books could only give a correct answer by accident, perhaps you will allow me to state the following very easy rule of my own, which is demonstrably good for every case:—

Let A be a smaller number than B. Then $S = A$ will give a smaller current than $S = B$, if AB is smaller than NX/r; but not otherwise.

If your readers will try this with $N = 14$, $X = 1.4$ and $r = 1$, they will find that it gives them the right grouping with even less trouble than the usual rule gives them the wrong one, and that the increase of current with my rule is over 20 per cent.

For a demonstration that my rule must hold good in every case, I must refer your readers to my pamphlet on the Grouping of Electric Cells.

W. F. Dunton.

Newcastle-on-Tyne, *February 4th*, 1915.

Electric Lighting Authorities and the Law of Rating.

[illegible] with much interest the recent article in your [illegible] Lighting Authorities and the Law of Rating.

Your contributor states the matter fairly clearly except in regard to the portion referred to as "tenant's share." He explains what this item means, but adds that "it would not, of course, include the value of the boilers, engines, dynamos or other fixed machinery at the central station," and I cannot trace throughout the figures that any percentage whatever is taken in regard to capital cost involved in the works. I was always under the impression that some percentage of the capital cost involved was allowed, the amount varying with the age of the plant and the loan period.

I should be glad if your legal contributor could give a little more explanation on this point.

Fredk. W. Purse,
City Electrical Engineer.

[illegible] *February 2nd*, 1915.

The statement in the article referred to that the tenant's share would not include "the value of the boilers, engines, dynamos or other fixed machinery at the central station" was founded upon the decision in R. v. Lee (1866), L.R.I.Q.B., 241. According to Mr. Ryde in his "Law of Rating," p. 279, that case decides that in arriving at tenant's capital, the hypothetical tenant must be supposed to provide "all the necessary stock-in-trade, coals, tools, and loose machinery necessary for carrying on the business. These include (in the case of a gas company) the meters placed on their customers' premises, but not the retorts, purifiers, steam engines (used for driving machinery and fixed by screw-bolts), boilers or gasholders, all of which are valued as enhancing the value of the freehold."

It is true, as stated by your correspondent, that no deduction for the tenant's capital is specifically mentioned, but it is included in the item "Tenant's share 17½ per cent. on £51,000." referred to in the table of figures headed: "Ascertainment of Rateable Value," which appeared in the article. According to Mr. Ryde [illegible] p. 280 "The hypothetical tenant must also provide sufficient capital to carry on the business until he receives enough money from that business to meet the current working expenses including (*inter alia*) the rates."

As to there being any deduction on account of "capital cost," I do not know of any such deduction being allowed.

The Writer of the Article.

The Acquisition of Enemy Patent Rights.

A very interesting aspect of the relative trades of the United Kingdom and enemy countries is offered by the statistics of firms or individuals to whom British patents have been granted in recent years. In 1911, for instance, out of the 17,164 fully granted British patents of that year, it is surprising to see that 2,886 were granted to residents of Germany, and 325 to residents of Austria. Nearly a fifth of the patents of the United Kingdom have in recent years been passing into the hands of enemies.

In many cases the articles or processes controlled by these enemy patents are manufactured or carried on mainly or exclusively abroad, the British patents being used merely for the purpose of closing the English market to persons other than the patentee.

In 1907, a strenuous effort was made to compel foreigners to manufacture in this country the articles protected by their British patents. As you are aware, the law was to the effect that anyone could apply for the revocation of the patent on the ground that the patented articles were being manufactured mainly or exclusively abroad. This effort has not by any means given the results which had been desired. It is surprising to find that throughout the four years next subsequent to the commencement of this law, *i.e.*, until December, 1911, only 81 applications for revocation were lodged. Out of these, 42 applications were abandoned or dropped owing to expiry of the patents. On the whole, during the period referred to, there were only some five patents per annum actually revoked for non-compliance with the law.

Upon the commencement of war, new and practically unprecedented conditions arose. It became substantially a physical impossibility for the German patentees to continue to import their patented articles into this country, and in the large number of cases in which no British manufacture had been commenced, British subjects were wholly unable to obtain these articles, and they were, furthermore, unable to manufacture, as the patents still in fact existed and remained the property of the enemy proprietors.

An emergency law was, as you are aware, very soon introduced, the result of which now is that any British manufacturer can apply to the Board of Trade for the right to manufacture under any enemy patent. The right is granted in the form of a personal licence, and it is now definitely established that the British manufacturer will not be deprived of his right to manufacture upon the termination of hostilities.

That the emergency law is of far greater value than the 1907 law is proved by the fact that throughout the past few months of war, and notwithstanding the adverse circumstances existing as a result of the war, there have been 248 applications for this right to manufacture, as compared with the 81 applications which were made throughout the four years following the introduction of the 1907 law.

An obvious reason for the enhanced value of the emergency law is that it confers a certain degree of monopoly in favour of the one applying for the right to manufacture. The entire revocation of the patent, as in the practice under the 1907 law, has the disadvantage that the applicant for revocation, after having gone to the trouble and expense of his application, is, when he succeeds, placed only upon the same footing as all other manufacturers in the country. Such other manufacturers are vested with an equal right to manufacture without having contributed to the trouble and expense involved in nullifying the patent.

Having, therefore, in view the merits and advantages of the emergency law, and having in view also the large numbers of valuable enemy patents which are in our midst, it appears eminently desirable that no time should be lost in taking all possible advantage of the facilities which are offered, as, while the benefits conferred during war will continue to exist after the expiration of hostilities, the opportunity of obtaining them is of duration substantially limited to the period of war.

Lewis Wm. Goold, F.C.I.P.A.

Birmingham, *February 6th*, 1915.

Consulting "Engineers."

It is curious to note, in most large towns, certain individuals who rent a small office, fix a brass plate, lay in a stock of stationery, and open out as full-blown consulting engineers.

One such gentleman we have in mind who obtained his engineering training in the manufacture of artificial teeth. Another one was formerly a draper, and so on with other instances that might be quoted.

The most surprising thing is that these persons are occasionally employed by large firms, who, one would naturally expect, would look more closely into the qualifications of those to whom they entrusted their work.

Delta.

February 8th, 1915.

WAR ITEMS.

Copper Enough for Thirty Years!—At the quarterly meeting of the Association of German Ironmasters, held at Düsseldorf on January 31, Dr. Schuster, the secretary, stated that when the stocks of copper in Germany were exhausted the Germans would seize everything made of copper in the parts of Belgium and France occupied by them. (By all accounts they have already been doing so for the past two months.) They would take electric wires, kitchen utensils, fittings from sugar refineries and other industrial works—everything down to the very door-handles. After that, if necessary they would strip Germany of copper, and by taking the metal off the roofs of public buildings and melting down their bronze monuments they would have enough to last them for thirty years. Which reminds us that in the other Thirty Years' War Gustavus Adolphus of Sweden thus addressed the silver statues of the Twelve Apostles he found in a church: "Gentlemen, how is it you are standing here doing nothing? Don't you remember your Master ordered you to go about through the world?" And he promptly melted them down and minted them into dollars.—"Ironmonger."

Employment of Belgian Engineers.—We read in the "Times" that during the last few weeks a large number of Belgian engineers have been engaged at Messrs. Vickers' works at Barrow. There has been a very big demand for engineers owing to the large Government orders for war purposes, and although a great many additional British workmen were taken on, the supply was insufficient. Arrangements were therefore made to employ a small party of Belgians to begin with, and the experiment proved so satisfactory that others were sent for, and now 900 Belgians are employed by the firm. The greatest difficulty has been to find houses for the men. The engineers so far have shown themselves to be very efficient workmen, although many of them are now doing a class of work differing largely from that which they have been used to. They work very satisfactorily with their fellow British workmen, and arrangements are now being made to introduce Belgians at the works of the Furness Railway Company at Barrow.

Board of Trade Assistance.—The Board of Trade continue to receive a very large number of enquiries for the names of sellers or buyers of articles of which the sources of supply or market have been interfered with by the war. Special arrangements have been made in the Commercial Intelligence Branch of the Board of Trade for dealing with these enquiries, and lists are prepared and circulated of articles which enquirers desire (a) to purchase, and (b) to sell. The eighth list is now ready, and may be obtained by United Kingdom manufacturers and traders. British firms interested in any of the goods mentioned, either as buyers or sellers, should communicate with the Director of the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Maximum Prices for Metals.—According to a U.S. Consular report, the German Federal Council has issued an order establishing maximum prices on copper, brass, and other metals. The regulations became effective on December 14. The maximum prices are indicated in the table following, and are applicable to metals marketed within the German Empire:—

Metals.	Price per 100 pounds.
Refined copper	£4.45
Scrap brass	3.22
Red brass (gunmetal)	3.88
Aluminium	7.21
Nickel	10.0
Refined antimony	3.32
Tin	11.1

Trade in Belgium.—Everyone anticipates that when the war is over Belgian manufacturers and merchants will give preference to trade with the Allies, indeed, we have already had ample evidence to that effect. We are now informed that some influential Belgian business men have taken steps with a view to organising an office called "For Commerce with the Allied Nations," the temporary address of which is c/o London Chamber of Commerce, 97, Cannon Street, London, E.C. Its objects are to secure for well recommended and fully qualified Belgians the agency in Belgium of British firms, and to answer enquiries from Belgian firms who are desirous of replacing foreign goods by their English equivalents. Trade papers, catalogues, etc., are invited and they will be filed in order to give all possible assistance to enquirers.

Anglo-Russian Commerce.—Reuter's agent at Odessa (according to the "Financial Times") says that the local branch of the Anglo-Russian Chamber of Commerce, at a well-attended meeting, discussed the further development of the commercial relations between the two countries. The present time was regarded as a very favourable moment, and it was decided to study questions of railway tariffs, and to reorganise the Chamber, so that it may incorporate the great possible number of members of the British colony interested in trade and industry. The British Consul was elected as honorary member.

Swiss Aluminium.—According to a Schaffhausen newspaper, the French Government has placed under control of State officials the Marseilles branch of the Aluminium Industry Co., of Neuhausen, Switzerland. A seizure of stocks has not taken place, as no aluminium is reported to have been found on the premises. It is assumed in certain German circles, who are interested in the Neuhausen Company, that the Swiss Federal Council will lodge a protest against the action taken by the French Government in regard to "the French branch of a Swiss undertaking."

Lamps for Malay States.—Before the war the price of a 25 c.p. tungsten lamp in Kuala Lumpur was never more than 2s. 4d. The Board of Trade correspondent for the Federated Malay States says that these lamps mostly came from Austria, some from the Netherlands, and some were not marked with country of origin. The Netherlands are now furnishing a supply at 3s. 6d. each. It is suggested that British firms have not sufficiently realised the opportunity afforded by the war of gaining a footing in this market.

Salary Advances to Men on Active Service.—The Tramways Committee of the Bradford Corporation have decided that as regards employés in the Tramways Department who are on active service with the Navy or Army, any advances of wages falling due to them under scale shall accrue as usual, notwithstanding absence from work in the department.

Personal.—Sapper Walter Fox, who is in the Naval Engineers of the Colonial Defence Corps at Singapore, was up to a few months ago an electrician in the employ of the Stalybridge, Dukinfield, Hyde, and Mossley Joint Tramways and Electricity, Ltd.

Private M. J. Fox, of the 4th Middlesex Regiment, who was for six years employed in the Rochdale Corporation tramways department, has been awarded the Distinguished Conduct Medal for bravery in the field.

Company Sergt.-Major Thos. Perkins, an employé in the Wigan tramways department, has received a commission as lieutenant and transport officer.

Mr. F. C. Locke, of the Anchor Cable Works, a well-known athlete, has joined the Sportsmen's Battalion.

Private John Brand, of the 8th Royal Scots, who previous to the war was employed at the Dalkeith Electricity Station, made a valiant attempt to save his Captain. Brand dragged the officer, who was wounded, into safety, and after three hours' crawling arrived at the British trenches. Unfortunately the officer expired. Brand has been in hospital suffering from severe strain.

We recently mentioned that Mr. S. W. Carty had resigned his position as overhead superintendent with the Liverpool Corporation Tramways Department, and had obtained a commission in the Army Service Corps. We now learn that Mr. Carty has not resigned, and his position is being kept open for him by the Corporation.

The following notice appeared in the "London Gazette" on Tuesday:—

Territorial Force.—London Electrical Engineers: The undermentioned Second Lieutenants to be Lieutenants (temporary). Dated January 1st, 1915:—Thomas F. Middleton-Case, George R. Madge, Maurice G. Bland.

Mr. Fred Middleton, electrical engineer, of Park Road, Hadfield, Glossop, has joined the 3rd Southdown Royal Sussex Regiment.

BUSINESS NOTES.

Consular Notes.—TASMANIA.—*Machinery Trade.*—In reviewing the machinery import trade of Tasmania for the first half of last year, the United States Consul at Hobart notes that in electrical plant and appliances the bulk of the trade was supplied by Germany and the United States, despite the preferential tariff to Great Britain. The United States figured exceptionally in the importation of dynamos, but this trade is irregular, and it may be many years before Tasmania may again be in the market for such a large supply, whilst the considerable imports of general electrical appliances are staple. It is in these latter lines that business should be developed. The United Kingdom made a strong showing in portable engines, and had appreciable success in motor-power machinery, sharing the latter line with the United States. Sweden provided about half the total imports in this class. On account of the rapid development of electric power in Tasmania, the sales of such machinery should show a gradual development. Present indications, the Consul says, point to a normal trade in all lines of machines and machinery except those for mining, which industry is stagnant on account of the low price of tin and the entire loss of a market for other products. As was shown in our issue of February 5th, the tariff preference to British manufactured machinery has been increased.

THE RUSSIAN MARKET.—In the hope that the seed may possibly fall on fruitful ground, H.M. Consul-General at Moscow reiterates, in his recently issued report, the oft-told tale of British indifference to local requirements, of the "take or leave" attitude shown by the British manufacturer in many cases where the error of his ways is pointed out by the Consular officer, his own agent, or a prospective customer, all of whom, being on the spot, are much better qualified to judge of the requirements of the market, and the best policy to pursue to meet local and foreign competition.

In Moscow, says the Consul, there is an opening for every class of British merchandise. Even with the high import duties in force British goods can compete in many cases with the locally-made and protected article by reason of their superiority, and the Russian customer is quite willing to pay an enhanced price for the best qualities. Meanwhile, on every side, one has seen German goods. An inquiry for an article of British manufacture will be met with an expression of regret that it is not saleable in Moscow, but a substitute has been forthcoming, patently of German origin, which not seldom bears a description or name in English, generally misspelt, but, nevertheless, a subtle piece of flattery to the selling power of the British article, if it were only to be found on sale.

In seeking business in Russia the Consul emphasises the importance of granting credit. Firms not willing to grant credit for four or six months after the receipt of goods had much better not attempt to enter this market. Their German and French competitors will at once offer such credit as is desired, and the efforts of the British trader will be useless. The request for credit is no captious demand in Russia, but an essential corollary of a commerce carried on in a vast Empire in which railways are few, markets widely separated, and roads bad and often non-existent. The majority of the customers are peasants who can only pay on the realisation of the harvest, and the retail merchant must have credit to allow him to carry any stock. The great question does not, however, lie merely in the granting of credit, but to whom the credit is granted; and where British merchants and manufacturers are at fault is that they will often grant credit where none should be given, and when once bitten refuse it where it should be granted freely. This state of affairs is due to the imperfect knowledge of Russian conditions, and can only be rectified by the intimate personal knowledge which can be gained by frequent visits of principals or travellers to this country.

An instance of how not to grant credit may be taken from the following case:—A British firm, wishing to enter this market, applied to the Consulate at Moscow for information as to the standing of an agent who had been recommended to them. Though it was known in the Consulate that the agent bore no good reputation, further inquiries were at once set on foot, which not only confirmed the previous information, but rendered it imperative to warn the British firm most strongly against the man. Disregarding the Consular advice, on the strength of a banker's recommendation the man received the agency. Within six months the British firm lost many thousands of pounds, and have applied to the Consulate to assist them to collect what is due to them.

British manufacturers and merchants must also remember that in a great trading and manufacturing centre like Moscow, there are many of their fellow-countrymen who by their foresight and adventurous spirit have not only traded with, but established factories in, the district, and whose interests have to be as much consulted as those of any other British subject. Many of these are men of substance and buy for their own account from the United Kingdom, but there are also numbers of others who, though not in affluent circumstances, are anxious and willing to undertake agencies. These men are generally thoroughly conversant with Russian customs and requirements, and speaking Russian themselves would be most useful to British firms. In order to employ such men it is generally advisable to make some advance or to supply a stock free of charge, and any expenditure thus incurred is generally compensated for by the extra reliability and commercial integrity of such persons as compared with those of another race.

ITALY.—*Government Contracts.*—The United States Consul at Rome has been actively investigating the openings for increasing American trade with Italy which have arisen since the outbreak of war. Although many of the opportunities he indicates must be considered as temporarily deferred owing to the depression in business caused by the earthquake, it is useful to put on record his advice with regard to obtaining Government contracts in Italy, as to which conditions are somewhat peculiar. There are certain well-established contractors in Rome who have obtained Government orders, and it is almost unprecedented for such orders to be placed through other mediums. Apparently, also, the Italian Government will not deal in the first instance direct with actual—at least foreign—exporters and manufacturers, but insists that negotiations be carried on through a local agent; it is also a common experience for the principal to the transaction to receive direct communication from the Government purchasing department over the head of his agent. This is doubtless the reason why local agents demand exclusive representation for such business, in order to protect themselves against loss of commission. It is also customary for the Italian Government to demand a deposit of 10 per cent. of the total value of the order upon signing the contract to insure prompt delivery, and this deposit is returned only upon completion of the contract. It is possible that this onerous condition would now be renounced.

Shortage of Electrical Goods in Spain. — The Fomento del Trabajo National, which was called together to adopt measures to meet the crisis in the electrical goods market, has arrived at certain decisions, which the American Consul at Seville quotes from the *Revista Comercial.* To carry out these decisions it is proposed to nominate a committee, composed of members of the Association of Industrial Electricians of Cataluna, the Metallurgical Association of Spain, and other representatives of Spanish industries. The proposals are:—

1. To obtain from the Government a tariff reduction on all electrical materials manufactured outside of Spain, by means of a regulated tariff.
2. To ask the Government to make inquiries through the various ambassadors abroad which country is best able to supply these materials; at what prices, and on what conditions, if for personal account or account of the committee mentioned, which would undertake to supply all Spain.
3. To inform the manufacturers in Spain that in the event of their needing materials they should inform the committee, which will facilitate their obtaining them and also price lists.
4. To get in touch with the sellers of materials who had offered them at customary prices, secure detailed information regarding these goods, and distribute this information to the industrialists of Spain.
5. To ask the help of representatives of foreign houses in ascertaining if their houses can supply materials, and the prices thereof.

New Zealand.—A firm in Wellington wants to add sole agencies for British makers of glassware, electric lamps, and carbons. H.M. Trade Commissioner, P.O. Box 369, Wellington.

Anglo-Norwegian Trade.—The Norwegian Chamber of Commerce, London, Inc., Kingsway Chambers, Kingsway, W.C., has received so many inquiries respecting trade and other matters that it has now published an official organ with the object of fostering trade between England and Norway. A copy of the first monthly issue is before us. It is entitled the *Anglo-Norwegian Trade Journal*, and contains brief articles on such matters as the import trade of Norway, Norwegian copper imports from America, exports prohibited from Norway, prohibited exports from the United Kingdom, a trade inquiry department, and so on.

Improved Outlook in Argentina.—The American Consul-General at Buenos Aires reports that the end of November was signalised by an entire change of tone in Argentine commercial and financial circles. The prospects for the immediate future were generally regarded as very reassuring. Notwithstanding decreased foreign trade due to over-speculation and enforced retrenchment, together with poor crop returns, the country is looking forward to the results of the coming crop with a strong measure of confidence. Given usual prices the export year 1914-5 is expected to prove "to be the greatest in Argentine history." Horses alone to the value of £4,000,000 (300,000 in number) are now being selected for European countries. "The immediate effect of the more hopeful tone in the general market has been already shown in increased banking movements and in a general inclination throughout commercial circles, particularly among importing houses, to make preparations for future business." Another Consul mentions that $107,000 is eventually to be placed at the disposal of the Ministry of Public Works for remodelling a Government building in Rosario to meet the needs of a local Post Office. Plans submitted by the Director-General of Architecture have been approved.

The U.S. Consul at Rosario reports that a company is in process of formation at Santa Fé for installing and operating light and power plants in the cities and agricultural colonies of the Province. The capital is to be $424,600, and it is reported that the first of five series of $84,920 each has already been subscribed. The promoters stated that operations were to be commenced on January 1st, 1915. Communications should be addressed: Sr. Armando Antilla, Gral. Lopez 87, Santa Fé.

Canada.—An Edmonton company already handling certain British electrical lines wants to take up further British agencies. The name and address can be ascertained at the Board of Trade Commercial Intelligence Department in London.

Book Notices.—*Lockwood's Builders' and Contractors' Price-Book.* London: Crosby Lockwood & Son. Price 4s.—This useful work contains a section on electric lighting, which has been revised by Mr. A. P. Haslam, and includes, besides general information, a number of price lists, mostly under the names of well-known firms. Some estimates of the cost of wiring small installations, as well as of the running cost, are also given. There are some features to which we may take exception: we doubt whether lead-covered wire with paper insulation has any vogue nowadays for house wiring; on p. 380, after an estimate for lamps using 21 watts, it is stated that 20-watt lamps (of the same C.P.) are now obtainable, which enable the charge for energy to be "considerably reduced;" and on p. 390 we read "Geeks" for "Geeko." As a whole, the book contains a mass of information, about one-third of its contents consisting of legal notes, building Acts, regulations, &c.

Spon's Architects' and Builders' Pocket Price Book (London: E. & F. N. Spon, Ltd. Price 2s. 6d. net) for 1915 has been issued, with revised prices, and, we understand, new matter, though its size remains the same as last year. In the "Electrician" section the only changes discernible are the substitution of metallic-filament lamps in the table on p. 222 for the carbon-filament type, and slight alterations in the table of lamp prices, &c., on the following page. The difficulties experienced by the editor of such a publication at such a time as this must be considerable, when the prices of some materials are subject to rapid change, and he has our sympathy. The book is a very handy one, and convenient for the pocket.

The Colliery Manager's Pocket Book and Diary for 1915, edited by H. Greenwell (London: *Colliery Guardian* Co., Ltd. price 2s. net) is in its forty-sixth year of publication, and needs no introduction to our readers. It is indispensable to colliery officials, amongst whom the electrical engineer now occupies a place of constantly-increasing importance. Special sections deal with the regulations affecting the use of electricity and the duties of those in charge, and there is a mass of general information on all mining questions. It is certainly an excellent publication.

"*Journal* of the Institution of Electrical Engineers." Vol. 53, No. 241. February 1st, 1915.—This issue contains papers on "The Shape of the Pressure Wave in Electrical Machinery," by S. P. Smith and R. S. H. Boulding; "The Magnetisation of Iron at High Flux Density, with Alternating Currents," by J. F. Nicholson; and "The Current Transformer," by A. G. L. McNaughton. London: E. & F. N. Spon, Ltd Price 3s. 6d.

"Annual Report" of the Director of the Bureau of Standards for the Year ended June 30th, 1914. Washington, U.S.A.: Government Printing Office.

"Model Power Boats." By E. W. Hobbs. London: Percival Marshall & Co. Price 5s. net.

The *Central* for December contained articles on the maintenance of a railway (by A. C. Cookson), the efficiency of electric radiators (Percy Good), the Wilson induction coil (H. R. R. Moore), and Canada (J. H. P. Daman). There is also the first instalment of the "Old Centralians' Roll of Honour."

The *Faraday House Journal* for the Lent Term contains articles on "Transforming from Three-phase to Two-phase for Single-phase Distribution" (by L. Romero); "Weddle's Rule for Finding Areas," and "Fourier's Theorem" (by Dr. Alex. Russell), and "Saturation Effects in A.C. apparatus" (by F. T. Chapman), and supplementary lists of present and past students who are serving with the Colours.

"Recenti Progressi della Telegrafia e della Telefonia senza fili." By G. Vallauri. Reprint of a paper read before the Associazione Elettrotecnica Italiana.—From the author.

"Science Abstracts," Sections A and B. Vol. XVIII. Part 1. January 30th, 1915. Price 1s. 6d. each net. Index to Vol. XVII, Sections A and B. London: E. & F. Spon. Price 1s. 6d. each net.

"Dynamometers." By Rev. F. J. Jervis-Smith, M.A., F.R.S. London: Constable & Co. Price 14s. net.

Electrical Fires. — The value of the Pyrene fire extinguisher, which was described in our issue of February 20th, 1914, has been demonstrated by its successful use on several occasions at the Bexley U.D.C. electricity works. A fire broke out among the rubber cables of the old H.T. switchboard, which would have led to disastrous results had it not been for the promptness with which the fire extinguisher was used. On another occasion a burn-out took place on a traction generator, and, in this instance, the damage done to the machine was comparatively small on account of the efficiency of the extinguisher. A third instance was a burn-out on a single-phase alternator armature coil, which was quickly put out without finding it necessary to stop the machine, which is one coupled in tandem to the traction generator. The fire extinguisher has also been used on small outbreaks in the workshop and boiler-house, and Mr. H. P. Stokes, electrical engineer and tramway manager, expresses himself as perfectly satisfied with the success of the device; he specially emphasises the fact that in no instance has any injury been caused to the electrical apparatus on which the fires have occurred, the fluid used being a non-conductor.

For Sale.—Salford Electricity Committee has for sale two 900-KW. D.C. generators, 440 to 550 volts, coupled direct to six-cylinder compound engines, also a motor-driven boiler feed pump, and a high-pressure steam feed water-heater. Tenders by February 20th. Particulars are given in our advertisement pages to-day.

The businesses and premises of Messrs. W. Bryden & Son, electrical engineers, &c., of Edinburgh and Glasgow, are to be sold, together or separately. Particulars are given in our advertisement pages to-day.

The Position of Engineering Trade in Canada.—We learn from a correspondent that the war has had a most disastrous effect upon all Canadian business, and especially upon engineering developments. A large number of contracts of all descriptions that were in progress before the war were immediately suspended when hostilities began, and they will not be proceeded with until after the winter. The manager of one engineering works in Canada said a few weeks ago that whereas their "wages" and "materials purchased" accounts in normal times averaged from $90 000 to $100 000 per month, at the present time these accounts were less than $4 000 per month! As it is of course impossible to reduce establishment charges in proportion to the turn-over, this means that engineering businesses are being carried on at a heavy loss at the present time. Notwithstanding the present depressing conditions, however, everyone is stated to be confident that Canada will be the first country to recover at the close of the war, and as there is a very strong Imperialistic tendency resulting from the war, there should be a great increase in British trade. Our correspondent holds that there never was a time when the prospect for British manufacturers capturing a large portion of the Canadian trade was brighter than it is at present, and it is hoped that our manufacturing friends at home will not fail to seize the opportunity.

We learn that the Canadian British Engineering Co, Ltd., of Winnipeg, of which Mr. Leonard Andrews is the managing director, has taken advantage of the slack time to move into new premises (85, Lombard Street). The company now has between 6,000 and 7,000 ft. of warehouse space all on the ground floor, with excellent offices on the second floor; also means of unloading machinery from a railway siding directly into the building. The company also has the use of a good yard space. One of the features of the new building is an engineering showroom with about 1,000 sq. ft. of floor space, of solid concrete and tiled floor. This enables the company to show machinery in motion, which was not possible in the old premises. This showroom has been fitted up as a permanent exhibition of British machinery in motion. Shortly before Christmas an opening week was held, demonstrations being given twice a day throughout the week. This exhibition was visited by about 200 visitors, including many Government and city officials, consulting engineers, architects, and local business men. Mr. Hamilton Wickes, the British Trade Commissioner, who happened to be in Winnipeg during the week, was also a visitor to the exhibition. The keenest interest was shown in the company's demonstrations, and visitors were practically unanimous in their congratulations upon this method of introducing British machinery. Inquiries are being received daily as the direct result of this exhibition, and when trade revives the Canadian British Co. expects to do quite a big business in the sale of British-made appliances. It is Mr. Leonard Andrews's idea, as stated above, to run this showroom as a permanent exhibition of British-made appliances, changing the exhibit from time to time so as to keep the interest in it alive. It may be that manufacturers at home who have specialities they want to introduce into the Canadian market will feel disposed to take advantage of this opportunity and send out appliances for exhibition. The cost of running such an exhibition is very heavy, and only those appliances can be shown which can be handled with advantage.

Bankruptcy Proceedings.—Albert Whiteley, electrical and mechanical engineer, Tudno Works, Tudno Street, Llandudno, Carnarvon.—The first meeting of creditors was held at Chester last week, when the statement of affairs showed liabilities amounting to £476, and assets estimated to realise £163 net, the estate disclosing a deficiency of £312. The failure of the debtor was due to want of capital, loss of money in former partnership, and giving long credit. It was decided to leave the matter in the hands of the Official Receiver.

Jas. W. & Tom W. Tattersall (Tattersall & Tattersall), electrical engineers, Kimberley Road, Willesden Lane, N.W.—Receiving order made February 1st on debtors' own petition. First meeting February 12th; public examination March 16th; both at Carey Street, W.C.

Meldrum Bros., Ltd, Timperley, Manchester.—A third and final dividend of 1s. 8½d. was payable on February 8th at 3, York Street, Manchester.

Map.—Messrs. Edward Stanford, Ltd., of Long Acre, W.C., have issued, as usual, a coloured map (2s. sheet, 4s. in case), showing the proposed railways, tramways, and other schemes affecting London, in the Parliamentary Bills deposited.

Water-Tube Boilers.—The Stirling Boiler Co., Ltd, state that, as far as water-tube boilers are concerned, business has become exceedingly lively since the beginning of the year. The following are among the more important repeat orders received by hem:—

One boiler for the Newcastle and District Electric Lighting Co., Ltd.
Two boilers for the Admiralty for Portsmouth Dockyard.
Four boilers for the Corporation of Huddersfield.
Five boilers for a large firm of ordnance makers in the North, fulfilling ontracts for munitions of war.

Heavy Machines in Germany. — The syndicate of makers of manufactures in the heavy electrical branches, to which almost all the large groups and works belong, has been provisionlly prolonged until the end of March. This will enable further ime to be gained for negotiations for the renewal of the comination which would otherwise have come to an end at the close f 1914.

Deed of Assignment.—R. H. Clampett, electrical ngineer, Manchester.—Claims must be sent in by February 20th, o the trustee, Mr. W. Kenyon, 41, Corporation Street, Manchester.

Catalogues and Calendars.—From Messrs. Hart and Co., of Bonnington Works, Newhaven Road, Edinburgh, we have received an art calendar for 1915. It consists of monthly cards each of which contains a charming reproduction from original water colours, showing various views of the building of the Panama Canal.

Messrs. E. Brook, Ltd, Colne Road, Huddersfield.—February stock list of electric motors.

The General Electric Co., Ltd, 67, Queen Victoria Street, London, E.C.—Leaflet X1,850, giving illustrated particulars and prices of "Salford" circuit breakers. Also an illustrated and priced leaflet of the E.V.C. standard electric sign for indicating vehicle charging stations.

Messrs. Isaac Storey & Sons, Ltd, Empress Foundry, Cornbrook, Manchester.—40-page excellently illustrated and fully descriptive catalogue of the Scott patent air compressors. Dimensions, prices, and code-words are tabulated.

Messrs. Ley's Malleable Castings Co., Ltd., Derby.—60-page illustrated catalogue of American and English "Blackheart" malleable castings. The history of the Ley's company and particulars of the different departments are given.

Trade Announcements.—New premises at 31, Silver Street, Stockton-on-Tees, have been opened by Messrs. R. Pickersgill & Son, Ltd., electrical engineers, &c.

Messrs. Tredegar, of 53, Victoria Street, S.W., recently converted their business into a limited liability company, with the title of Tredegar's, Ltd., in order to give the staff a personal interest and to cope with increased business. Mr. H. A. Bartlett and Mr. G. F. A. Norman will be governing director and director respectively.

The Anglo Engineering Co., Ltd, has removed to larger premises at 6 and 7, Gough Square, Fleet Street, London, E.C. New telephone number: Holborn 5923.

The manufacturing branch of Houghtons, Ltd., hitherto carried on at the Ensign Works, Walthamstow, under the title of Houghtons, Ltd. (Spratt Bros.' Branch) has been amalgamated with the factory of W. Butcher & Sons, Ltd., and formed into a separate company known as the Houghton-Butcher Manufacturing Co., Ltd. The management of the factories remains as hitherto. The new company has taken over all the contracts, assets and liabilities of the amalgamated factories.

Russian Trade.—The American Consul at Moscow reports that three societies have recently been founded with the economic development of Russia in view: For Russia, The Economic Revival of Russia, and the Russian Trade and Industry Union for the Development of Domestic and Foreign Trade; and the Moscow Merchants' Society has appointed a Special Committee for the same purpose. The Russian Trade and Industry Union will supply information to merchants with regard to foreign markets, will conduct sales and purchases on a commission basis, and will organise throughout the Empire trade and industrial museums and exhibits of samples.

Liquidations and Dissolutions.—The Miner's Lamp Electric Lighting Co., Ltd.—A meeting will be held at 42, Spring Gardens, Manchester, on March 10th, to hear an account of the winding up from the liquidator, Mr. James Blakey.

The Westminster Lighting, Heating and Ventilating Co., Ltd.—A meeting of creditors is called for February 22nd, at 14, Old Jewry Chambers, E.C.

Harry Wittusen & Co., glass merchants, 24, Thavies Inn, E.C. Messrs. E. Oakley and H. Wittusen have dissolved partnership.

Exhibition of Industrial Furnaces.—On Monday last Prof. J. O. Arnold, of Sheffield University Applied Science Department, opened an Exhibition of Industrial Gas-heated Furnaces, which will be on view until March 6th. The Exhibition consists of the products of the Brayshaw Furnaces and Tools, Ltd., of Manchester, and includes gas-heated furnaces for annealing, hardening, and tempering all classes of steel up to the hardest, and small tools. There is in connection with the furnaces an installation of electric pyrometers, supplied by the Cambridge Scientific Instrument Co., Ltd.

LIGHTING and POWER NOTES.

Antrim.—The C.C. has granted permission to Messrs. J. Densmore & Sons to erect an overhead cable for power supply from Greenfield to Oldgreen.

Ballymena.—Workhouse Lighting.—The B. of G. on the report of the electrical engineer has decided to install the electric light at the old infirmary.

Batley.—The plant ordered for the extension of the electricity works a year ago, which includes a 1,250-kw. Ljungstrom turbine set, has been requisitioned by the Admiralty for installation at one of the naval bases. This machinery, as also a similar turbine set for the Kensington and Notting Hill Co., and a rotary converter for the Kettering Council, was requisitioned at the Brush Co.'s works, where it has been constructed.

Beaumaris.—E.L. Scheme.—The Council has decided to request Mr. Price White to advise it on the proposed scheme for the electric lighting of the borough for municipal and general purposes.

Blackburn.—The borough electrical engineer is to proceed with the work of laying cable to the new electricity substation at Mill Hill.

Boroughbridge.—E.L. Scheme.—The question of introducing electric light into the town and Aldborough, at a cost of £1,200-£1,500, on lines indicated by Messrs. Best & Pullan, is to be discussed at a general parish meeting.

Bradford.—The Electricity Committee is fitting up a stand at the Belgian Village and Exhibition to be held in the Manningham Lane Rink.

In connection with the various Bills in Parliament during the 1915 Session, the Finance and General Purposes Committee has instructed the town clerk to seek, if possible, protection of the Corporation's interests which would be affected by the Keighley Electricity Order; to present a petition against the Yorkshire Electric Power Bill; and to obtain a protective clause in the Halifax Corporation Bill securing that omnibuses shall not be run along Bradford's tramway routes.

Canada.—According to a Government engineer's report, no less than 400 000 H.P. can be developed within 80 miles of Winnipeg. It is thought that the production of electrical power on the Winnipeg River will lead to the founding of numerous additional towns along its banks.—*Financier.*

Canterbury. — Restricted Lighting. — Owing to restricted lighting, there has been a saving of £157 in the street lighting account for the last quarter.

Cheriton.—The Folkestone Electricity Supply Co. has applied for the consent of the U.D.C. to a B. of T. order empowering it to supply current outside its prescribed area, and in the Council's district. The company has also informed the Council that it was possible it would enter into a contract with the War Office to supply current to the hut encampment on St Martin's Plain.

Dartford.—The U.D.C. has decided to supply free current to premises occupied by Belgian refugees, and to allow a rebate of two-thirds of the charge for current used at the club of the National Reserve Guard.

Darwen. — Restricted Lighting. — Owing to the scarcity of coal the General Purposes Committee has decided to curtail the lighting of the street lamps, with the exception of the main thoroughfare.

Doncaster.—Three-Phase Plant Extension.—The alterations and additions at the electricity works have now been completed. The new plant comprises a 1,000-KW. Willans-Siemens turbo-alternator, one 600-KW. and one 350-KW. Westinghouse rotary and H T. switchgear. The installation will generate three-phase current at 3,300 volts, and sub-stations are erected, or are in course of erection, at Bentley, Hexthorpe and Balby for distribution purposes. The work of installation was carried out by the Corporation's own staff. The extensions cost about £21,000, and constitute part of a larger scheme which has been drawn up by the Corporation electrical engineer (Mr. E. S. Rayner), and will be continued when necessary.

Dover.—Plant Extensions.—Additional plant is to be provided at the Corporation electricity works, at an estimated outlay of £6,000. It is proposed to take out two sets of 75 and 178 KW., and replace them with a 1,000 KW. turbine set.

The B. of G. has under consideration a scheme for new laundry, cooking and heating plant at the workhouse, with provision for E L. It is proposed to install a duplicate E L. plant, with batteries of 100 cells, for 400 lamps, the estimated cost of this portion of the scheme being £1,900.

Dukinfield.—Sewage Works Lighting, &c.—The T.C. has decided to offer no objection to a proposal of the Ashton Corporation to light the sewage disposal works at Plantation Farm (which is in the Dukinfield area), and to drive a pump there by electricity obtained from the Ashton works.

Dundee.—The Dundee and Forfar Courthouse Committee has decided to install the electric light throughout the Courthouse.

Eastbourne.—New Plant.—The T.C. has referred back to the Committee the recommendation for the purchase of a 1,250-KW. "Ljungstrom" turbo-alternator and condensing plant, at a cost of £5,085.

Elland.—The Electricity Committee has decided to reduce the price of current supplied to cinematograph lanterns to 2½d. per unit.

Gillingham (Kent).—Loan Sanction.—The T.C. has received from the L.G.B., sanction to a loan of £6,800 for extensions to mains and services, and of this £6,000 is to be taken up at the present time.

Glossop.—The T.C. has decided, in order to protect its own interests, to oppose the Bill of the Stalybridge Joint Tramways and Electricity Board, which includes powers to purchase the local Urban Electric Supply Co.'s undertaking.

Hendon. — Workhouse Lighting. — The Hendon Electric Supply Co. has offered to enter into a contract for a period of five years for the supply of current for lighting and power to the workhouse at £2 10s. per KW. per quarter, and ½d. per unit, if the Board will permit the company to run a low-pressure main from the transformer in the main road in order to supply consumers in the Burnt Oak area. The Sub-Committee of the B. of G. recommends the acceptance of the offer, as the annual charge would be £150, as compared with the estimated present cost of £259, and the scheme would reduce the excessive heat in the laundry, and result in considerable saving in cleansing and decoration, and possible reduction in coal consumption. The Guardians have adopted the recommendation, and tenders are to be invited for the work.

Henley.—The R.D.C. has decided to support the Reading Electric Supply Co.'s application for powers for an extension of the area of supply.

Holywell. — Workhouse Lighting. — The E.L. installation at the workhouse, carried out by Messrs. E. M. Evans and Co., of Manchester, under the supervision of Mr. A. J. Leigh, electrical engineer, at a cost of £727, has been completed.

India.—Tata Scheme.—On Monday the Governor of Bombay switched on power from the Tata hydro-electric scheme. The technical features of the scheme were described and illustrated in our issue of January 16th, 1914.

Kintore.—Exhibition.—An exhibition and demonstration of electrical cooking and heating appliances has been given in the power station at Kintore by Messrs. T. C. Smith & Co., of Aberdeen.

Leeds.—Loan Sanctions.—At a meeting of the City Council, it was reported that the L.G.B. had sanctioned the borrowing of a further instalment of the £200,000 loan for the extension of the Whitehall Road electricity works. It was stated that in September, 1912, the Council threw out a scheme involving an expenditure of £595,000, the loan to be spread over 15 years, but since that date £265,821 in loans had been sanctioned for the department, and two further loan applications were before the Board which would bring the sanctioned expenditure up to £384,000. A resolution has been adopted that the Gas and Tramways and Electricity Committees be directed each to appoint four members to form a joint Sub-Committee whose duties shall be to consider and report to the full Committee from time to time on all questions relative to the scale of gas and electricity to consumers, with a view of preventing and avoiding overlapping and competition in the sale of those commodities.

Littleborough.—Supply in Bulk.—An agreement has been formally entered into between the Rochdale Corporation and the U.D.C. in connection with the supply of electricity in bulk.

Liverpool.—Docks Electric Plant.—The Mersey Docks and Harbour Board has decided to provide an electrically-driven dust extracting plant in the band alleys, &c., of the Waterloo grain warehouses, and to substitute electric light for the existing gas jets, at a total estimated cost of £3,200.

London.—Hackney.—The Electricity Committee has considered the electrical engineer's reports as to the desirability of linking up the electricity undertaking with that of the Poplar B.C. The result of linking up would be that the works belonging to Stepney, Shoreditch, Poplar and Hackney would be interconnected and able to supply each other in case of need; also it would be possible under the proposed conditions for one undertaking to supply the others from 12 o'clock midnight to 6 o'clock a.m., so that the necessity for running any works on a light and uneconomical load would be entirely avoided.

Several circumstances in the past have prevented the Hackney and Poplar undertakings from being interconnected. Hackney had no plant of a type that could be run in parallel with Poplar; the cost of interlinking the mains would have been very great; and Poplar insisted upon heavy fixed charges being paid whether any units were taken or not.

The first difficulty has been overcome by the installation of plant suitable for running in parallel with Poplar, the laying of E.H.T. ring mains, which can be looped into Poplar from the junction of Wick and Sidney Roads, has removed the second difficulty, and the third difficulty has been overcome, as Poplar is now willing to give and take a supply with Hackney at a small charge per unit, without any heavy annual fixed charges.

The Committee recommends that steps be taken to prepare a draft agreement containing the following conditions:—

1. Poplar to lay and maintain two 0·15 three-core, 11,000-volt standard paper-insulated copper-shielded and lead-covered cables, with pilot and telephone cable from the Northern Poplar substation to the Poplar-Hackney boundary in Cadogan Terrace.

2. Hackney to lay similar cables, forming a loop of the ring main from the pit at the junction of Wick Road and Cassland Road to the Poplar-Hackney boundary in Cadogan Terrace.

3. The cost of the necessary switchgear to be provided for the purposes of the linking-up mains in the Poplar Northern substation to be borne equally by Hackney and Poplar.

4. Either party to have the use of the other party's natural reserve plant without the payment of any fixed charges.

5. In the event of either party installing reserve plant for stand-by or other purposes at the request of the other party, the first-named party to receive payment of such proportion of the

loan charges on the capital expenditure, and for such period as may be mutually agreed, or, failing agreement, the sum and period to be fixed by arbitration.

6. Either party to supply energy to the other party (subject to such limitation as is defined in Clause 4) at a price per unit measured at the supplier's switchboard, of 0 25d.

7. So far as practical, each party shall give to the other, equal supplies of energy, and only excess supplies shall be subject to be paid for in cash.

8. The period of the agreement to be for 20 years, during which time the charges may be revised by mutual agreement at the end of each fifth year.

The cost of the necessary mains and switchgear for effecting the link is estimated at £2,720.

Battersea.—The Electricity Committee reports that owing to the increasing demand for the supply of electrical energy in the Nine Elms district, it will be necessary to extend its plant, and recommends the adoption of the scheme of the electrical engineer for two rotary converters of 500-kw. each, and one of 1,000-kw., together with the necessary switchgear and transformers, at an estimated cost of £8,750, and for duplicate E.H T. feeders to be drawn into the existing ducts between the electricity generating station and a point in New Road, at an estimated cost of £7,000. The Council is recommended by the Finance Committee to make application to the L.C.C. for sanction to a loan of £15,750 to carry out the work. The Committee also recommends that negotiations be opened with the Fulham B.C. with a view to linking up the supplies of Battersea and Fulham under the London Electric Supply Act, 1908.

Deptford.—In order to comply with the regulations of the L.C.C. as to the condition of the electrical installation at the borough hall, the Council is obtaining expert advice.

Fulham.—The Electricity Committee reports that the demands for energy for consumers in the De Morgan and Townmead Roads area are increasing, and recommends that the Stephendale and Townmead Road sub-stations be connected up, and that the necessary cable high and low-tension switchgear, and two 100-kw. transformers be obtained at a cost of £570.

St. Pancras.—The chief electrical engineer reports a difficulty in obtaining supplies of coal; he has communicated with the railway company, the War Office, and the Railway Executive Committee, pointing out that unless the supply is improved the circumstances may be serious having regard to the fact that the factories in the borough, many of which are engaged in Government work, may have to shut down. The difficulty seems to have arisen owing to supplies not coming through from the collieries specified in the contract.

In reply to the B C.'s application for a loan of £22,530 for boilers at King's Road generating station and £8,970 for mains, house services, meters and arc lamps, the L.C.C. states that the Parliamentary power to lend money to Metropolitan B C.'s in the current financial year is nearly exhausted, and that the Council can only make an advance of £10,000 to the B C. at the present time.

The Finance Committee has accepted the loan of £10,000, and will report later as to the steps taken to obtain the balance of the loan.

L.C.C.—The Finance Committee recommends the sanction of the Council to the application of the Hammersmith B.C. to borrow £10,000 for purposes of the electricity undertaking, viz, £416 for buildings, £3,449 for mains, £1,535 for transformers, switch panels, &c., £2,980 for house services and £1,620 for meters.

According to the *Daily News and Leader*, the L.C.C. has given notice of the withdrawal of its Electric Supply Bill, but a private Bill of a similar kind proposing to form a company for electric supply in London was put down for Thursday. This, it was stated, will be opposed by the County Council and by members on both sides of the House.

The *Standard*, of last Friday, said that the Bill would not be withdrawn, but the application for first reading would be postponed, with a view to reconsideration of the vote.

Restricted Lighting.—It is somewhat astonishing to find in these days of darkness that complaints have been made against the brilliantly lighted windows of the Houses of Parliament. Possibly the presence of so many "shining lights" within its portals, and a natural antipathy to hiding them, may account for the trouble.

Mottram-in-Longdendale.—The U.D.C. has decided to oppose the Bill of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, by which further electricity powers are sought.

Newcastle Power Schemes.—Reference has been made on many occasions in these columns to the development of electrical power distribution on the North-East Coast, more especially to the several power stations which have been built in the neighbourhood by the Newcastle-on-Tyne Electric Supply Co. and its associated companies. Some six and a half years ago, the Supply Co. decided that it would be expedient to construct a coal-fired power station at a point higher up the Tyne, and on the Gateshead side of the river, and it was decided to erect a plant on the banks of the Tyne at Dunston. This station, which has a river frontage of about 900 ft., was put into service some three and a half years ago, and formed the subject of a detailed illustrated article, which appeared in our issue of July 7th, 1911. The Dunston station generates three-phase current at 40 cycles and 6,000 volts. The steam pressure is 200 lb. per sq. in., and the steam is superheated, the total temperature being practically 570° F. The main generating units at present consist of two A.E.G. sets, each of 10,500 h.p., and a Brown-Boveri set of 9,000 h.p., all three running at 1,200 r.p.m. The station was originally laid out to accommodate eventually six generating units, each of 10,000 h.p. continuous capacity and 13,000 maximum capacity, or a total capacity of about 70,000 h.p. In connection with the present extension scheme, an agreement was entered into with the Teams By-Product Co., Ltd., to purchase the available supply of gas from a large battery of Otto-Hilgenstock coke ovens distant 1½ miles from the Dunston power station. This gas is led along the North-Eastern Railway Dunston branch in a 16-in. welded steel pipe, supplied by Messrs. Stewarts & Lloyds, Ltd. The joints were welded *in situ* by the acetylene process. The boiler-house extensions comprise a steel frame building, sheeted in with corrugated iron, 114 ft. long × 75 ft. wide, with two steel chimneys. There are two coal-fired water-tube boilers, each capable of producing continuously 30,000 lb. of steam per hour, with the necessary furnace and fixtures, also stokers and superheaters. In addition, there are four gas-fired water-tube boilers, each capable of dealing continuously with 57,000 cb. ft. of gas per hour, built in two batteries, with the necessary flue fixtures inclusive of gas burner and superheaters. The fuel economisers, one for each boiler, have automatic tube scrapers and dampers, also soot-cleaning gear. Induced draught fans, direct driven by electric motors, deal with the products of combustion from two gas-fired boilers and one coal-fired boiler. There are two feed pumps, each capable of dealing with 200,000 lb of water per hour at 190 lb. to the square inch, boiler pressure. The coal-handling plant is of the gravity bucket conveyor type, and capable of feeding the coal into the overhead bunkers at the rate of 40 tons per hour. The plant is suitable for receiving coal from two hoppers of 25 tons capacity, each traversed by a railway truck. The overhead bunkers have a capacity of 950 tons. All the boiler-house plant and buildings were contracted for by Messrs. Babcock & Wilcox, Ltd., and the whole of these buildings were placed on a 6 ft. 6 in. reinforced concrete raft supported on 376 40-ft. pitch pine piles, which work was executed by Messrs. Robert McAlpine & Sons, Ltd. The engine room plant extensions consist of a 12,000-kw. turbo-alternator with direct-coupled exciter, the turbine being of Messrs. Richardsons, Westgarth's manufacture, and the alternator by Messrs. Brown, Boveri. The surface-condensing plant consists of a Contraflo surface condenser capable of dealing with 141,600 lb. of steam per hour. The turbine is of the impulse-reaction type, designed to run at a speed of 1,200 r.p.m. with steam at a pressure of 190 lb. per sq. in., and at a temperature of 600° F, with a vacuum of ·9-in. mercury. Though the normal and most economical load is 12,000 kw., the machine is capable of 50 per cent. overload. The alternator has a normal capacity of 12,000 kw. at a power factor of ·7 lagging and 5,750 volts, 40 periods. It will, however, take overloads up to 13,200 kw. steady, and 15,000 kw. for 60 minutes, equivalent to 21,400 kva. The necessary condensing plant has also been supplied by Messrs. Richardsons, Westgarth, and the whole of the installation has been built and started up under the supervision of Messrs. Merz & McLellan, the consulting engineers to the Supply Co.

Nottingham. — Proposed Loan. — The T.C. has adopted the recommendation of the Electricity Committee to borrow £20,000 for the extension of the electricity mains and services.

Nuneaton.—Current for lighting halls used for drill purposes is to be supplied by the T.C. free of charge. The Electricity Committee is still considering the question of giving a supply of current to the Stockingford district.

Oldham.—The T.C. has decided to oppose the Stalybridge Joint Board's Bill, which seeks additional facilities and extension of area for electricity supply.

Ormskirk.—The U.D.C. has decided to oppose the Gas and Electricity Bill promoted by the Ormskirk Gas Co. A previous resolution to the same effect was declared invalid.

Perth.—New Turbine Plant.—The Electricity Committee recommends the T.C. to apply for sanction to a loan of £4,000 for new plant, including a new turbo-generator, at the electricity works.

Portaferry (Co. Down).—An official inquiry was held last week into the Downpatrick R D.C.'s application for powers for the electric lighting of the town.

Reading.—The T.C. has decided to oppose the Reading and District Electric Supply Co.'s Bill to extend the area of supply in order to include Henley-on-Thames, as the Council considers that the extension would not prove sufficiently remunerative, and that the time at which the company's charges for lighting and power could be reduced will be postponed.

St. Anne's (Lancs.).—The U.D.C. has decided to supply electric light free to local training corps.

Sheffield.—The City Council has been recommended to adopt electricity for lighting the Fulwood Park Estate. It is proposed to put up a temporary installation for lighting Club Mill Lane, consisting of 20 wooden poles each fitted with a 60-watt (50-c.p.) metal filament-lamp and overhead cable. The Electric Supply Committee has decided to charge all hospitals for current consumed for lighting purposes at 4d. per unit less a rebate of 33⅓ per cent. A similar rate is to be offered to the Guardians for all lighting at the Firvale workhouse buildings.

Stretford.—PUBLIC LIGHTING.—The U.D.C. has approved of the extension of the scheme for improved lighting of Chester Road. The lighting of the thoroughfare by half-watt lamps previously authorised is now completed.

As the lighting battery at Longford Hall will shortly require renewal, the electrical engineer, together with the surveyor, is to report upon the question of supplying current from the public mains.

The Electricity Committee proposes to re-appoint Mr. Thomas L. Miller as consulting engineer at a fee of 25 guineas.

Southport.—RESTRICTED LIGHTING.—The electrical and gas engineers have been instructed to reduce the illumination of all lamps by darkening the tops and parts of the sides. The electrical engineer is to act on the instructions of the military authorities as to cutting off the supply if and when necessary.

Torquay.—The Electricity Committee reports that there was an increase of 189,959 A.C. units sold during the past year, while there was a decrease of 25,000 D.C. units.

Wakefield.—NEW LOANS.—In connection with the electricity undertaking, application is to be made to the L G.B. for sanction to borrow £3,000 for mains, £500 for sub-stations, and £500 for transformers. Sugar Lane is to be lighted by electricity.

The ventilation of the public library is to be improved by the provision of an electric motor and fan, at a cost of £65.

The Stanley Electric Lighting Provisional Order is to be opposed.

Wigan.—PROPOSED LOAN.—Application is to be made for sanction to the borrowing of money for switchgear and a transformer.

Wimbledon.—The Electricity Committee reports that a supply of electrical energy has been given to the factory of Messrs. Hugh Stevenson & Son, at 1d. per unit, with a minimum consumption of 20,000 units per annum, the supply to be taken for one year certain.

Owing to the difficulty in obtaining delivery of coal at the generating station, consumers were warned that the Council might be compelled to restrict the output of electricity for all purposes at any time after 12 o'clock noon on February 3rd. On inquiry, on Tuesday last, we were informed that the difficulty had been removed.

Windermere.—PUBLIC LIGHTING.—The U.D.C. has invited the Electricity Supply Co. to quote terms for the public lighting of the district known as Craig Walk.

Worcester.—L.G.B. INQUIRY.—Mr. H. R. Hooper has held an inquiry into an application to borrow sums of £5,250, £1,975 and £850 for purposes of the electricity undertaking. He criticised the over expenditure on loans, and finally adjourned the inquiry with a view to obtaining amended financial returns.

Yorkshire Electric Power Bill.—A conference of local authorities affected by the provisions of the Yorkshire Electric Power Co.'s Parliamentary Bill, was held at Wakefield last week, under the chairmanship of the Hon. C. G. Milnes-Gaskell, when a resolution was adopted that, failing satisfactory amendments to the Bill, it should be opposed by the Urban and Rural Councils of the West Riding, and that the Executive Committee of the District Councils' Association be requested to co-operate with the County Council for the purpose of making such opposition effective. In a discussion with the representatives of the Power Co. which followed, it was stated that 33 out of the 84 Councils affected, approved of the proposals and supported the Bill. Mr. A. G. Lupton, chairman of the company, said that if any local authority wished to be cut out of the Bill, and such authority passed a resolution accordingly, they would be left out and cut off from all benefits that the company wished to bestow upon them. The Burley-in-Whafedale District Council, have taken advantage of this last statement, and have passed a resolution requesting to be cut out of the Bill, failing which they will oppose it in accordance with the above-mentioned resolution. The New Mill District Council have also passed a resolution asking to be left out of the Bill altogether. We also note that the Skipton R.D.C. and Silsden U.D.C. are opposing.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. CARS.—The proposal to abolish the P.A.Y.E. cars on the Corporation tramways came before the T.C. last week, and after three hours' discussion a decision was deferred pending further consideration by the Tramways Committee.

Barnes.—ELECTRIC DUST VANS.—After trials of Baker and Edison dust vans, the Public Health Committee recommends that four such vans with Edison batteries be purchased, and that steps be taken to obtain a loan for the purpose.

B. of T. Tramways Statistics.—The annual return of the Board of Trade respecting the tramways, light railways and railless vehicle undertakings of the United Kingdom, for the period ending March 31st last, shows that 2,700 miles of route were open, and that 3,426,473,192 passengers were carried, 354,379,672 miles being run—these figures being in excess of those for the year 1912-13. The percentage of working expenditure to gross receipts increased from 62·6 to 64·3, while the average receipts per passenger decreased from 1·065d. to 1·053d. The total capital expenditure amounted to £80,977,838. Some 4 per cent. of the route mileage is not worked by electric traction.

Of the 279 undertakings, 171 belong to local authorities and 108 to companies or other parties. The net receipts of municipal undertakings amounted to £4,071,610 for the year; £1,218,299 was required for interest or dividends, £120,039 for rent of leased lines, and £1,371,263 for reduction of debt; £589,886 was paid in relief of rates and £711,217 was carried to reserve and renewals. Three local authorities and five companies show an excess of working expenditure over gross receipts. In 26 cases it was necessary to seek aid from the rates to meet some part of the charges, including interest and debt charges.

Of 26 railless traction undertakings authorised, 21 belong to local authorities and 5 to companies. Altogether 131 miles have been authorised, and 21 miles were worked, all by local authorities.

Municipal undertakings carried 2,696,759,064 passengers, worked 262,675,163 car-miles, and were credited with the use of 499,809,146 KW.-hours. The return shows that 406 horses were still in use, these, however, being mainly on the L.C.C. routes, which are now being electrified; Northampton and Morecambe being the only other places where horse traction still survived in municipal service.

The company undertakings carried 729,714,128 passengers, worked 91 704,509 car-miles, and were credited with the use of 130,052,873 KW.-hours. They also employed 550 horses in 11 undertakings, and 29 locomotives in 8 undertakings. On all lines, 13,196 electric cars were in use and 462 non-electric cars.

As regards railless traction undertakings, Brighton and Hove have the largest authorised capital expenditure (£99,000 and £88,000), while Rotherham (£48,000), and Chesterfield (£42,000), also figure prominently. Two company undertakings in North Yorkshire and Monmouthshire have an authorised capital of £130,000 between them. The returns for English railless traction undertakings working show that 1,807,222 passengers were carried, 369,691 miles were run, and 370,532 KW.-hours used. Working expenditure amounted to £10,935 and net receipts to £3,143. The only undertaking operating outside England was at Dundee, where 152,919 passengers were carried and 40,366 miles run, the receipts being £314 less than the working expenditure, £776.

Bolivia.—TRAMWAY SCHEME.—A scheme for the construction of an electric tramway from La Paz to the Yungas Districts has been reported on favourably, and will in all probability be approved by the House of Legislature in due course. The territory through which the proposed line is to pass is probably the richest agricultural part of the Department of La Paz under actual cultivation. The roads leading thither from La Paz are good, and from a short distance from the city to the farthest distances travelled enormous water power is to be found to supply not only the proposed line, but any number of industries. It is almost certain that an electric tramway once constructed would cost very little to operate. The maximum cost of the line is calculated as £500,000, and the work would be directed by the Public Works Department of the Bolivian Government, its cost being defrayed from the Treasury of the Department of La Paz. Surveys have been made by the Bolivia Railway Co. and by the Public Works Office. The United States Minister states that there might be an opportunity for a manufacturer, who was sufficiently interested, to arrange with the Government to construct the tramway on his own account.

Bradford.—The Corporation Tramways Committee has decided to remove the exisiting car-shed at Bolton before the end of the present year, and has instructed the city architect, in conference with the general manager, to proceed with the preparation of plans for the erection of a new car depôt. A special Sub-Committee has been appointed to inquire into the whole question of tramway track construction and maintenance.

Bury.—The extensions of the Corporation tramways to the borough boundary at Jericho, and to the New Inn at Walmersley, have now been completed, and are awaiting inspection by an officer of the B. of T.

Clayton-le-Moors.—The Council has decided to object to the granting of an extension of time for the construction of the Clayton Light Railway.

Doncaster.—TRAMWAY EXTENSIONS.—The extension of the tramways system from Balby to Warmsworth was inspected on the 4th inst. on behalf of the B. of T.

Four additional cars have been ordered, and borrowing powers are being sought by the T.C. for six others.

London.—L.C.C.—The total traffic receipts on the Council's tramways from April 1st, 1914, to January 27th, 1915, were £1,906,270 from lines worked by electric traction, and £9,164 from horse traction, a total of £1,915,434. The receipts for the corresponding period of the previous year under the same headings were £1,803,109, £18,635, and £1,821,744 respectively.

Merthyr Tydfil.—ASSESSMENT TROUBLES.—The Merthyr Electric Traction Co. has appealed against the assessment of its undertaking, fixed at £2,571 in the borough and £86 in Cefn. In 1905 the rateable value was fixed at 6 per cent. on the gross receipts, with an agreed sliding scale basis, and in 1913, it was contended, the rateable value had risen to 11 per cent. The company considers that £1,600 should be the proper rating for Merthyr, and that on a give-and-take principle it should not exceed £1,780. The Assessment Committee has decided to ascertain from the valuers the basis on which they arrived at their assessment.

London.—The Metropolitan Railway, which has been reconstructing its country extension with four tracks, is to provide a new fast service of trains on those lines from May 1st.

Nelson.—The tramways continue to suffer as a result of the war. It was reported that for the period commencing December 12th, and ending January 9th, 216,236 passengers had been carried, against 279,437 for the corresponding period a year ago, the receipts being down to the extent of £206.

South Africa.—Electrification of Railways.—At a meeting of the South African I.E.E., Mr. F. W. Mills, electrical superintendent S.A. Railways, stated that electrification of the suburban lines at Cape Town had been considered and reported upon, and that he had no doubt that in the near future the electrification of certain sections of the line would become one of the live questions, as both Mr. Hoy and the Railway Board were keenly interested. He considered that under certain conditions it would pay to electrify the railways, and with the assistance of the Victoria Falls Co. he considered that electrification was at hand if only a low price for power could be obtained.

South Shields.—A Tramway Proposal.—The T.C. last week agreed to the Tramways Committee's proposal to confer with the Jarrow Corporation, and to enter into negotiations with the Jarrow Tramways Co. with the view to taking over the company's undertaking.

Walsall.—The Finance Committee of the T.C. has decided to transfer from the tramways account a further sum of £1,000 towards the relief of the rates during the year ending March 31st next.

The Daimler Co. having offered six motor-omnibuses at the price of £5,369 complete, the Tramways Committee has purchased the same, and recommends the Council to enter into a new contract therefor, the old contract for six vehicles to remain in force, and to be fulfilled as soon as circumstances enable the company to deliver the vehicles.

Wigan.—The Tramways Committee has decided to carry out alterations to the tramways track in Standishgate and Crompton Street, at an estimated cost of £1,126.

TELEGRAPH and TELEPHONE NOTES.

A Real Wireless Antenna.—According to a letter published in the *Scotsman*, from a Scot resident in Buenos Ayres, there were "Clandestine wireless installations all over the city, which could reach a strong station on a German 'estancia' down south, which, in its turn, used to communicate steamer sailings, &c., to the German commerce destroyers. . . . . When the Argentine Government got after the clandestine installations the German Electric Co. used the smoke of their big chimney instead of antennæ, as the smoke contains enough carbon to act as conductor for the Hertzian waves. What do you say to that?"

This seems to go one better than Mr. Campbell Swinton's bedstead receiver.

Automatic Telephones.—It is proposed to provide all the telephone exchanges in the Sheffield area with full automatic equipment, and to replace the present Liverpool Central Exchange by a semi-automatic exchange in the "Bank" building.

China.—The United States Consul at Hankow states that last July a new C.B. installation, with American equipment, was opened at Changsha. It has a present capacity of 1,000 local lines and 40 toll or long-distance lines, and is arranged for an ultimate capacity of 3,000 lines. It replaces one of the magneto type, equipped for 350 lines. The Chinese have now thoroughly realised the advantages of the telephone for commercial as well as Government uses, and are beginning to recognise that telephone systems, properly designed and managed, will yield profits, so that it will be easier to interest local capital in such schemes.

Illicit Wireless Installations.—At Enfield Police Court on Monday Stanley Warren White, a wireless student, was charged on remand with having in his possession, without the written permission of the Postmaster-General, a complete wireless installation. Experts stated that the apparatus was capable of sending and receiving messages from eight to ten miles. The defence was that the apparatus was really a toy. The magistrate imposed a fine of £7 and costs, and the wireless apparatus was ordered to be detained by the Post Office authorities until after the war.

Mr. Hamilton Bell, a draper, was fined £20 by the Castle Eden magistrates on Saturday for being in unlawful possession of a wireless apparatus at Blackhalls, on the Durham Coast.

Long-Distance Telephony.—The trans-Continental telephone service between New York and San Francisco will be opened for commercial use early next month. The rates will be \$20.70 for three minutes and \$6.75 for each additional minute. These high rates are justified by the fact that communication between these cities involves the employment of \$2,000,000 worth of plant.

New Cable.—The new submarine cable between Nagasaki and Shanghai, the laying of which has been in progress for the last two years, has now been completed and opened for the transmission of messages between Japan and China.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 6th. U.D.C. Twelve months' supply of cables, meters, joint-boxes, &c., lamps, uniforms, tickets and other stores. See "Official Notices" February 5th.

February 19th. Wiring and fittings at the Police Court, for the Glamorgan Quarter Sessions Standing Joint Committee and C.C. Specification from the Architect, County Hall, Cardiff.

Australia.—Brisbane.—March 10th. Motor-generator, power board, &c., for Postmaster-General. See "Official Notices" January 15th.

April 7th. Deputy P.M.G. Wheatstone receivers and transmitters (Schedule 335). High Commissioner for Commonwealth, 72 Victoria Street, S.W.

Melbourne.—March 16th. White Wheatstone receiving tape, for Postmaster-General. See "Official Notices" February 5th.

Bedwas.—March 4th. Electrical goods for 12 months, for the Bedwas Navigation Colliery Co., Ltd. Forms of tender from the Secretary.

Blackburn.—February 13th. Corporation. Twelve months' supply of stores, including a number of electrical items, for the Electricity Committee. See "Official Notices" Jan. 29th.

Bootle.—February 17th. Corporation. Twelve months' supply of cables, meters and electrical stores. Forms of tender from the Borough Electrical Engineer.

Bridlington.—The T.C. has instructed the Borough Electrical Engineer to obtain provisional tenders from six firms for the erection and equipment of a refuse destructor.

Cardiff.—February 22nd. Installation, 750 points, at New Technical Institute, Cathays Park, for the City Council. See "Official Notices" January 22nd.

Dublin.—February 18th. Corporation. Twelve months' supply of arc lamp carbons. See "Official Notices" to-day.

Edinburgh.—The City Council has decided to postpone advertising for contracts for stores for two months, and, in the event of the present conditions continuing into April, to make the contracts then advertised extend, if necessary, over short periods only, instead of 12 months.

Gloucester.—April 1st. Twelve months' supply of stores, for the Electricity and Light Railways Committee. Forms of tender from Mr. F. H. Corson, General Manager, Light Railways Offices, Bristol Road.

Halifax.—February 15th. Corporation. Twelve months' supply of stores, including lighting fittings and electrical accessories, cables, telephone wire, meters, &c. See "Official Notices" January 22nd.

Ilford.—February 23rd. U.D.C. Twelve months' supply of stores for the electricity works. See "Official Notices" February 5th.

Leeds.—February 20th. Corporation. Twelve months' supply of stores, including cable, mains boxes and fittings, jointing and insulating material, electric lamps, fittings, &c., for Electric Lighting Department. See "Official Notices" January 22nd.

February 17th. Electrical work, Hough Lane School, Bramley, for the Education Committee. Education Architect.

February 22nd. Corporation. Twelve months' supply of electrical sundries, for the Tramway Department. Forms of tender from the Tramway Manager.

London.—Islington.—February 24th. B.C. Twelve months' supply of electrical stores. See "Official Notices" February 5th.

St. Pancras.—February 15th. B.C. Arc lamp carbons, for the Electricity Department. See "Official Notices" January 29th.

St. Marylebone.—February 17th. Stores, including meterboards, casings, &c., cables, box compound and insulating materials, &c., for Electricity Department. See "Official Notices" Jan. 29th.

Wimbledon.—February 22nd. Corporation. Twelve months' supply of stores for the Electricity Department. See "Official Notices" to-day.

Fulham.—February 24th. B.C. Twelve months' supply of electrical stores. See "Official Notices" to-day.

Hammersmith.—February 24th. B.C. Twelve months' supply of general electricity stores. See "Official Notices" to-day.

Battersea.—March 2nd. B.C. Supply of stores for Electricity Department. See "Official Notices" to-day.

Macclesfield.—March 10th. Cheshire County Asylum, Parkside. Electrical goods for one year. Forms of tender and particulars from Mr. Wm. Tingay, Clerk of Asylum.

Manchester.—February 16th. Corporation. Twelve months' supply of stores for the Tramway Department. See "Official Notices" January 29th.

New Zealand.—May 3rd. Electrically-driven turbine pumps of 80,000 and 100,000 gallons capacity per hour, together with direct-coupled motors. Commercial Intelligence Department, Board of Trade, London.

North Bierley.—February 22nd. 800 electric incandescent lamps, for the Guardians. See "Official Notices" to-day.

Portsmouth.—February 16th. Corporation. Six months' supply of stores, for the Tramway Committee. See "Official Notices" February 5th.

Reigate.—February 20th. Corporation. Supply of coal for the electricity works. Particulars from Mr. W. S. Ross, Electrical Engineer.

Rotherham.—February 22nd. Corporation. Two water-tube boilers, automatic mechanical stokers, economisers, superheaters, foundations, steel chimneys, steam valves, steam pipes, induced-draught plants, and all auxiliaries. See "Official Notices" January 29th.

Salford.—February 22nd. Twelve months' stores for the Tramways Department. General Manager, 32, Blackfriars Street.

Spain.—The municipal authorities of Cogeces del Monte (Province of Valladolid) have just invited tenders for the concession for the electric lighting of the town.

Stockton-on-Tees.—February 19th. Corporation. Two 500-KW. rotary converters, transformers and starting apparatus. See "Official Notices" February 5th.

Swindon.—February 17th. Corporation. Four-way and other stoneware conduits, for the Electricity and Tramway Department. See "Official Notices" February 5th.

CLOSED.

Argentina.—The American Consul at Rosario says that the Government has accepted the tender of the Gasmotoren Fabrik Deutz for the installation of motors for electric plants in 11 barracks in the cities of Tucuman, Salta, Jujuy, Corrientes, San Nicolas, Santiago del Estero, Catamarca, Mendoza and Mercedes. Six tenders were received, ranging from $33,118 to $89,166. The Gasmotoren Fabrik Deutz offers to deliver the motors for $33,118, to which amount $2,123 is added for necessary masonry work.

Batley.—The E.L. Committee has accepted the tender of Messrs. Ferranti, Ltd., for 17 meters.

Bradford.—The Corporation Tramways Committee has accepted the tender of Messrs. W. A. Stevens, Ltd., for a 40 H P. Tilling-Stevens petrol-electric chassis required for a tower wagon, at £672.

Ecuador.—The Guayaquil Electric Light & Power Co., Guayaquil, Ecuador, has placed the following contracts:—

Two 400-B.H.P. Diesel engines.—Hick-Diesel Oil Engines, Ltd.
One 275-KW. alternator and one combined traction and alternator set.—Crompton & Co., Ltd.

Clyde Navigation.—Messrs. Johnson & Phillips, Ltd., have secured an order from the Clyde Navigation for an installation of power cables for Queen's Dock.

Dartford.—The following tenders for coal for the electricity works have been accepted by the U.D.C.:—

John Herd, Son & Co., Ltd.—Yorkshire rough small, 22s. 6d. per ton South Hetton rough small, 5s. per ton above contract price.
Bradbury, Son & Co., Ltd.—Tamworth 1½-in. slack, 16s. 7d.; Gedling 1½-in. slack, 17s. 6d.
Cleeves & Co.—Mid-Cannock 2-in. slack, 17s. 6d.; Kirkby 2-in. slack, 18s. 4d.; Baddesley fine slack, 13s. 1d.
E. J. & W. Goldsmith, Ltd.—Rubbly Culm, 2s. per ton above contract price.
Myers, Rose & Co., Ltd.—Ripley nutty slack, 1¼ in. to 1½ in., 20s.; Gedling coal, 18s.; Mansfield coal, 18s. 9d.

Dorchester.—The County of Dorset Supply Co. has placed a meter contract for the period of 1915-16 with the Electrical Apparatus Co., Ltd.

Dover.—The T.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for 50 tons of tramway rails (45 ft.), at £8 15s. per ton. Two other tenders, each for 30-ft. rails, were £7 15s. 4d. and £8 8s. per ton respectively.

Keighley.—The tender of Messrs. Drakes, Ltd., Halifax, for new carbonising plant at the gasworks, including electrical power generating plant, has been accepted by the T.C.

London.—Messrs. Napier-Kimber, Ltd., have obtained a contract from the Metropolitan Asylums Board for installing an electrically-driven mincing machine and potato-paring machine at Western Hospital, Fulham.

The London Education Committee has received the following tenders for installing electric light at the Exmouth Street School, St. Pancras:—

H. J. Cash & Co. (accepted)	£349	G. Weston & Sons, Ltd. ..	£410
A. Hawkins & Sons	355	T. H. Smerdon	412
Alpha Manufacturing Co. ..	365	Lund Bros. & Co.	414
Johnson, O'Sullivan & Co. ..	365	Honor Bros.	660
R. H. & J. Pearson, Ltd. ..	399		

FULHAM.—The Electricity Committee reports that Messrs. A. Duckham & Co., Ltd., and Messrs. Wilcox & Co., Ltd., the contractors for lubricating oils, are prepared to renew their contracts on the existing terms for the ensuing year, and recommends that further contracts be entered into with Messrs. A. Duckham & Co., Ltd., for 12 months to March 31st, 1916, for the supply of cylinder oil at 1s. 8d. per gallon, and with Messrs. W. H. Wilcox & Co., Ltd, for the supply of engine oil at 1s. 4d. per gallon, and turbine oil at 1s. 6d. per gallon.

STEPNEY.—With reference to the Council's orders for carbons, the British Central Electrical Co., Ltd., writes to state that the French Government's prohibition of exports of carbons only prevailed for a few days, and is now removed.

Middleton.—The E.C. has accepted a tender of Mr. G. Hulbert to supply 1,800 tons of coal during the six months commencing March 1st.

Romford.—The B. of G. has accepted the tender of the Private Telephone and Electric Co., Ltd., for the installation of a house telephone service, at £59.

Salford.—The following plant has been obtained for the electricity station, Frederick Road:—

Turbine-driven boiler and feed pump.—G. & J. Weir, Ltd., £235.
Boiler feed water heater.—Isaac Storey & Sons, £78.

Sheffield.—The following tenders have been recommended to the City Council for acceptance:—

ELECTRIC SUPPLY DEPARTMENT.

C. A. Parsons & Co.—One turbo-alternator, consisting of steam turbine, condensing plant, alternator and accessories, £31,413.
Abbott & Bannister.—Erection of sub-station, Carr Road, Walkley, £215.
British Electric Transformer Co.—Three 150-K.V.A. transformers, £225.

WATER DEPARTMENT.

General Electric Co.—One 40-H.P., one 20-H.P., one 6-H.P., and one 1-H.P. electric motors.

TRAMWAYS DEPARTMENT.

Durham, Churchill & Co.—45-H.P. chassis for 'bus, £650.
Hadfield's Steel Foundry Co.—17½ tons of tie-bars.

Ship Lighting.—A contract for Osram lamps has been placed with the General Electric Co., Ltd., by the Bibby Line of steamers, supplanting carbon lamps and other makes of metal-filament lamps. This contract covers an exceedingly large quantity of lamps, and was placed after exhaustive tests.

The lamp contract mentioned under the above heading last week is for the Orient Steam Navigation Co., and not the British India Steam Navigation Co., as mentioned.

Southport.—The tender of the Improved Wood Pavement Co., Ltd., for the repairing of tramway track in Lord Street, at a cost of 13s. per sq. yd., has been accepted.

Torquay.—The T.C. on February 2nd accepted the following tenders:—

Rees Roturbo Co.—Motor-driven sea water pump for generating station, £248.
Herbert Morris, Ltd.—Overhead travelling crane, £185.
T. L. Harding & Sons.—Steelwork for coal transporter, £35.
British Thomson-Houston Co., Ltd.—Switchgear, £1,564.

Tunbridge Wells.—The T.C. has, subject to the L.G.B. sanctioning loans, accepted the following tenders:—

Stirling Boiler Co.—Boiler and auxiliary plant, £5,630.
Witting & Partners.—Cooling tower, £1,800, and dismantling the existing tower and rebuilding a new one, £950.

Walsall.—The Tramways Committee has accepted the offer of the Daimler Co., Ltd., to supply six motor-omnibuses in addition to those already contracted for—and which will be delivered as soon as the requirements of the War Office are complied with—at a cost of £5,369.

Warrington.—The Electricity and Tramways Committee has accepted the tender of the Lion Foundry Co. for the supply and erection of tramway shelters.

Watford.—The tender of Messrs. Jackson & Co. has been accepted by the U.D.C., at £220, for repairs to a turbine.

Wigan.—At the T.C. meeting on February 3rd, Alderman Higham stated that the E L. Committee had rescinded a resolution accepting the tender of a firm for switchgear and a transformer, the discovery having been made that the firm was a German concern. He was pleased to say that an English firm had undertaken to do the work for the same price.

Wolverhampton.—The Electricity Committee has accepted the tender of the Rees Roturbo Co., Ltd., at £165, for two electrically-driven pumps.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, February 12th. At 8 p.m. At Imperial College of Science, South Kensington, S.W. Papers on "The Criterion of Steel Suitable for Permanent Magnets," by Prof. S. P. Thompson, F.R.S.; "A Galvanic Cell which Reverses its Polarity when Illuminated," by Mr. A. A. C. Swinton; "An Investigation on the Photographic Effect on Recoil Atoms," by Messrs. A. B. Wood and A. I. Stevens.

Salford Technical and Engineering Association.—Saturday, February 13th. At 7 p.m. At Royal Technical Institute Peel Park. Paper on "How Plants Protect Themselves," by Mr. J. E. McDonald. Ladies invited.

Greenock Electrical Society.—Saturday, February 13th. Visit to Royal Technical College, Glasgow.

Thursday, February 18th. At 7.45 p.m. At 21, West Stewart Street. Paper on "Diesel Engine Testing and Running," by Mr. J. Richardson.

North of England Institute of Mining and Mechanical Engineers.—Saturday, February 13th At 2 p.m. At Memorial Hall, Newcastle-on-Tyne. Various papers will be open for discussion. To be read, paper on "Winding-Engine Signals," by Mr. W. H. Davis. Demonstration with a Sterling Mine-signalling apparatus.

Royal Society of Arts.—Monday, February 15th. At 8 p.m. At John Street, Adelphi. Fothergill Lecture on "Motor Fuel," by Prof. V. B. Lewes.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, February 15th. At 7.30 p.m. At Mining Institute. Discussion on "Wiring."

Institution of Post Office Electrical Engineers.—Monday, February 15th. At 6 p.m. At Institution of Electrical Engineers Victoria Embankment, W.C. Paper on "Wireless Call Devices," by Mr. L. B. Turner. Demonstration following.

Illuminating Engineering Society.—Tuesday, February 16th. At 8 p.m. At House of Royal Society of Arts, John Street, Adelphi. Discussion on "The Development and Design of Lighting Fixtures in Relation to Architecture and Interior Decorations," opened by Mr. F. W. Thorpe.

Institute of Marine Engineers.—Tuesday, February 16th. At 8 p.m. At Tower Hill, Minories, E. Discussion on "Fuel Test."

Nottingham Society of Engineers.—Wednesday, February 17th. At 7.30 p.m. At Welbeck Hotel, Milton Street. Paper on "The Apprentice Question," by Prof. C. H. Bulleid.

Institution of Mechanical Engineers.—Friday, February 19th. At 8 p.m. At Storey's Gate, S.W. Annual General Meeting. Paper on "Convertible Combustion Engines," by Mr. A. E. L. Chorlton.

Royal Institution of Great Britain.—Friday, February 19th. At 9 p.m. At Albemarle Street, W. Paper on "The Visit of the British Association to Australia," by Prof. H. E. Armstrong, F.R.S.

Saturday, February 20th. At 3 p.m. Lecture on "Recent Researches on Atoms and Ions," by Prof. Sir J. J. Thomson, F.R.S.

Association of Mining Electrical Engineers.—Saturday, February 20th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Some Experiences in the Handling of Electricity," by Mr. A. Smellie.

NOTES.

The War and Foreign Trade.—The January Figures.—The following are the electrical and machinery figures given in the official returns for January:—

	Month of January.		*Inc. or dec.*
IMPORTS.			
Electrical goods and apparatus, excluding machinery and uninsulated wire...	£56,865	−	£81,646
Machinery	£618,404	+	£19,013
EXPORTS.			
Electrical goods and apparatus, excluding machinery and uninsulated wire	£269,893	+	£16,172
Machinery	£1,663,482	−	£1,724,253

Electric Cars and Accessories at the New York Show.—The wider use of the battery for ignition, the practically universal adoption of electric starting and lighting, improvements in electric gear-shifting mechanisms and the introduction of electric transmission systems were features of electrical interest at the fifteenth annual national automobile show held in New York, January 2nd to 9th.

The development of electrical accessories for 1914, as evidenced by various devices shown, has been directed chiefly towards greater simplicity, and, wherever possible, a reduction in weight. This has been particularly the case with magnetos. Among the starting apparatus there were a variable-speed compound-wound machine of improved type and several new devices for starting Ford cars. With lighting systems the lamps have been made simpler in appearance. Many devices were also shown for dimming the brilliance of headlamps.—*Electrical World.*

Melbourne City Council and British Preference.—At a December sitting of the Melbourne City Council, consideration was given to a letter from the British Trade Commissioner, Mr. G. T. Milne, suggesting that the Council in all its purchases should give preference to goods manufactured either in the Commonwealth or in the United Kingdom, and to recommendations of the Electric Supply Committee, as follows:—

"In purchasing or obtaining any goods, machinery, or material, the Council will give effective and substantial preference to goods, machinery or material manufactured or produced in the Commonwealth. If goods, machinery or material manufactured or produced in the Commonwealth cannot be purchased, or can only be purchased in insufficient quantities, or of a quality unsuitable for the work, the Council will give substantial and effective preference to goods, machinery or material produced and manufactured in the United Kingdom, as against those of foreign manufacture."—*Australian Mining Standard.*

Inquiries.—Makers of the "Franco," "Standard," and other flash-lamp refills are asked for; we understand that our correspondent has orders to place for large quantities. Makers of a substitute for Galalith are inquired for.

Iron Leads for Installation Work.—The Prussian Minister of Commerce and the Minister for the Interior have issued a joint memorandum pointing out that under existing conditions difficulties should scarcely any longer be met with in securing connections with central stations owing to the lack of installation materials, seeing that the Union of Electrical Engineers, in agreement with the makers of installation materials, has extended its standards to the possibility of the employment of iron conductors with impregnated paper insulation and a watertight metallic outer envelope. It is further suggested that easy terms of payment should be introduced for facilitating the carrying out of installation work, and that lower charges for supply should be granted in connection with small installations for a certain period.

Low-Tension Auxiliary Supply in High-Tension D.C. Traction Systems.—One of the minor problems associated with high-tension direct-current traction systems is that of obtaining current at low pressure for train lighting and the supply of heaters, fans and other auxiliaries, by means of a pressure-reducing apparatus at once light, compact and reliable. On the Biasca-Acquarossa 1,200-volt electric railway, on the 1,500-1,800-volt Wendelstein system, and on the Tavannes-Noirmont line in Swiss Jura there have been used, during the last few years, pressure-reducing motor-generators supplied by Brown, Boveri & Co. Each set comprises a direct-coupled interpole motor and dynamo, with differential compound winding on the motor for voltage regulation. The special feature, by which high-tension current is confined to the motor armature, is excitation of the high-tension machine by low-tension current derived from the lighting dynamo. The motor interpoles are connected to the earthed side of the motor-armature. Shunt characteristics are secured in the motor, but only its armature need be insulated for high pressure; the insulation there used is a special mica composition tested to 9,000 volts A.C.

These sets have proved so satisfactory in service that they are now adopted as standard by the makers for all D.C. traction systems operating at 1,200 volts or higher pressures. To save space and weight, both motor and generator armatures are mounted on the same shaft within a cast-steel housing serving as magnetic yoke for both field systems. The pole cores are bolted on. Besides supplying the lighting circuits, the dynamo also supplies current for heating purposes and for fans, air pumps, and any other auxiliary services on the train. Six standard sets range from 2 to 40 KW. output, and are wound for 1,500 to 2,500 volts primary and 30 to 330 volts secondary pressure. The 40-KW., 1,000-R.P.M. set, wound for 2,000-2,200 volts primary pressure, weighs 3,410 lb. net, and is used in all coaches on the Chur-Arosa and Nyon-Morez lines. To eliminate reproduction in the secondary circuit (proportionately reduced) of variations in the line pressure, a Brown-Boveri automatic voltage regulator may be used to operate on the dynamo excitation; differential compounding of the motor is provided on all new locomotives of the Oberland-Bernois lines, the revolutions per minute of the reducing set (which is direct coupled to a ventilating fan), being constant between primary pressure limits 1,300-1,700 volts. Sudden closing of the line circuit does not produce excessive sparking on the H.T. motor commutator, and special attention has been directed to securing sparkless commutation during normal operation. A 40-KW. four-pole single commutator motor designed for 2,200 volts commutates sparklessly on 3,500 volts under 20 per cent. current overload.—*La Lumière Electrique.*

A New Turbo-Electric Steamer.—As previously reported in this journal, the large Swedish steamship company, the A/S Sveabolaget, has lately been making an experiment by building a new turbo-electric steamer, which seems to be of considerable importance. The company has had under construction at the Lindholmen Shipbuilding Yard at Stockholm two steamers, which have been built according to the same drawings, and resemble each other as closely as possible. This has been done with the view of making a fair comparison between them possible. Both steamers have now been completed, and have a displacement of 2,225 tons; they have been designed for a normal speed of 11 knots. The first one, the *Mimer*, was finished in October, and was equipped with an ordinary triple-expansion engine, while the second, the *Mjölner*, was completed just before Christmas, when it underwent its first trial with its turbo-electric plant, which was designed by the Swedish engineer Ljungström. The turbine plant occupies much less space than ordinary triple-expansion engines, and is not so expensive as a Diesel engine. The consumption of coal was estimated to be less than for ordinary steamers, and, in fact, there was guaranteed a saving of 30 per cent. of coal. On the trial trip the *Mjölner* was fitted with the screws of the *Mimer*, and the trial, which lasted seven hours, gave excellent results. The machinery, in which gearing is employed, developed 975 I.H.P., or 75 H.P. more than it had been designed for, and an average speed of 11 [illegible] knots was obtained. The consumption of coal turned out to be 35 per cent. below that of the sister-ship, and during the three hours, when the consumption was measured, the quantity of coal required per I.H.P. hour amounted to [illegible] lb. Representatives of the shipping and technical world who accompanied the ship on its trial trip, among whom were also representatives of the Swedish Navy, expressed their satisfaction with the results obtained, and there was, in fact, unanimous agreement that the turbo-electric steamers would be the ships of the future.

Fatalities.—A Cape Town correspondent reports that an accident occurred at Sea Point, on January 11th, whereby a young man named Arthur Grover, an electrical jointer in the employ of the Cape Town Corporation, lost his life. It appears that Grover was occupied in cleating up some high-tension live wires in a new transformer station when he noticed some "arcing" in progress between one wire and the wall of the transformer station. Instead of switching off the high-tension side, which would have necessitated his walking to the next transformer station, he simply told his assistant (a coloured man) to take the wire out of his way. The assistant did so by placing the wire on the floor with a bare end exposed, and shortly afterwards Grover accidentally touched the bare end; as he was then standing in an open trench, he received practically a full 2,000-volt shock to earth. A local doctor was immediately in attendance, but on his arrival pronounced life to be extinct.

An inquest was held at Brotton-in-Cleveland, on February 2nd, touching the death of Hugh Fraser (39) who was fatally injured at the Skinningrove Ironworks on the previous Saturday morning, whilst in charge of an electric elevator at the gas producer.—William Wild, electrician, stated that deceased had full charge of the elevator. Hearing of the accident, witness went up the elevator into the machine house, and found Fraser on the machinery gear fastened by his clothing, which was badly torn. Witness at once secured the necessary tools to take the machinery to pieces. Deceased talked to the workmen while they were endeavouring to release him, and he told witness that in returning from an examination of the coal bunker on the elevator, he stepped on to the casing of an electric motor and slipped, falling into the moving machinery. Before going to examine the coal bunker, Fraser should have stopped the machinery, which he could have done in a second or two.—Replying to Mr. W. B. Lauder, H M. Inspector, witness admitted that there was no controlling switch for the motor in the motor-house, and there was no fencing for the cog-wheels or shafting. Fraser had been in charge of the plant only a week, but thoroughly understood his work.—The jury returned a verdict of "Accidental death," and suggested that H M Inspector should take steps for having the machinery better protected.

An inquest was held at Westminster on 2nd inst. into the death of Frederick Charles Humphries, aged 30, a gateman employed on the Piccadilly and Brompton Railway. Humphries was missing from his train (which was coming from Finsbury Park) when it arrived at the next station after leaving Leicester Square. His body was subsequently found about 13 yards inside Leicester Square tunnel. He died in hospital next morning. The medical evidence showed that deceased was severely burned by the live rail, and his feet were run over. One of the company's electrical engineers, in giving evidence, said that this particular train was the only one of the kind running. Probably the deceased had not securely closed the sliding door, which would have a tendency to open with the train in motion. A verdict of "Accidental death" was returned.

American Electrical Development.—We have before us an interesting 20-page pamphlet, entitled "What it Has Done," the "it" being the Society for Electrical Development, Incorporated, of New York. The Society is a strong and representative organisation, whose enterprising efforts to popularise electrical service of all kinds have been frequently reviewed in our columns. The objects of the present publication are:—To inform the Society's own members of what it has done (moving picture demonstrations, publication of articles in magazines and trade journals, advertising, and other forms of publicity, "field co-operation," research departments, display service bureau, and so forth); also to act as a campaign document in interesting the men engaged in the electrical industry who are not yet members of the Society. A "National Electric Week" is now being organised. Mr. J. M. Wakeman, is the general manager (29, West 39th Street, New York).

Institution and Lecture Notes.—**Institution of Electrical Engineers.**—ASSOCIATE MEMBERSHIP EXAMINATION.—An examination will be held on Aprll 30th and May 1st, at the Examination Hall of the Royal College of Physicians and Surgeons, Queen's Square, Bloomsbury, W.C. Should a sufficient number of candidates make application, arrangements will be made for the examination to be held concurrently in local centres. Entry forms, which must be returned not later than March 1st, may be obtained, together with the examination regulations, on application to the secretary of the Institution.

At the meeting of the MANCHESTER LOCAL SECTION, on Tuesday last, a paper was read by Prof. E. W. Marchant, on "Conditions affecting the Variations in Strength of Wireless Signals," and was followed by a discussion.

A paper on "Distribution and Rise of Temperature in Field Coils," was read before the SCOTTISH LOCAL SECTION in Glasgow, on Tuesday last, by Prof. Magnus Maclean, the paper being a collaborative effort by Prof. Maclean, and Messrs. D. J. McKellar and R. S. Begg. Sir John Snell, the president of the Institution, was present, together with Mr. Rowell, the secretary, and both delivered addresses.

At the meeting of the BIRMINGHAM LOCAL SECTION on Wednesday last, a paper was read by Mr. N. Shuttleworth, M.Sc., on "Polyphase Commutator Machines and their Application." A discussion followed.

Iron and Steel Institute.—The annual meeting will be held at the Institution of Civil Engineers, London, on Thursday and Friday, May 13th and 14th. Thursday, May 13th, has been provisionally fixed for the annual dinner, and the autumn meeting is expected to be held in London during the week ending September 25th.

Association of Mining Electrical Engineers.—At a meeting of the East of Scotland Branch, at Cowdenbeath, a paper was read by Mr. Wm. Webster, of the Lochgelly Iron Co., on "The Utility of Surface Earthing on Armoured Systems." The author questioned the utility of elaborate surface earthing installations on completely armoured systems, and pointed out that there was no compulsion to install earth-plates underground, although it was recommended to do so should the circumstances require it. He had seen instances where much time and money had been expended on elaborate systems of surface earthing without much consideration being paid to underground conditions. The laying-out of an elaborate earthing system suggested the possibility of a large leakage current, and that, to his mind, constituted a danger even where the earthing was perfect. He was favourably disposed to the use of leakage trip gear for the prevention of dangerous leakage currents. Where these were installed, the insulation of the system would require to be kept in a higher state of efficiency, and the dangers from shock, fire, and ignition of gas or dust would be reduced to a minimum.

Rifle Shooting.—A match took place on February 4th, at Dalston, between the Electrical Press and Messrs. Siemens Bros. Dynamo Works, Ltd., the scores being:—Electrical Press, 738; Siemens Bros., 860 (10 a side). The visitors were hospitably entertained by the winning team, and the contest proved thoroughly enjoyable.

Patents and Alien Enemies.—Application has been made by Messrs. R. S. Wright and E. E. Burnside to the Board of Trade to avoid or suspend Letters Patent No. 25,101/12, granted to Bauer, for high-tension electrometers; the hearing is fixed for February 24th.

A licence has been granted to Mr. E. Mills in respect of Patent No. 362/12 (Hinselmann).

Educational Notes.—The Appointments Board of the UNIVERSITY OF LONDON recently issued a pamphlet setting forth the aims and work of the Board, which has for its main object the assistance of Graduates and Students of the University in securing appointments. It is stated that over 100 posts were so secured during the past year. Employers desirous of getting in touch with well-educated young men and women are invited to make use of the Register, and to make known their requirements to the Secretary of the Board at the University, South Kensington.

A foundation has been endowed by Lord Rosebery at the London School of Economics and Political Science, whereby two prizes, one of £25 and one of £10, will be awarded annually for the best monographs on a question dealing with the History, Theory, or Organisation of Inland Transport. For 1916 the subject is "Workmen's Trains." Candidates must be present or past students of the school.

Electrical Heating.—A Committee appointed by the Stockholm electricity and gas works, for the purpose of making exact inquiries into the subject of electrical heating with the view of ascertaining its cost compared with that of other heating systems, recently issued its report. The first step that was taken was to install hot-water apparatus in certain premises, together with thermostats, according to the system of Dr. Ekström. The water was heated by coke or by electricity. During the winter the premises were heated alternately by means of two systems for two weeks at a time, during which experiments the consumption, temperatures, &c., were kept under close observation.

The experiments were carried out in two different ways. In one case the apparatus were in partial operation during the whole day and night, and attendance was dispensed with, as the system worked automatically. In the other case, the supply of heat was cut off for the night from 5 p.m. until 7 a.m. With few exceptions the temperature in the morning was as high as 18° C. Between 9 a.m. and 5 p.m. the apparatus were working automatically.

When the systems were in use the whole day and night, it was found that the consumption of 1 hectolitre of coke corresponded to 198 KW.-hours of electricity. The efficiency of the hot-water system averaged about 60 per cent.

When the current was switched off for the night, 1 hectolitre of coke was equivalent to 120 KW.-hours, representing a saving of about 40 per cent.

As regards the capital expenditure, with consequent interest and depreciation, the Committee arrived at the result from the experiments that the cost was about the same for both systems, and it came to a similar conclusion with regard to the cost of up-keep. With reference to the attendance, the expenses for the electrical system were practically *nil*, while those of the other system amounted to about 20 per cent. of the cost of the fuel.

The results derived from the experiments show that when the price of coke is 1·50 kr. per hl. (1s. 8d.), as much as 0·76 öre per KW.-hour can be paid for continual heating, and 1·25 öre (⅕d.) with 10 hours' heating. If the cost of attendance be included, the above-mentioned figures will be raised respectively to 0·90 öre and 1·50 öre (1 krone = 100 öre = 1s. 1½d.)

The Committee comes to the conclusion that in consideration of the great advantages of the electrical system it ought to be possible to go even beyond those prices. Surplus electrical energy from water-power plants is regarded as the most suitable source of supply for electrical heating. Whether more satisfactory results could be obtained by dispensing with hot water pipes and using electric radiators in the rooms was not stated, but in view of the increased efficiency of this method the results would probably be more favourable.

Appointments Vacant.—Assistant engineer (£125) for Burgh of Hamilton Electricity Supply; electrical foreman, (£280 +) for Federated Malay States Government Railway; meter tester (35s.) for Borough of Salford; junior assistant (£1) for Llanwrst Electric Light Works; chief inspector of railway telegraphs for Ceylon Government Railway (£250 +); junior shift engineer (30s.) for Luton Electricity Works; shift engineer (35s.) for Colne Corporation Electricity Works. Particulars are given in our advertisement pages.

Electricity in Surgery.—The medical correspondent of the *Times* in Calais states that the radiographic room of the Queen Elizabeth Hospital there, which is under Belgian control, and is used for wounded Belgian soldiers, possesses an exceptionally interesting and up-to-date electrical equipment. Apparatus is provided for taking instantaneous X ray photographs, with the minimum of discomfort to the patient, and the localisation of foreign bodies is facilitated by the use of stereoscopic X-ray photographs. The water supply is sterilised with ultra-violet rays. The installation is in the charge of M. Emile Lajéot.

Workmen's Compensation.—The Finance and General Purposes Committee of the Bradford Corporation has decided that in view of the large percentage of the sums claimed under the Workmen's Compensation Insurance Fund for the three years ended March 31st, 1914, as compared with the premium income in the electricity department amongst others, the premium be increased from 12s. per cent. to 18s. per cent. for the years ending March 31st, 1915, and March 31st, 1916. The gas department rate has been increased from 12s. per cent. to 20s. per cent.

Special Services in London.—In the course of a paper read before the Telephone and Telegraph Society of London, by Mr. D. H. Kennedy (Assistant Superintendent Engineer, Post Office Engineering Department), on January 25th, interesting demonstrations were given of the working of some of the "special services" in operation in the metropolis. A test call was sent from the Lecture Hall of the Institution of Electrical Engineers to the fire brigade stations at Scotland Yard and Whitefriars; a horsed escape and a horsed fire engine from the former and a motor fire engine from the latter arrived simultaneously in 2 minutes and 20 seconds from the moment when the handle of the fire alarm was pulled, the officers entered the theatre and spoke to one of the stations at two minutes thirty-three seconds. An order was telephoned to Selfridge's, and the article required was delivered in nineteen minutes, in spite of the foggy weather; the distance traversed was 1 mile 1,500 yards, and at a preliminary trial earlier in the day the feat was accomplished within 15½ minutes.

The author gave particulars of the remarkably varied "special services" which are provided by the telephone and telegraph department, in connection with public business, public information, public safety, and public pleasure. It appears that as there are no fewer than 12,000 private branch exchanges in the London area, and only 2,500 working positions at the main exchanges, the number of private exchange operators far exceeds the number of main exchange operators; 29 private exchanges have 112 operators' positions and nearly 7,000 stations. The Stock Exchange and the adjoining buildings constitute the most densely-telephoned area in the kingdom, possessing an extraordinary number of telephone cabinets. The news services transmit on an average more than 2,000,000 words a day. It is not generally known that the department has for many years maintained the system of division bells at the Houses of Parliament; moreover, a number of Members who live within six minutes by motor-car have had installed in their houses bells connected with the system, so that they can stay at home until their presence is indispensable. Various special services have been necessitated by the war, including one for the Press Bureau, which was installed in two days; 22 cabinets are provided for the use of Press representatives, who act in accordance with strict rules. When a news item has been passed by the Censor, it is distributed to all the reporters, who on a given signal simultaneously rush to their respective cabinets and call up their offices. The Department also maintains a complete system of fire alarms for the London Fire Brigade, and a similar system of street pillar boxes for the City Police Ambulance service; the average time from the occurrence of an accident to the arrival of the ambulance is under four minutes. A larger ambulance system is also maintained for the Port of London Authority.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Mr. Fred. Tyrrell, assistant engineer at Ascot electrical works, has been appointed to a similar position under the Nigerian Government at Lagos.

Mr. F. Crooks, clerk and collector to the Bridlington Corporation electricity department, applied for leave of absence in order to enlist in H.M. Forces, but the Electricity Committee is unable to consent, his services being essential to the department at the present time.

Mr. H. N. Newcombe has resigned his position as engineer-in-charge at the borough of Wimbledon electricity works. Mr. H. Oswald has been appointed temporary engineer-in-charge, at £104 per annum.

Mr. J. Ellis has resigned his position as shift engineer at the Watford electricity works.

Mr. F. J. Stratford, of Newton Abbot, has been appointed shift engineer at the Corporation electricity works at Bexhill-on-Sea.

General.—There were some 400 signatories, representing commercial interests in Dublin, Belfast, Cork, Limerick and other Irish centres, to an address presented to Mr. Wm. M. Murphy, chairman of the Dublin Tramways Co., in the Dublin Chamber of Commerce, in recognition of his valuable work as President of the Chamber and in relation to the tramway and other strikes of the year 1913. Accompanying the address were two fine portraits of Mr. Murphy, by Mr. Wm. Orpen, the distinguished Academician, one of which is to be hung in the Council Room of the Chamber. In his reply Mr. Murphy claimed that his enterprises had been free from self-seeking, and that what success had attended them was due mainly to those associated with him. He had, he said, carried the Irish flag far afield in commercial undertakings, and had proved that an Irishman, making his headquarters and spending his life in his native land, was not handicapped to such an extent as to prevent him from successfully extending his interests to Great Britain and abroad.

The *Times*, in announcing the staffs of the special departments at the King George Hospital, says that the following three physicians have undertaken to advise as to the equipment of the X ray department, and, in conjunction with the visiting staff, to render themselves responsible for its work:—W. Ironside Bruce, M.D., physician, X-ray department, Charing Cross Hospital; Stanley Melville, M.D., physician, X-ray department, Brompton Hospital; G. Harrison Orton, M.D., physician, X-ray department, St Mary's Hospital. The Joint Committee are advised that the expense of the establishment of this department will amount to £750.

Mr. F. Large, of Great Barrow, has been presented by his colleagues at the Helsby Works of the British Insulated and Helsby Cables, Ltd., with a case of cutlery.

Mr. W. Mottershead, works foreman at the Corporation electricity works at Tunbridge Wells, has received an appointment under the Admiralty.

The marriage took place at St. George's Church, Hanover Square, London, W., on February 2nd, of Mr. Walter T. Smith, of Messrs. T. Smith & Sons, electric crane manufacturers, of Rodley, near Leeds, and Miss Beatrice May Haysom, daughter of Mr. Geo. Haysom, L.C.C., of Hayling, South Croydon.

Alderman Tyrrell has been re-elected chairman of the Belfast Corporation Tramway and Electricity Committee, and Councillor Duff has been appointed vice-chairman.

The North-East Coast Institution of Engineers and Shipbuilders has conferred upon Lord Fisher the honorary membership of the Institute, in recognition of his support of the reform recently embodied in the Admiralty order conferring military rank upon the engineer officers of the Royal Navy.

Mr. Chas. Lill, who resigned his appointment with the Hackney Borough Council a short time ago in order to join Messrs. J. and H. Grevener, has, owing to the national crisis and with regret, severed his connection with that firm and has since been appointed engineer and manager to the Albion Electrical Co., Ltd., of 67, New Oxford Street, W.C.

Obituary.—Mr. Wm. Bulloch.—We regret to learn that the death took place, on Tuesday, at his residence, Normanhurst, Newbridge, Wolverhampton, of Mr. William Bulloch, a director of the Electric Construction Co., Ltd., Bushbury, and for over 20 years manager of the company's works. The deceased gentleman attended to his business engagements so recently as Friday in last week, and it was only on Saturday he was seized with the illness which, unfortunately, proved fatal. Mr. Bulloch, who was a Scotsman, was only 44 years of age. During the period of his management the E.C.C. works have extended and developed, and many departments have been reorganised. He took the keenest interest in the workmen, and was closely identified with their institute and their organised sports and recreations. For many years he was a member of the Wolverhampton Chamber of Commerce. For two years, 1907 and 1908, he occupied the presidential chair, and he served on several committees, being present at one of the meetings last Wednesday week. Mr. Bulloch was also a vice-president of the Wolverhampton and District Engineering Society. He will be missed in many circles, but especially at Bushbury, and sympathy will be unreservedly extended to Mrs. Bulloch and the family of two boys and one girl who mourn his decease.

Mr. J. H. Waddon, J.P.—The death has taken place of Mr. John Henry Waddon, J.P., a former Mayor of Bridgwater, and one of the pioneers of the local electric light undertaking.

Mr. A. J. Ickringill.—The death took place on February 2nd, at Guelph, Ontario, after an operation for appendicitis, of Mr. Arthur Jas. Ickringill, a director of the Keighley (Yorks.) Electrical Engineering Co., Ltd. He was only 39 years of age.

Mr. Arthur Keen.—The death occurred on February 8th at Birmingham, at the age of 80 years, of Mr. Arthur Keen, of Guest, Keen & Nettlefolds and other important engineering undertakings.

NEW COMPANIES REGISTERED.

Spicer & Co., Ltd. (13[illegible]).—This company was regis[illegible] £[illegible]00 in £1 shares, to take over [illegible] Charles Gustav Louis Heim and Edward Norcock Harwood Spicer, at 1, Cottage Lane, City Road, E.C., [illegible] with one share each) are: F. N. H. Spicer, 1, Cottage Lane, City Road, E.C., manufacturer; C. G. L. Heim, 1, [illegible] Private company. The number of directors is not to be less than two or more than five; the first are not [illegible] Bedford Row, W.C.

Standard Insulator Co., Ltd. (139,241).—This company [illegible] capital of £100 in £1 shares, to carry on the business of manufacturers and proprietors of and dealers in magnetos, magneto parts and accessories, motors, motor and other carriages, vans, wagons, motors, launches and flying machines, electricians, engineers, rubber manufacturers, etc. The subscribers (with one share each) are: H. Doe, 14, R[illegible] S.W., [illegible] R. B[illegible], 96, Mil[illegible] Road, Clapton, N.E., clerk. Private company. Table "A" mainly applies. Solicitors: J. B. & F. Purchase, 14, Regent Street, S.W.

E. S. Co., Ltd. (139,230).—This company was registered [illegible] of £2,000 in £1 shares, to take over from E. C. Beman the business of an electrical supply agent and wholesale factor carried on at 53, Victoria Street, Westminster, as the Electrical Supplies Co. The subscribers (with one share each) are: E. C. Beman, 53, Victoria Street, Westminster, S.W., electrical engineer; F. J. Roden, 53, Victoria Street, Westminster, S.W., traveller. Private company. The number of directors is not [illegible] than five; the first are E. C. Beman and F. J. Roden (both permanent, with £260 and £208 per annum respectively as remuneration). Qualification £100. Registered office: 53, Victoria Street, Westminster.

Arthur Lyon & Wrench, Ltd. (139,224).—This company was registered on February 4th with a capital of £12,000 in £1 shares, to take over as going concerns the businesses carried on at 5, Crawford Passage, Farringdon Road, E.C. [illegible] "Wrench Manufacturing Co.," and [illegible] House, W[illegible] "Arthur Lyon & Co.," to carry on the business of manufacturers of cinema requisites, and electro-mechanical engineers, manufacturers of lamps, light-projecting apparatus, dynamos, signalling apparatus, searchlights, arc projectors, oxy-hydrogen and oxy-petrol lighting sets for motor cars, motor lorries, motor locomotives, aeroplanes, monoplanes, hydroplanes, biplanes, etc., and to adopt agreements (1) with H. H. Wrench, and (2) with A. A. Lyon and Goldenlyte, Ltd. The subscribers (with one share each) are: H. H. Wrench, Kensington Palace Mansions, W., manufacturer; A. A. Lyon, Caxton House, Westminster, engineer. Private company. The number of directors is not to be less than three or more than seven; the first are H. H. Wrench, A. A. Lyon, W. Engelke, and A. F. Burman (all permanent). Qualification, 500 ordinary shares. Remuneration as fixed by the company. Registered office: Caxton House, Westmisnter.

Kaywright Engineering Co., Ltd. (139,257).—This company was registered on February 6th, with a capital of £500 in £1 shares, to carry on the business of electrical and mechanical engineers, builders, contractors, electricians, producers and suppliers of electricity, etc. The subscribers (with one share each) are: R. Orwin, 42, Elvedon Road, Palmers Green, N., engineer; F. R. Orwin, 42, Elvedon Green, N., pattern maker. Private company. Table "A" mainly applies. Solicitors: Davidson & Morriss, 40-42, Queen Victoria Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

St. Helens Cable & Rubber Co., Ltd. (87,774).—Capital, £10,000 in £1 shares. Return dated Dec. 31st, 1914. All shares taken up; £10,000 paid. Mortgages and charges, £148,464.

Perfect Burglar Alarm Co., Ltd. (recently known as Lichtenfeld Burglar Alarm Co., Ltd), (112,522).—Capital, £4,000 in £1 shares (1,000 pref.). Return dated Dec. 18th, 1914. 230 pref. and 1,710 ord. shares taken up; £1 per share called up on 1,210 shares and 5s. per share on 230 shares; £1,267 10s. paid; £500 considered as paid on 500 shares. Mortgages and charges, nil. Name changed on Jan. 13th, 1915.

Provincial Tramways Co., Ltd. (6,445).—Capital, £275,440, in 10,000 pref. shares of £10 each and 175,440 ord. shares of £1 each. Return dated Dec. 10th, 1914. 10,000 pref. and 124,560 ord. shares taken up; £10 per share called up on 3,814 pref. and £1 per share on 124,560 ord. shares; £162,700 paid; £61,860 considered as paid on 6,186 pref. shares. Mortgages and charges, £175,000.

Gosport & Alverstoke Electric Lighting Co., Ltd. (82,693).—Capital, £5,000 in £10 shares. Return dated Dec. 11th, 1914. All shares taken up; £5,000 paid. Mortgages and charges, nil.

Ferranti, Ltd. (83,718).—Capital, £130,000 in £1 shares (160,000 pref., 60,000 ord., and 10,000 defd.). Return dated Nov. 13th, 1914. 60,000 pref., 53,374 ord., and 10,000 defd. shares taken up; £123,374 considered as paid. Mortgages and charges, £157,962 11s.

CITY NOTES.

Yorkshire Electric Power Co.

The directors report that for the year ending December 31st, 1914, the net profit on the revenue account, after payment of mortgage interest for the three years ending December 31st, is as follows:—1912, £7,361; 1913, £15,401; 1914, £20,535 plus £4,188 brought forward, making £24,723. Deducting the dividend paid to June 30th, 1914 on the preference shares, £4,392, and on the ordinary shares £2,552, there remains a disposable balance of £17,778, which is to be dealt with thus:—Dividend for the half-year ending December 31st, 1914, at the rate on the preference shares (6 per cent.). £4,979; write off the bonus paid upon the second mortgages, £2 250; transfer to general reserve fund, £7,500: carry forward £3,049. In view of the progress of the company during the first six months of 1914, the directors felt justified in July in paying a dividend at the rate of 2 per cent. per annum, a rate which they had reason to believe would be maintained for the whole year. Immediately following this the outbreak of war caused a serious reduction in the current used by customers during the months of August and September, and checked the expanding revenues of the company. For the last three months of the year the revenue has again shown considerable improvement, being a substantial increase on that of the corresponding months of 1913. Owing to the financial caution, which is specially advisable at present, the directors recommend the shareholders to be satisfied with the dividend already paid (equal to 1 per cent. for the whole year), so as to strengthen the position of the company, by placing £7,500 to reserve, raising this fund to £12,500.

On February 17th of last year the proprietors authorised the issue of a further 10,000 6 per cent. preference shares of £5 each, making a total authorised issue of £200,000. Applications were made by holders of second mortgages for £35,405, making, with further applications which have since been received for these and the balance of the former issue, a total of £56,365 taken up during 1914. Applications are being received for the balance, which at this date is £13 090.

The second mortgages, which, with the bonus upon them, amounted to £47,250, have been repaid. In order to give further security to the company's bankers, the mortgages have been transferred to them instead of being allowed to lapse.

To provide the capital required for the additional plant and machinery installed at Barugh power station, the Yorkshire Waste Heat Co., Ltd. (of which the power company is the sole shareholder) sanctioned an issue during 1914 of a further £22,000 of 5¼ per cent. first mortgage debenture stock of that undertaking.

Out of the rent paid for the use of the Barugh station a sinking fund is set aside by the Waste Heat Co. to repay their debenture stock on December 31st, 1937. The sum accumulated to December 31st, 1914, amounts to £1,392.

Electrical Distribution of Yorkshire, Ltd., now hold 16 Electric Lighting Provisional Orders, for which a bulk supply of energy is taken from the power company. In order to extend their operations, an allotment of £12 500 of ordinary capital was made to their shareholders during the year. The business of that company has throughout shown steady and advancing progress, and the directors decided to increase the holding of the Power Company by taking up further capital.

The meeting will be held at Leeds on Tuesday, February 16th.

St. James' and Pall Mall Electric Light Co., Ltd.

The directors report that the connections, which at the end of 1913 were 15,119 KW., have been increased to 15,423 KW. and 11,171,348 units were supplied to consumers. The Central Electric Supply Co., Ltd., has declared a dividend of 5 per cent. on the ordinary shares and £2,500 (less tax) will be payable to this company. The revenue derived from the sale of electricity has been greatly reduced by the war. The company is associated with other London electric supply undertakings in the promotion of a Bill entitled the London Electric Supply (No. 2) Bill. The net profits for the year 1914, applicable to dividends on shares, amount to £27,133 plus £2,283 brought forward. Deducting the interim dividends paid in August last at the rate of 7 per cent. on preference shares, £3,500, and 10 per cent. on ordinary shares, £10,000, £15,917 remains to be dealt with. After paying the further 7 per cent. preference dividend, a dividend on the ordinary shares for the second half-year of 5s. per share is recommended, making, with the interim dividend paid in August last, a total distribution of 10 per cent. for the year, £10,000, leaving £2,417 to be carried forward.

Generated and purchased—		Private supply	11,171,348
Generated by steam plant	1,403,027	Works	310,338
Purchased	13,250,989	Batteries	336,070
		Transmission and transformation	2,136,918
		Distribution and unaccounted for	699,347
Total	14,654,016	Total	14,654,016

Total connections .. .. 15,423 KW.

Annual meeting, February 16th.

Lanarkshire Tramways Co.

For the half-year ended December 31st, 1914, the revenue was £48,583, and the expenses were £31,544, leaving £17,039. After meeting debenture and other interest charges and contributions to local authorities there remains £13,873, plus £5,645 brought forward. £9,000 has been placed to reserve for depreciation. £9,432 is absorbed by dividend at the rate of 5½ per cent. per annum for the half-year on the share capital, £167 is paid to directors, and £919 is carried to revenue new account. The revenue shows an increase of £192, and the expenses an increase of £5,088, as compared with the revenue and expenses for the corresponding half-year of 1913. For the month of July the traffic receipts were over £1,000 in excess of the figures for the corresponding month of 1913, but from the outbreak of the war there was a continuous falling off in the receipts, and it is estimated that there was a decrease in the revenue of fully £4,000 on this account. The increase in expenses was mainly due to operating the lines leased from the Lanark County Council, which were not in operation for the full half-year of 1913, and to heavier maintenance charges for permanent way, rolling stock, &c. A large number of employés have joined the Colours, and allowances to wives and dependents to December 31st cost £329. Payments to local authorities for the year will amount to £1,730, of which £1,433 was reserved in the accounts to June 30th, leaving a charge in the past half-year's accounts of £297. A dividend for the half-year at the rate of 5½ per cent. per annum is recommended, making 5¾ per cent. for the year.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June, 1913	24·62	8,579 876	£42,884	1·20d.	979 621	66
December, 1913 ..	34·29	9,471,832	£47 760	1 21d.	1,074,440	78
June, 1914	36·47	9,926,810	£49,923	1·21d.	1,169,837	78
December, 1914 ..	36·47	9,467,472	£48,035	1·22d.	1,161,066	78

Dublin United Tramways Co., Ltd.

AT the annual meeting, held on 3rd inst. in Dublin, the chairman MR. W. M. MURPHY, said the expenditure on capital account had exceeded the receipts by £68,836, but against this the company held £39,400 in redeemed bonds. Workshops at Ballsbridge had been extended, and £1,871 worth of additional machinery had been erected at Blackrock sub-station. On revenue account there were gross receipts of £3,066 in excess of 1912, and £24,166 in excess of 1913—the great strike year. This showed that their business had not been seriously affected by the war. Traffic, in fact, showed great vitality, as for last month (January) there was an increase of £2,109 over January, 1914, and £960 over January, 1912. Receipts from goods traffic had grown to £1,550—doubling since 1912—and parcels traffic reached £7,129. The working and general expenses, however, had increased by £14 378. A sum of £14,427 had been contributed to local authorities in respect of wayleaves for the year. The company now paid rates on a £41,000 valuation—an increase from £30,000 in two years. Operation cost £567 more than in 1912, and expenditure under maintenance showed, apart from rail renewal, a net increase of £4,749. Increases for renewal and maintenance of track, plant and rolling stock, must be looked forward to, but Mr. Murphy anticipated increased receipts to meet increasing expenses, maintaining net earnings. The balance for appropriation was £98,047, and after deducting preference and interim dividends, they were paying a final dividend of 5 per cent. per annum on the ordinary shares, leaving a surplus on profit and loss account of £34,366, the most urgent claim on the disposal of which was for renewal of portion of the track. They were, the chairman added, substituting a rail of 105 lb. to the yard for one of 92 lb. originally laid down. They had adopted the Thermit system of welding. A reserve of £40,768 had been depleted by £18 277 in respect of track renewal, and £18,000 would be given from the surplus to restore that fund, while £5,000 would go to general reserve, which would then amount to £55,679, and £11,366 would be carried forward, being £1,409 more than they carried forward from last account.

National Gas Engine Co., Ltd.—The directors report that the net profit for the year ended December, 1914, after providing amply for depreciation of buildings, tools, &c., and allowing for management salaries and income-tax, is £62,257. Interim dividends for the six months to June 30th, amounting to £28,500, being at the rate of 5 per cent. per annum on the preference shares, and 7½ per cent. per annum on the ordinary shares, were paid on July 31st, 1914, leaving a balance of £33,757, which, added to £11,903 brought forward, makes a total of £45,660 to be dealt with. The directors recommend the payment of a final dividend at the rate of 5 per cent. per annum on the preference shares and one of 7½ per cent. per annum on the ordinary shares, both less income-tax, for the six months ended December 31st, 1914. This will absorb £28,500, and leave £17,160, which it is proposed to carry forward.

Companies Struck off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Automatic Lock Nut Co.
British Medical Electric Appliances Co.
Dioptric Sign Co.
Electrical Power Users' Association.
Electric Fire Prevention Appliances and General Mfg. Co.
Institution of Signal Engineers (Inc.).
International Marine Signal and Carbide Co.
International Syndicate for Electric Water-Power and Public Works Concessions.
London Electric Treatment Institute.
Machinery.
Mica Mines.
Never-Skid Band Manufacturing Co.
North Lancashire Tramways Power and Construction Syndicate.
Power Engineers.
Star Electric Light Co.

Official Notices re Companies.—The following companies will be struck off the register at the expiration of three months unless cause is shown to the contrary:—

Alkaline Accumulators Paul Gouin.
Anglo-Brazilian Power and Shipping Corporation.
Beam Co. (British Electrical and Mechanical Co.)
Blast Furnace Power Syndicate.
Controllers (London).
County Electric Traction Co.
Electric Batteries and Carbons.
Leeds Electric Co.
Mego-Acoustics.
Schoenfeld Universal Oil Filter Co.
Silent Gear Syndicate.
Southwold Electricity Works.
Witney Electric Supply Co.

Smithfield Markets Electric Supply Co., Ltd.—The directors report that the gross profit for the year 1914 amounts to £4,576, compared with £5,764 and the net profit to £3,139, compared with £4,237 last year. A further sum of £400 has been placed to the debenture stock redemption fund (making a total of £793) and £1,000 to depreciation account. The available balance, including £791 brought in, is £2,530. A dividend at the rate of 2 per cent. per annum, on the ordinary shares will absorb £1,200, leaving £1,330 to carry forward.

Underground Electric Railways Co. of London, Ltd.—Subject to final audit, the revenue of the Underground Co. will enable it to pay full interest to December 31st, 1914, on its 6 per cent. first cumulative income debenture stock and on its 6 per cent. income bonds, and to carry forward about £35,000.

Central Electric Supply Co., Ltd.—The directors' report for 1914 states that energy has been supplied to the Westminster, St. James' and Pall Mall, and the Chelsea Companies to an amount of 28 967,111 units. After making a full allowance for sinking fund and depreciation the net balance for the year 1914 is £4,999. After paying of a dividend at the rate of 5 per cent. on the ordinary shares for the year £5,000, £6 remains to carry forward. The Right Hon. Wm. Hayes Fisher has been appointed a director.

Stock Exchange Notices.—Application has been made to the Committee to appoint a special settling day in and to grant a quotation to—

General Electric Co., Ltd.—Further issue of 10,000 ordinary shares of £10 each, fully-paid: and 30,000 6 per cent. cum. pref. shares of £10 each, fully-paid.

And to allow the following securities to be quoted in the Official List:—

Crompton & Co., Ltd.—79,539 ordinary shares of £1 each, fully-paid, Nos. 1 to 79,539; and 136,000 pref. shares of £1 each, fully paid, Nos. 1 to 136,000 (renewed application).

General Electric Co., Ltd.—40,000 ordinary shares of £10 each, fully-paid.

Central London Railway Co.—The directors recommend the following dividends:—

On the undivided ordinary stock for the six months ended December 31st, 1914 at the rate of 2¼ per cent. per annum, making with the interim dividend of £3 per cent. per annum, a dividend for the year 1914 of 2⅝ per cent.

On the preferred ordinary stock for the six months ended December 31st, 1914, at the rate of £4 per cent. per annum, making with the interim dividend, a dividend for the year 1914 of £4 per cent.

On the deferred ordinary stock for the year ended December 31st, 1914, a dividend of 1¼ per cent., carrying forward £15,413.

City and South London Railway Co.—The directors recommend a dividend on the 5 per cent. preference stocks 1891 and 1896 for the six months ended December 31st, 1914, at the rate of 5 per cent. per annnm, making with the interim dividend a dividend for the year 1914 of 5 per cent. No dividend will be paid on the 5 per cent. preference stocks 1901 and 1903 for the half-year ended December 31st, 1914.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The report for the year ended December 31st, 1914, states that the annuity payable by the Anglo-Argentine Tramways Co., Ltd., has been received, and the net revenue for the year has amounted to £67,392. Interim dividends paid for the nine months ending September 30th, 1914, absorbed £46 500, leaving £20,892. The directors recommend a final dividend of 1s. 3d. per share (making 5s. per share—5 per cent. per annum—less income-tax) for the year, absorbing £15,500, and £5,200 is to be transferred to general amortisation fund, leaving £192 to be carried forward. Annual meeting, February 15th.

Tyneside Tramways and Tramroads Co., Ltd.—The accounts for the past half-year show a divisible balance of £6,241. Traffic receipts showing an increase of £2,263 compared with 1913. A dividend at the rate of 3 per cent. is proposed on the ordinary shares; £1,400 is to be placed to reserve and renewals fund, and £1,500 to special reserve, carrying forward £731.

London Electric Supply Corporation, Ltd.—The company has issued the following statement:—

	1914.	1913.
Profit	£93,234	£71,753
Dividend on ordinary shares	4	3 %
Sinking fund	£12,000	£12,000
Reserve account	10,000	*Nil.*
Contingencies account ...	7,000	3,000
Carry forward	8,828	5,098

Metropolitan District Railway Co.—The directors recommend the payments of dividends in full on the 4 per cent. guaranteed stock, and on the 4½ per cent. preference stock; and on the 5 per cent. second preference stock for the past six months at the rate of 1 per cent. per annum, making for the year 2 per cent.

London Electric Railway Co.—The directors recommend a dividend on the ordinary shares for the past six months at the rate of ½ per cent. per annum, making for the year ⅝ per cent.

Parsons Marine Steam Turbine Co., Ltd.—The directors announce an interim dividend of 12 per cent.

STOCKS AND SHARES.

Tuesday Evening.

FROM the general Stock Exchange point of view, the most interesting points of the account are those concerned with the Home Railway dividends. People were completely in the dark as to what the companies were likely to pay, the only guide being an assurance by the Government that traffics would be made up to a certain amount. This, of course, did not pledge the directors to maintain previous dividends. In two or three cases the announcements are satisfactory, but in the majority, the results are regarded as somewhat disappointing

With reference to those with which this page is immediately concerned, the various distributions declared by the Tube Railways cannot be held as good. In one case—that of the Underground Electric Railways of London—the company has fulfilled hopeful anticipations by announcing the payment of the full dividend on the 6 per cent. income bonds, whereas some few weeks ago the idea was current that this rate might be cut down to 4½ or 5 per cent.

On the other hand, the Central London and the City and South London publish poor performances; and none too much satisfaction is felt with that of the London Electric Railways. Prices have mostly given way, and the Underground stocks have joined with the rest of the Home Railway group in showing decided signs of heaviness. The public decline to buy Home Railway ordinary and deferred stocks—at least, so the level of present prices indicates—unless the investments yield about 6 per cent. on the money; and inasmuch as this return can be obtained from several of the best-class ordinary shares in the steam-list, it is not surprising that others should give way.

HOME ELECTRICITY COMPANIES.

	Mean price. July 27.	Feb. 9, 1915.	Rise or fall this week.
Brompton Ordinary	9½	8⅞	—
do. 7 per cent. Pref.	8⅜	8⅝	—
Charing Cross Ordinary	5¼	4⅞	—
do. do. do. 4½ Pref.	4¾	4¼	—
do. do. City Pref.	4½	4	—
do. 4 Deb.	91½	90	—
Chelsea	4¼	4¾	—
do. 4½ Deb.	96½	92	—
City of London	16	14¼	—
do. do 6 per cent. Pref... ..	13½	12¾	—
do. do. 5 Deb.	116½	114	—
do. do 4½ Deb.	100¼	98	—
County of London	12	11¼	—
do. do. 6 per cent. Pref. ..	12	11¼	—
do. do. 1st Deb...	102½	99	—
do. do. 2nd Deb.	100½	97	—
Kensington Ordinary	7½	7¼	— ¼
London Electric	1 7/16	1¼	—
do. do. 6 per cent. Pref... ..	5 1/16	5	—
do. do. 4 Deb.	92½	87	—2
Metropolitan	3½	3⅛	—
do. 4½ per cent. Pref.	4 1/16	4	—
do. 4½ Deb...	97½	96	—
do. 3½ Deb..	83	78	—2
St. James' and Pall Mall	9⅝	9	—
do. do. do. 7 per cent. Pref.	7	6½	—
do. do. do. 3½ Deb.	84½	82	—
South London	3 1/16	3	—
South Metropolitan Pref.	1¼	1⅛	—
Westminster Ordinary	8⅝	8¼	—
do. 4½ Pref...	5⅛	4⅞	— ⅛

HOME RAILS.

	Mean price. July 27.	Feb. 9, 1915.	Rise or fall this week.
Central London, Ord. Assented	83	77	—1
Metropolitan	37½	30½	—1½
do. District	21¾	17¾	— ½
Underground Electric Ordinary ..	2½	1¾	— ⅛
do. "A"	7/6	6/-	—
do. Income	88	82½	— ½

TELEGRAPHS AND TELEPHONES.

	Mean price. July 27.	Feb. 9, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108¼	106½	—
do. Def.	23	23	+ ⅛
Chile Telephone	7⅜	7⅛	—
Constantinople Tel.	4½	3½	—
Cuba Sub. Ord.	8¼	8¼	—
do. Pf.	16½	15¾	—
Eastern Extension	12¾	12¾	+ ¼
do. 4 Deb.	97½	94	—
Eastern Tel. Ord.	130½	128	+1
do. 3½ Pf.	77½	71	—
do. 4 Deb.	96½	94	+1
Globe Tel. and T. Ord.	11¼	10¼	+ ¼
do. Pf.	12⅝	11¾	—
Gt. Northern Tel.	32½	27	—1
Indo-European	59	55	—
Marconi	1 1/16	1⅝	+ 1/16
New York Tel. 4½	101	97	—
Oriental Telephone Ord.	2 5/32	2	—
do. Pf.	1 3/32	1 3/16	+ ⅛
Tel. Egypt Deb.	98	82½	—
United R. Plate Tel...	6⅜	6	—
do. Pf.	5½	5	—
West India and Pan.	1¼	1½	+ ⅛
Western Telegraph	13⅝	13	—
do. 4 Deb.	96½	96½	—

FOREIGN TRAMS, &c.

	Mean price. July 27.	Feb. 9, 1915.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅞	4½	—
do. 2nd Pf.	4½	4	—
do. 4 Deb	91	84	—1
do. 4½ Deb...	98½	93	—1
do. 5 Deb.	96	88	—
Brazil Tractions	66	54½	—2
Bombay Electric Pf.	11⅝	10½	—
do. 4½ Deb.	96	91	—
Mexico Trams..	70	40	—
do. 5 per cent. Bonds ..	84	60	—
do. 6 per cent. Bonds ..	76	50	—
Adelaide Sup. 6 per cent. Pf.	5¼	5⅛	—
do. 5 Deb.	104	101½	+ ½

MANUFACTURING COMPANIES.

	Mean price. July 27.	Feb. 9, 1915.	Rise or fall this week.
British Westinghouse Pref.	1¾	1⅞	— 1/16
do. 4 Deb.	74½	70	—
do. 6 p. lien	102½	98½	—
Callenders	11⅝	11½	—
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	—
Castner Kellner	2⅞	3¼	—
Edison & Swan, £3 pd.	3/32	11/6	—
do. do. fully paid	1½	2	—
do. do. 4 Deb.	59	60	—
do. do. 3 Deb.	63½	60	—
Electric Construction	17/32	14/-	+ 6d.
do. do. Pf.	1/16	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	13½	—
do. 4½ Pref.	5	5	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	8½	—
Telegraph Con.	88½	86½	—

Oddly enough, however, the preference stocks of the Home Railway companies are in good demand; and the discount of 2 points on Metropolitan 5 per cent. preference has given place to a small premium, while the new London and South Western preference, issued at 99¼ to pay for electrification work, has risen to 106½. It will be seen from the subjoined price lists how the ordinary stocks have given way:—

Electricity supply shares lean a little to the dullish side. Westminster preference, for instance, have lost the small fraction they picked up last week. Kensingtons are 5s. down. The report of the St. James' Company is considered satisfactory enough in the circumstances. But a certain amount of anxiety is expressed as to the position of all the electric lighting companies, in regard to their holding of coal, and to the prices at which they will have to enter into new contracts.

The Borough of Wimbledon circularised its inhabitants with the intimation that, owing to the scarcity of coal, it might be necessary to curtail the supply of electric current. Inland Revenue offices in the City display small handbills urging economy in the use of electric light. One, at least, of the gas companies has issued a very strongly-worded appeal to its stockholders and consumers, begging them to use what influence they can to bring the matter before Parliament. All things considered, these are not good days for illumination industries.

The Bournemouth and Poole Company is offering its shareholders 2,500 6 per cent. second preference shares of £10 each at par, and, considering the excellence of the security, there can be little doubt about the success of the issue, which is one of the first, by the way, to receive the Treasury imprimatur of permission to appear. There is no premium on the shares in the market, but as a 6 per cent. investment of their class they will rank high. The Melbourne Electric Supply issue achieved distinct success, and the shares are already 7s. 6d. premium in the market, the old stock keeping about 170. Manufacturing shares are quiet. Electric Constructions continued to harden, and British Westinghouse preference wavered a trifle.

The foreign tramway list shows Brazil Tractions down a further 2 points, which leaves the price 54½. Mexican issues are also weak. Illustration of the state of the market may be seen in the fact that for one of the Mexican bonds, which was quoted nominally at 50, an insistent seller the other day obtained no more than 25. The condition of the unfortunate country at present holds out no hopes of improvement. Adelaide Supply debenture stock has hardened, on the absorption of a fair block which was offered at 101 free of stamp duty. The Anglo-Argentine debenture stocks have given way a point or so.

Telegraph stocks and shares are firm, and the advancing tendency recently shown is fully maintained. Rises have occurred this week in Anglo "B," "China" shares, Eastern ordinary, Globe ordinary and Panamas; and the only fail worth noticing is £1 in Great Northerns. Marconis hardened a shade on buying, said to be inspired by Irish sources. Americans are steady at 10s., Canadians at 4s. 9d. Oriental Telephone preference rose ⅛ on a small enquiry. The difficulty is to buy stock in any good-class concern; and would-be purchasers of £100 of this, that, or the other stock in the telegraph list have been disappointed, several times this week, in not being able to get their stock even at the higher of the prices quoted.

The armament group shows slackness, and there has been quiet pressure to sell Vickers and Armstrongs, no doubt on behalf of those who bought the shares lower down and are content to take profits. The rubber market received an unpleasant surprise early this week in the issue by one of the leading companies of new capital allotted to its proprietors by way of bonus, though the value of the gift was quickly modified by the market's putting down the price of the old shares to within a florin of the new. Rubber itself is steady, and the best-class shares attract a fair amount of investment attention in the provinces.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Jan. 27	2,557	— 118	4	2,557	— 118	..	..
Blackpool-Fleetw'd	Feb. 6	1,135	+ 86	5	1,592	+ 51	8	..
Bristol	" 5	33,194	+3,523	5	42,386	+ 3,653	30·5	..
Chatham and Dist.	Jan. 28	3,748	+ 537	4	3,743	+ 537	14·98	..
Dublin	" 29	23,070	+2,194	4	23,070	+ 2,194	54·25	..
Cork	" 28	1,714	— 61	4	1,714	— 61	9·89	..
Hastings	" 28	2,785	— 201	..	..	— 202	19·3	..
Lancashire United	Feb. 3	5,835	— 94	42	7,990	— 77	42	..
Llandudno-Col. Bay	Jan. 29	673	+ 114	8	1,379	+ 163	6·5	..
Tyneside	" 27	1,905	+ 123	4	1,905	+ 123	11	..
Anglo-Argentine ..	Feb. 4	200,337	—26,172	5	253,057	—31,519	..	..
Auckland	Jan. 15	22,164	—3,469	28	147,096	+11.558	25·42	1·06
Calcutta	Feb. 6	17,030	— 916	..	.	+ 1,998	..	..
Kalgoorlie, W.A. ..	Nov.	2,414	..	47	28,919	..	..	..
Madras	Dec. 31	3,725	— 132	53	44,441	+ 1,495	..	..
Montevideo ..	Jan.	32,443	—5,813	13	88,129	—13,967	..	..
Dublin-Lucan Rly.	Feb. 5	445	+ 6	5	581	— 8	7	..

ELECTRICITY ON THE RAND.

The following data, relating to electric generating plant and large winding engines installed on the Rand, were published in the *South African Mining Journal* from figures compiled by the S.A. Institute of Electrical Engineers and presented to the S.A. Association for the Advancement of Science:—

Name of power supply company, mining company, or municipality owning generating plant.	Name of generating station.	No. of sets.	Makers' rating per set. KW.	Makers' name.	Type of plant.	Total capacity of station. KW.
The Victoria Falls and Transvaal Power Co., Ltd , and	Brakpan	2	3,000	A.E.G.	Turbine 3-phase	6,000
	Simmer Pan	6	3 000	A.E.G.	" "	
		2	11,000	A.E.G.	" "	40,000
The Rand Mines Power Supply Co., Ltd.	Rosherville	5	9,600	A.E.G.	" "	48,000
	Vereeniging	2	9,600	A.E.G.	" "	
		2	12,000	A.E.G.	" "	43,200
	Total	19				137,200
Randfontein Estates Gold Mining Co., Witwatersrand, Ltd.	Randfontein Estates Power Station	3	6,000	1 Westinghouse 2 Parsons	Turbine 3-phase	
		3	2,000	Parsons	" "	26,000
		2	1,000	Parsons	" "	
East Rand Proprietary Mines, Ltd.	E.R P.M. Central Power Station	3	1,150	Belliss & Morcom and G.E.C.	Reciprocating	
	Angelo Section	1	1 500	Parsons.	Turbine 3 phase	
		1	3,000	Willans and	" "	19,950
		1	6,000	Dick, Kerr	" "	
		1	6,600	A.E.G.	" "	
The Municipality of Johannesburg	Municipal Power Station, Johannesburg	3	3,000	Belliss & Morcom	Turbine 2-phase	
		1	1,000	"	Recip'g "	
		2	250	Allen	" "	
		2	1,000	Belliss & Morcom	Reciprocating	13 250
		2	500	"	Direct-current	
		1	250	Allen	plant	
Kleinfontein Power Association	Kleinfontein Power Association, Central Power Station	3	2,000	Parsons	Turbine	6,000
The Langlaagte Estate and Gold Mining Co., Ltd.	Langlaagte Estate Power Station	1	85	Bruce Peebles	Reciprocating	
		3	400	A.E.G.	"	
		1	500	Siemens	"	2,085
		2	150	A.E.G.	"	
A. Goerz & Co., Ltd.	Geduld Proprietary Mines	1	800	Siemens	Exhaust steam turbo	800
	Princess Estate	1	170	"	Steam-driven	
		1	64	"	"	390
		1	160	"	"	
S. Neumann & Co., Ltd.	Witwatersrand Deep	1	1,000	Parsons	Turbine	
		1	750	Brit. W'house	Reciprocating	2,500
		1	500	Gen. Electric	Curtis turbine	
	Cons. Main Reef	1	1,000	Parsons	Turbine	
		2	250	Gen. Electric	Rope drive	1,500
	Wolhuter G.M. Co.	2	400	E.C.C. & B.G.E.	Rope driven and recip.	800
	Knight Central	1	750	A E.G.	Rope-driven	750
General Mining and Finance Corporation, Ltd.	Aurora West	1	160	Mather & Platt	Direct coupled	
		1	100	"	"	360
		1	100	E.C.C.	Rope-driven	
	Van Ryn	2	500	Brit. W'house	Reciprocating	1,375
		3	125	Mather & Platt	Rope-driven	
Krugersdorp Municipality	Power Station	2	225	Siemens	Reciprocating	450

Name of mine.	Name of supplier.	Type of winder.	No. and H.P. of motors per winder (continuous rating).	Maximum depth of wind.	Weight of rock per wind.	Complete trips per hour.	Voltage of winder motors.	Speed of winder motors.
Crown Mines, Ltd.	Electrical—G E.C. of America. Mechanical—Frase and Chalmers.	Ward-Leonard cylindro-conical drums.	Two 2,000 H P. each motor.	3,510 ft. vertical.	8 tons.	44	1,000 v. across two motors in series.	53·5 R.P.M.
" "	Motor generators—Siemens. Winder motors—A.E.G. Mechanical—Fraser & Chalmers.	Two Ward-Leonard winders, cyl. con. drums.	Two 1,420-H.P. each motor.	2,260 ft. vertical.	8 tons.	45	1,000 v. across two motors in series.	53·5 R.P.M.
E R.P.M. Hercules Shaft	British Westinghouse Co.	Ward-Leonard cyl. con. drums.	Two 750-H.P. each motor.	4,500 ft. vertical.	8 tons.	20	1,000 v. across two motors in series.	33·3 R.P.M.
Village Deep, Ltd., and City Deep, Ltd.	" "	Three-phase motors direct-coupled. (Two cyl. drum hoists. Four Whiting hoists.)	One 1,600 H.P.	3,600 ft. vertical.	5 tons.	32	2,000 v.—three-phase 50 cycles.	100 R.P M.
Bantjes Consolidated Mines, Ltd.	Siemens.	Three-phase motor geared to cyl. drums	One 1,470-H.P.	4,000 ft. incline.	[illegible] tons.	23	2,000 v three-phase—50 cycles.	250 R.P.M
Consolidated Langlaagte G.M. Co., Ltd.	"	Ward-Leonard (Two similar equipments.)	One 1 290-H.P.	1,230 ft. vertical and 3,000 ft. incline.	5 tons	23	500 v. direct current across winding motor.	80 R.P.M.
New Modderfontein G.M. Co., Ltd.	A.E.G.	Three-phase motor, direct coupled to cyl. drums.	One 1,200-H.P.	2,000 ft.	3 tons.	45	2,000 v.—three-phase—50 cycles.	

RUSSIA'S IMPORTATION OF ELECTRICAL GOODS.

The past few years have been characterised by a great rise in the importation of merchandise into Russia. The average for the five years 1909 13 was 1,004,000,000 roubles, against 646 000,000 roubles in the immediately preceding five years. The largest importation has been in finished goods; these rose by 92 per cent in the last five years named over the corresponding importations of the preceding five years, whereas the rise in the importation of raw materials in the same space of time was only 45 per cent. But no class of goods has shown such a great advance in the importation movement into Russia as the products of the electrical industry. The average annual importation during the last five years, compared with the preceding five years, has grown by about three times, or to 15 200 000 roubles value from 5,500 000 roubles. The following table (from the *Electritchestvo*) shows the importation into Russia of electrical goods along with the importation of all other kinds of metal goods :—

TABLE I.—Ten Years' Importation into Russia.

	Electrical goods. Roubles.	All other goods made of metal. Roubles.
1904	4,472,000	96 167,000
1905	4,562 000	100,276,000
1906	5,567,000	106 969,000
1907	5,759,000	117,908,000
1908	7 073,000	129,616,000
1909	8,316,000	151,581,000
1910	10,888,000	186 006,000
1911	14,342,000	226 879,000
1912	17,014,000	229,201,000
1913	25,240,000	259,718,000

Thus, the table shows that the importation of both categories of goods has risen from year to year, but whereas the importation of electrical goods for the ten years figured in the table rose from 4,500,000 roubles value to 25,200,000 value, or, five and a half times, the importation of general metal goods rose only two and a half times.

Table II gives the importation of electrical products from the time of the introduction of the 1906 tariff according to classification. With the generally very significant increase in the consumption of electrical products, the importation from abroad of some goods in this group is relatively small, as the demand is covered by the home production. The importation of insulated copper wire for the past few years has not exceeded 10,000 poods; the demand for electrical cables is almost entirely supplied from the home production. In the year 1913 only 8,000 poods were imported, whilst 10 to 15 years ago the annual importation was about 150,000 poods. Similarly, the home manufacture provides accumulators and telephone and telegraph apparatus. Of the accumulators received of recent years, less than 2,000 poods have been imported, and of telephone and telegraph apparatus only 7,000 to 8,000 poods. German statistics show respecting this item that it is telephone apparatus rather than telegraph apparatus that is imported.

The importation of electric cars compared with the home production is insignificant; the number imported in 1913 was only 106. The total value of all the goods enumerated, namely, insulated wire, cables, accumulators, telephone and telegraph apparatus, and electric railway cars, in 1913, does not exceed 1,500,000 roubles out of a total importation of electrical goods valued at 25,200,000 roubles.

The importation of incandescent electric lamps amounted in 1913 to 30,000 poods against 5,600 poods in 1906, and the corresponding values were 4,600,000 roubles and 400,000 roubles respectively. It is mostly metal-filament lamps that are imported, namely, 23 000 poods against 4,000 poods with carbon filaments. Until the introduction of the law of May 28th, 1912, o.s., all lamps in cases paid a duty of 30 roubles per pood; but the law referred to made the duty 65 roubles per pood for metal-filament lamps.

Germany had an exceptional position in the supply of electric material to Russia. As can be seen from the following table, her part amounted to 80 per cent. to 90 per cent. of the importation, and the relative position of Germany improved year by year, whilst the importation from other countries improved at a very slow rate or did not improve at all. It was only in the importation of telephonic apparatus that Germany suffered very serious competition from Sweden.

TABLE II.—Classified List.

		1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.
Stranded copper wire covered with fibrous material, gutta-percha, rubber, &c. :—									
(a) 2 millimetres and upwards	poods	7,000	3,000	5,000	4,000	7,000			
	roubles	232,000	122,000	167,000	144,000	251,000	7,900	5,800	8,000
(b) Ditto, covered with silk or mixture of other fibrous material	poods	—	—	—	700	600	371,000	245,000	355,000
	roubles	12,000	11,000	16 000	27,000	27,000			
(c) Finer than 2 mm.... ...	poods	2,000	—	1,000	600	600			
	roubles	56,000	20,000	24,000	25,000	30,000	1,400	1,600	2,400
(d) Ditto, covered with silk or mixture of other fibrous material	poods	—	—	—	400	300	78,000	98,000	136,000
	roubles	15,000	21,000	15,000	26,000	27,000			
Electrical cables—all kinds ...	poods	192,000	16,000	34 000	8,000	14,000	13,000	9,500	8 000
	roubles	1,355,000	281,000	457,000	158,000	212,000	148,000	102,000	155,000
Electric locomotives	poods	—	—	2,000	300	300	1,300	7,100	3,500
	roubles	—	—	23,000	6 000	4,000	16,000	83 000	38,000
Dynamo-electric machines and electric motors—all kinds	poods	83,000	91,000	131,000	143 000	146 000	215,000	251,000	383,000
	roubles	1,526,000	2,143,000	3,155,000	3,584,000	4,157,000	5,373,000	5,947,000	9,595,000
Electrical transformers	poods	4,000	12,000	11,000	12 000	16,000	19,000	25 000	32,000
	roubles	80,000	251,000	259,000	237,000	334,000	465,000	478,000	704,000
Parts of electric machines and transformers :—									
(a) Bobbins	poods	—	1,000	1,000	1,000	600	1,800	1,500	1,400
	roubles	16,000	28,000	59,000	48,000	29,000	73 000	66,000	65,000
(b) Armatures & commutators	poods	2,000	5,000	5,000	4,500	3,000	4,500	5,600	5,600
	roubles	64,000	143,000	169,000	137,000	103,000	146,000	183,000	168,000
(c) Carcasses with copper cover over bearing parts	poods	—	2,000	1,000	300	1,000	3,200	4,700	16,000
	roubles	5,000	38,000	22,000	7 000	26 000	78,000	116,000	488,000
(d) Telegraph and telephone apparatus	poods	5,500	6,200	5,300	5,800	7 000	7,600	7,900	8,400
	roubles	190,000	209,000	165,000	195,000	248 000	282 000	240,000	363 000
(e) Electric accumulators	poods	1,000	1,100	700	4 400	2,900	1,000	1 800	1 900
	roubles	11,000	21,000	12,000	80,000	75,000	28,000	50,000	58,000
Electrical switches, keys, fuses, lamp sockets and rheostats assembled or not, electric bells, electric signal parts	poods	24,000	31,000	37,000	46,000	65,000	105,000	140,000	230,000
	roubles	727,000	879,000	990,000	1,462,000	1,983,000	3,036,000	3,849,000	6,602,000
Electrical measuring apparatus, ammeters, wattmeters and voltmeters	poods	4,700	7,000	8,400	11 000	15 000	21,000	27,000	33 000
	roubles	215,000	335,000	354,000	493,000	702 000	940,000	1,183,000	1,452,000
Electric incandescent lamps in cases	poods	5,600	7 800	10 000	13 000	18,000	23 000	30 000	* 27,000
	roubles	396,000	748,000	1,029,000	1,515,000	2,251,000	2,613,000	3,798,000	4,619,000
Electric incandescent lamps without cases	poods	100	—	—	—	—	—	—	—
	roubles	11,000	2,000	1,000	2,000	1,000	2,000	10,000	2,000
Electrical railway cars, large ...	units	84	63	40	63	89	150	184	106
	roubles	656,000	507,000	156,000	170 000	448,000	693 000	566 000	440,000
Total value in 1,000's of roubles ...		5,567	5,759	7,073	8,316	10,888	14,342	17,014	25,240

* This includes lamps with carbon filaments, 4,000 poods, and with metal filaments, 23 000 poods.

Recently published data show that the movement has continued even into the year 1914. Thus, from January to July the figures were 14,852 000 roubles, against 12,142 000 roubles in the first seven months of 1913, and 9,460,000 roubles in the first seven months of 1912.

Great attention, says the article, must be paid to the exceptional importation of some goods when the new treaties come to be made after the war. Incandescent lamps, for example, may be made easier to be produced in Russia by the imposition of higher tariffs. Germany's electrical business profits principally by the free importation of copper. In Russia the duty on copper in 1905 was 3 roubles 75 copecks to 5 roubles per pood; and the price is one and a half times dearer than in Germany or England, notwithstanding the increase in the smelting of copper in Russia itself.

TABLE III.—Importation per Country in 1,000's of Poods.

Figures per country for 1913 not yet published.

	1908.	1909.	1910.	1911.	1912.
Dynamo machines and electro-motors.—					
From Germany	112·4	125·9	138·0	192·2	226·6
,, Great Britain ...	12·1	16·3	4·9	18·4	16·5
,, Austria-Hungary ...	3·6	1·4	1·8	2·8	7·7
,, France	0·7	1·8	1·3	2·5	1·3
,, Belgium	2·4	0·1	0·5	3·4	0·1
,, Sweden	0·1	0·5	1·7	2·8	1·7
,, United States of America... ...	0·1	0·7	3·0	0·6	4·7
,, Finland	0·4	0·3	0·9	1·8	2·9
,, Other countries ...	1·2	1·4	1·4	2·0	0·8
	133·0	148·4	153·5	226·5	262·3
Electrical transformers.—					
From Germany	8·7	9·3	14·6	15·3	23·3
,, Great Britain ...	0·8	1·1	0·7	2·9	1·8
,, Austria-Hungary ...	1·0	0·3	0·2	0·2	0·3
,, France	0·1	0·6	0·6	—	—
,, Holland	—	0·2	—	0·3	—
,, Other countries ...	0·1	—	0·2	0·3	0·8
	10·7	11·5	16·3	19·0	26·2
Electrical switches, keys, fuses, &c., bells, rheostats, &c.—					
From Germany	39·8	40·5	60·7	95·0	130·4
,, Great Britain ...	2·0	3·2	1·6	5·2	4·0
,, Austria-Hungary	1·5	1·4	2·6	3·1	5·4
,, France	0·4	0·6	1·2	0·9	1·0
,, Sweden	0·1	0·2	0·2	0·8	1·0
,, Belgium	1·6	—	0·5	1·7	1·6
,, United States of America ...	0·1	1·1	0·1	1·3	0·6
,, Other countries ...	0·7	0·9	0·6	1·2	1·4
	46·2	47·9	67·5	109·2	145·4
Electrical measuring apparatus.—					
From Germany	8·1	10·4	15·1	20·4	26·2
,, Great Britain ...	0·1	0·1	0·4	0·6	0·3
,, Austria-Hungary	0·1	0·4	0·1	0·1	0·4
,, France	0·1	0·2	0·2	0·2	0·3
	8·4	11·1	15·8	21·3	27·2
Electrical incandescent lamps in cases.—					
From Germany... ...	8·6	10·5	15·8	19·4	19·1
,, Great Britain ...	0·1	0·2	0·4	0·8	0·1
,, Austria-Hungary	1·5	1·6	2·1	3·1	1·9
,, Holland	0·2	0·3	0·2	0·5	0·1
,, France	0·2	0·1	0·1	0·1	0·1
,, Sweden	0·1	0·3	0·2	0·1	0·1
,, Other countries...	0·3	0·2	0·1	0·2	0·1
	11·0	13·2	18·9	24·2	21·5
Telegraph and telephone apparatus.—					
From Germany	1·2	2·6	2·9	3·6	4·2
,, Sweden	2·8	2·4	2·9	2·9	2·7
,, Great Britain ...	0·2	0·2	0·1	0·2	0·1
,, Austria-Hungary	0·8	0·5	0·6	0·5	0·1
,, Denmark	0·3	0·4	0·1	0·3	0·4
,, Belgium	0·1	—	—	—	—
,, Finland	0·1	0·4	0·5	0·3	0·2
,, Other countries ...	—	0·2	0·2	—	0·1
	5·5	6·7	7·3	7·8	8·1
Electric railway cars.—			Units.		
From Germany	25	63	72	78	131
,, Great Britain ...	15	—	—	—	4
,, Austria-Hungary...	—	—	7	17	9
,, Belgium	—	—	10	55	50
	40	63	89	150	191

The first position in the list of imports is occupied by dynamo-electric machines and electromotors, the importation which has increased steadily for years—namely, from 83,000 poods, value 1,500,000 roubles, in 1906, to 383,000 poods, value 9,600,000 roubles, in 1913. The importation of transformers during 1913 was 32,000 poods' weight, of value 704,000 roubles. Dynamos and transformers bear a Customs duty of 8 roubles 50 copecks per pood, or from 30 to 36 per cent. on the value; but parts of dynamos, machines and transformers are imported to a very slight extent. The second position in the list is occupied by sundry items grouped under one tariff and statistical denomination—electrical switches, keys, fuses, incandescent lamp sockets, rheostats and commutators of all kinds, complete and in parts, electric and pneumatic bells, and accessories for electrical signalling, the importation of which in the year 1913 amounted to 230,000 poods, value 6,600,000 roubles, against 24,000 poods, value 700,000 roubles only, in 1906. All these goods bear a duty of 9 roubles per pood or 28 to 33 per cent. of their gross value.

The importation of electrical measuring instruments, amperemeters, wattmeters, voltmeters, &c., during the year 1913 made a total of 1,500,000 roubles' value, against only 200,000 roubles' value seven years before. The duty on these is 12 roubles per pood or 26 to 28 per cent. of the imported value.

TRADE STATISTICS OF CANADA.

The following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1914, are taken from the recently issued trade statistics. Figures for the year 1912-13 are given for purposes of comparison, and notes of any increases or decreases have been added.

Imports.

	1912-13 Dollars.	1913-14 Dollars.		Inc. or Dec. Dollars.
Railway passenger cars.—				
From United States	303,000	2,067,000	+	1,764,000
Tram or horse cars.				
From United States ...	2,000	57,000	+	55,000
Copper wire, plain, tinned or plated.				
From United Knigdom ...	1,000	1,000		—
,, United States ...	105,000	115,000	–	10,000
Total	106,000	116,000	–	10,000
Electric light carbons and carbon points.—				
From United Kingdom ...	4,000	5,000	+	1,000
,, Germany	24,000	40,000	+	16,000
,, United States ...	41,000	39,000	—	2,000
,, Other countries ...	2,000	5,000	+	3,000
Total	71,000	89,000	+	18,000
Electric apparatus not mentioned—insulators, batteries, telegraph & telephone instruments.—				
From United Kingdom ..	987,000	809,000	—	178,000
,, Austria	2,000	2,000		—
,, France	13,000	29,000	+	16,000
,, Germany	77,000	141,000	+	64,000
,, Sweden	50,000	80,000	+	30,000
,, United States ...	5,849,000	5,515,000	—	334,000
,, Switzerland ...	2,000	3,000	+	1,000
,, Other countries ...	16,000	18,000*	+	2,000
Total	6,996,000	6,597,000	—	399,000

* Italy $5,000.

	1912-13 Dollars.	1913-14 Dollars.		Inc. or Dec. Dollars.
Incandescent lamp bulbs, etc.—				
From Austria	25,000	14,000	—	11,000
,, United States ...	111,000	110,000	—	1,000
,, Other countries ...	10,000	8,000	—	2,000
Total	146,000	132,000	—	14,000
Electric motors and generators.				
From United Kingdom ...	193,000	136,000	—	57,000
,, France	1,000	4,000		—
,, Sweden	68,000	103,000	+	35,000
,, United States ...	1,313,000	1,542,000	+	229,000
,, Other countries ...	6,000	22,000†	+	16,000
Total	1,581,000	1,807,000	+	226,000

† Germany $11,000.

	1912-13 Dollars.	1913-14 Dollars.		Inc. or Dec. Dollars.
Lamp chimneys, glass shades and globes.—				
From United Kingdom	8,000	6,000	—	2,000
,, Austria	18,000	23,000	+	5,000
,, Germany	35,000	50,000	+	15,000
,, United States ...	361,000	304,000	—	57,000
,, Other countries ...	3,000	3,000		—
Total	425,000	386,000	—	39,000
Gasoline engines.—				
From United Kingdom ...	107,000	111,000	+	4,000
,, United States ...	3,301,000	2,457,000	—	844,000
,, Other countries ...	6,000	2,000	—	4,000
Total	3,414,000	2,570,000	—	844,000
Manufactures of india-rubber and gutta-percha, [illegible] tires, clothing and similar goods.—				
From United Kingdom ...	218,000	231,000	+	13,000
,, Austria	12,000	15,000	+	3,000
,, France	8,000	9,000	+	1,000
,, Germany	60,000	61,000	+	1,000
,, United States ...	753,000	776,000	+	23,000
,, Other countries ...	—	5,000	+	5,000
Total	1,051,000	1,097,000	+	46,000

	1912-13. Dollars.	1913-14. Dollars.	Inc. or Dec. Dollars.	
Rubber belting.—				
From United Kingdom ...	15,000	4,000	—	11,000
,, United States ...	109,000	84,000	—	25,000
Total	124,000	88,000	—	36,000
Steam engines.—				
From United Kingdom ...	117,000	50,000	—	67,000
,, United States ...	459,000	386,000	—	73,000
,, Italy	—	19,000	+	19,000
Total	576,000	455,000	—	121,000
Steam boilers.—				
From United Kingdom ...	74,000	112,000	+	38,000
,, United States ...	323,000	273,000	—	50,000
Total	397,000	385,000	—	12,000
Concrete mixing, cement making, and coal handling machines.—				
From United Kingdom ...	*	32,000		—
,, United States ...	*	459,000		—
,, Other countries ...	—	4,000		—
Total	*	495,000		—

* Not separately mentioned.

All machinery not mentioned, except sewing machines, textile machinery, printing machinery, etc.—				
From United Kingdom ...	2,015,000	1,702,000	—	313,000
,, France	7,000	79,000	+	72,000
,, Germany	209,000	163,000	—	46,000
,, United States ...	17,485,000	12,811,000	—	4,674,000
,, Other countries ...	73,000	67,000	—	6,000
Total	19,789,000	14,822,000	—	4,967,000
Iron and steel wire, single or several, covered with cotton, linen, silk, rubber, or other material, including cables so covered.—				
From United Kingdom ...	434,000	304,000	—	130,000
,, United States ...	774,000	563,000	—	211,000
,, Other countries ...	12,000	11,000	—	1,000
Total	1,220,000	878,000	—	342,000
Iron and steel wire not mentioned (except fencing wire).—				
From United Kingdom ...	16,000	17,000	+	1,000
,, Germany	6,000	23,000	+	17,000
,, United States	301,000	211,000	—	57,000
,, Other countries ..	1,000	—	—	1,000
Total	324,000	294,000	—	30,000
Lighting fixtures of metal (including electric).—				
From United Kingdom ...	51,000	31,000	—	20,000
,, Austria	4,000	8,000	+	4,000
,, United States ...	709,000	637,000	—	72,000
,, Other countries ..	17,000	29,000	+	12,000
Total	781,000	705,000	—	76,000
Asbestos manufactures.—				
From United Kingdom ...	44,000	50,000	+	6,000
,, United States ...	443,000	415,000	—	28,000
,, Other countries ..	10,000	9,000	—	1,000
Total	497,000	474,000	—	23,000
Plumbago, ground and manufactured.—				
From United Kingdom ...	8,000	14,000	+	6,000
,, United States ...	50,000	47,000	—	3,000
Total	58,000	61,000	+	3,000

	Exports.			
Mica.—				
To United Kingdom ...	37,000	36,000	—	1,000
,, United States	282,000	156,000	—	126,000
,, Other countries ..	2,000	17,000	+	15,000
Total	321,000	209,000	—	112,000
Electrical apparatus.—				
To United Kingdom ..	12,000	25,000	+	13,000
,, Newfoundland	9,000	9,000		—
,, United States	188,000	67,000	—	121,000
,, Other countries	7,000	6,000	—	1,000
Total	216,000	107,000	—	109,000
Machinery (other than sewing machines and typewriters).—				
To United Kingdom ..	66,000	84,000	+	18,000
,, Newfoundland	112,000	56,000	—	56,000
,, New Zealand	5,000	9,000	+	4,000
,, Argentina	25,000	9,000	—	16,000
,, France	20,000	23,000	+	3,000
,, United States	806,000	729,000	—	77,000
,, Other countries	68,000	76,000	+	8,000
Total	1,102,000	986,000	—	116,000

CABLES.

The paper on "Cables," read before the Scottish Local Section of the Institution of Electrical Engineers by Mr. C. J. Beaver, was discussed at a meeting in Edinburgh on Jan. 12th. (For abstract of the paper, see Elec. Rev., Nov. 20th and 27th and Dec. 4th, 1914).

Mr. D. A. Starr (Glasgow) thought it very doubtful whether in Britain a 50 or 100-kilovolt transmission scheme could be justified. The plant capacity required for charging the cables alone would present difficulties which considerations of sound finance could scarcely surmount. Having regard to our extensive coalfields and our readily accessible seaboard, it would seem to be a sounder proposition to select a power station site with abundant condensing water and the use of seaborne coal, and to generate at a pressure not exceeding 20,000 volts rather than to select a site at a remote coalfield and transmit at 50,000 or 100,000 volts. It was a common experience with three-core paper-insulated cables which had been so built as not to exclude all interstices in which air might find a lodgment, that serious troubles arose at the end boxes due to the imprisoned air expanding under rising temperature. This air found its easiest escape through the compound in the end boxes, leaving a pin hole in its path through which damp air might be drawn when the temperature of the cable returned to normal. Very often the end-box design was blamed for what was really an inherent defect in the design or the manufacture of the cable. The general impression amongst engineers in this country was that pure manilla paper only should be used for cable manufacture; Dr. Borel had expressed the opinion that a pure manilla paper was much inferior to a manilla with a small proportion of wood pulp, stating that pure manilla was not sufficiently porous to absorb the necessary quantity of the insulating oil or compound, and that from his experience extending over many years he did not approve of pure manilla. Regarding the case of alleged mechanical damage at Manchester, it would appear that the trouble experienced was more likely to be caused by the accession of moisture through the joints in the troughing assisted, probably, by the presence of cable supports. It seemed highly improbable that the cable and troughing would be displaced, as obviously the ground under the troughing must have yielded by a corresponding amount. The corrosion of lead sheathing at troughing joints was no new phenomenon, and could easily be got over by a modification of the design of support used for keeping the cable central with the troughing. The real danger of wooden bridge pieces lay in the fact that it was almost impossible to eliminate the free acids in the wood. In the Ruthven-Murray bridge-piece steel was used, and the support was so shaped as to sling the cable from the sides of the trough. Owing to the temporary failure of an important feeder the remaining feeders might be required to transmit considerably more than their normal current for several hours; whilst paper-insulated cables could withstand such abnormal conditions without detriment, bitumen cables were sometimes irreparably damaged due to the conductors becoming decentralised through overheating. For this reason their use could not be recommended except in cases where they had to perform some well-defined service, and where discriminating cut-outs could be depended upon to protect them from themselves.

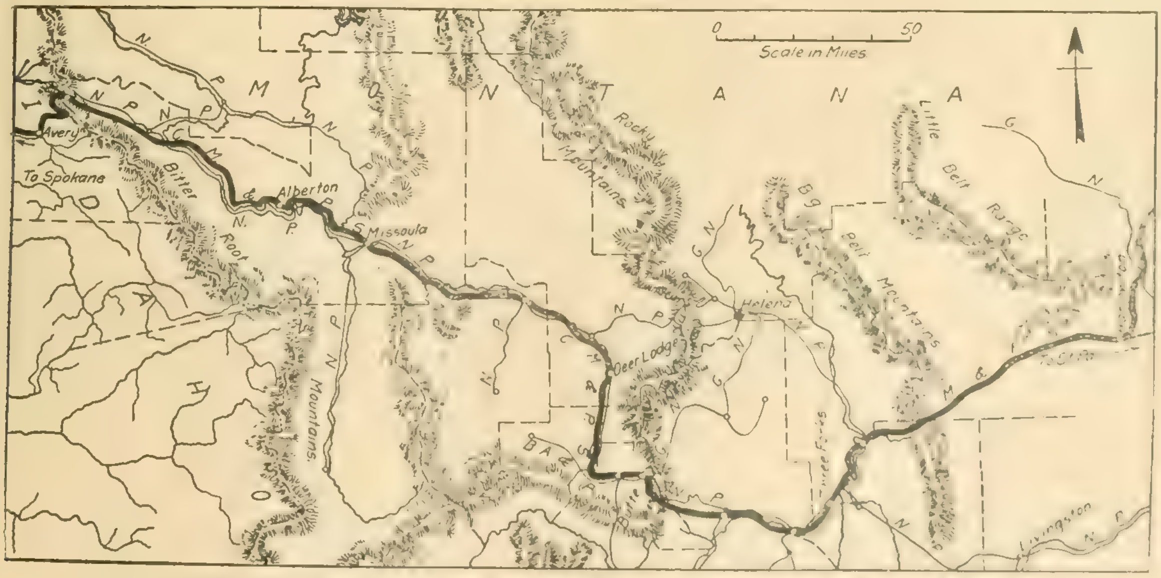
Mr. J. M. Munro (Glasgow) said that the lead sheathing of cables was returning to its own again now that safeguards were provided against leakage of current on to and from the sheath. But the inelasticity of lead and its consequent tendency to harden and creep and crack under mechanical stresses due to vibration, temperature variation or rough handling somewhat limited its use. Equipotential points also altered, not only with the growth of a network, but hourly with the diversity of load. It was disconcerting to hear of the hydrolysis of vulcanised bitumen, but he still imagined that moisture, even if slightly alkaline, but without current leakage, would not deeply injure vulcanised bitumen within any period of time likely to trouble the engineer who laid the cable. In all kinds of cable he set store by the filling of interstices between the wires of the core. There was need also for non-hygroscopic coverings to take the place of tape and braiding. Perhaps bitumen should be more largely used as a loading for rubber mixtures for cables, while what was known as cab-tire sheathing seemed likely to prove itself a distinct addition to the resources of those responsible for cables other than the underground type.

Mr. R. B. Mitchell pointed out that the author, in referring to cables suitable for pressures of 20 kilovolts, stated that makers had found no difficulty in keeping the dimensions of their cables within the limits of ordinary installation practice. It seemed to him that if the present British standards were adhered to, *i.e.*, if cables for 20 to 30 kilovolts had dielectric thickness in proportion to existing standards for 6 and 11 kilovolts, the result would be cables of unwieldy proportions. He found that a .2 sq. in. 3-core cable lead-covered and armoured for 30,000 volts could not be drawn into a 4 in. duct; without the armour it could be. The limiting size seemed to him to be that which could be got into a 4 in. duct. It had been suggested to him that 11,000-volt cable made to British standards would work quite safely at 20,000 volts. Time would show if that opinion was correct. The author stated that there was a much better chance of making a lead-sleeve joint watertight than a cast-iron box; but the wiped joints on lead sleeves could not always be relied upon, even if the highest class of labour was employed. In Glasgow this difficulty had been got over; a cast-iron sleeve was used, the ends being joined solid on to the lead and armour of the cable by means of cast lead, *i.e.*, lead in a molten state was run into a mould placed round the cable and sleeve. An absolutely watertight joint was obtained which would stand a water pressure over 100 lb.; no special labour was required, and there was no uncertainty as to the result as was the case with wiped joints. These joints were used not only for high-tension work, but also for services upon low-tension lead-covered and armoured cables laid direct in the ground. The results obtained in Glasgow with bitumen cables had been excellent in cases where the solid system had been used, but where the cables were drawn into ducts the results had been unsatisfactory, more particularly with small cables. The arc lamp circuits over the whole city were composed of bitumen cables drawn into iron pipes. The bitumen was found to crack in some cases and to soften in others.

In the course of his reply, Mr. Beaver assured Mr. Starr that very high-pressure cables were in contemplation; they were referred to in Messrs. Merz and Maclellan's report on the London systems, and he would not be surprised if the Newcastle district pressures, which had been pioneers up till now at 20,000 volts, would eventually be increased to 50,000 volts. The difficulty of providing charging currents was undoubtedly against them ever being used in very long lengths, but there would be quite a field for them apart from long lengths. Where the conditions were such as to permit of 50,000 to 100,000 volts pressure they would find that the conditions also allowed of overhead transmission. He did not agree that a paper containing a proportion of wood pulp would be better than a pure manilla paper. The improvement which had been made in the materials of vulcanised-bitumen cables militated much against their being damaged by overloading. Expansion defects which arose in the lead covering of cables were negligible, because they would be confined to some unfavourable place and the cable would go down in these places long before it suffered very generally. On the point of the association of rubber and bitumen and their mutual action, the addition of 10 per cent. of rubber to vulcanised bitumen showed practically no difference.

3,000-VOLT D.C. ELECTRIFICATION OF THE PUGET SOUND LINES OF THE CHICAGO, MILWAUKEE, AND ST. PAUL RAILWAY.

Plans for the electrification of the first engine division of the Chicago, Milwaukee and St. Paul Railway have now been completed and contracts let to the General Electric Co., of Schenectady, N.Y., for the electric locomotives, sub-station apparatus and line material, and to the Montana Power Co. for the construction of the transmission and trolley lines.



The Avery-Harlowton Section of the Chicago, Milwaukee and St. Paul Railway

This initial electrification of 113 miles of main line between Three Forks and Deer Lodge is the first step toward the electrification of four engine divisions extending from Harlowton, Montana, to Avery, Idaho, a total distance of approximately 440 miles, aggregating about 650 miles of track, including yards and sidings. While this comprises the extent of track to be equipped in the near future, it is understood that plans are being made to extend the electrification from Harlowton to the coast, a distance of 850 miles, should the operating results of the initial installation prove as satisfactory as anticipated.

The plans of the Chicago, Milwaukee and St. Paul Railway are of especial interest, as this is the first attempt to install and operate electric locomotives on tracks extending over several engine divisions, under which conditions it is claimed the full advantage of electrification can be secured. The various terminal and tunnel installations have been made necessary, more or less, by reason of local conditions; but the electrification of this road is undertaken purely on economic grounds with the expectation that superior operating results with electric locomotives will effect a sufficient reduction in the present cost of steam operation to return an attractive percentage on the large investment required.

The success of electric operation on such a large scale will, at least, settle the engineering and economic questions that enter into the advisability of making such an installation, and will limit similar future problems to the means of raising the money expenditure required.

The first step taken towards electrification by the Chicago, Milwaukee and St. Paul Railway was to enter into a contract with the Montana Power Co. for an adequate supply of power over the 440 miles of main line considered for immediate electrification. The precautions taken both by the railway company and power company to safeguard the continuity of power supply should guarantee a reliable source of power subject to few interruptions of a momentary nature only.

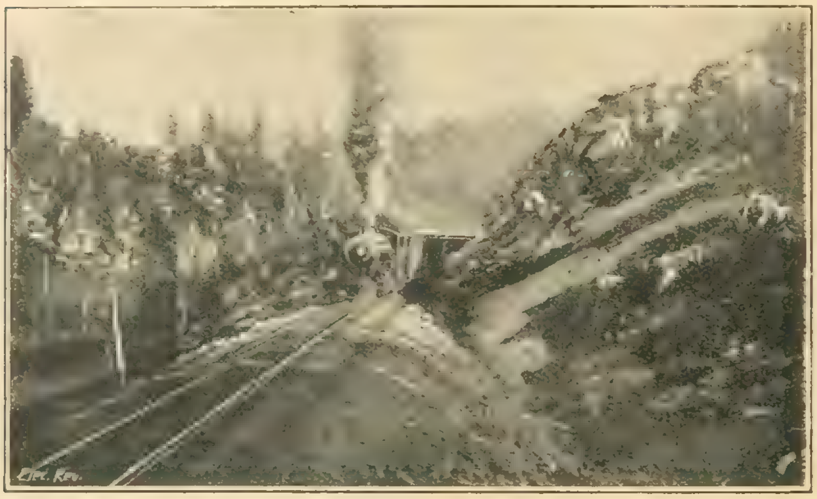
The Montana Power Co. covers a great part of Montana and part of Idaho with its network of transmission lines, which are fed from a number of sources with a total power capacity developed and undeveloped of 244,000 kw. The several power sites are inter-connected by transmission lines, supported on wooden poles and operating at 50,000 volts for the earlier installations, and on steel towers and operating at 100,000 volts for later installations.

Due to the great facilities available and the low cost of construction under the favourable conditions existing, the railway company will purchase power at a contract rate of $0.00536 per kw.-hour based on a 60 per cent. load factor. It is expected under these conditions that the cost of power for locomotives will be considerably less than is now expended for coal. The contract between the railway and power companies provides that the total electrification between Harlowton and Avery, comprising four engine divisions, will be in operation January 1st, 1918.

In order to connect the sub-stations with the several feeding-in points of the Montana Power transmission lines, a tie-in transmission line is being built by the railway company that will permit feeding each sub-station from two directions and from two or more sources of power. This transmission line will be constructed with wooden poles and suspension type insulators, will operate at 100,000 volts and will follow, in general, the right of way of the railway company except where advantage can be taken of a shorter route over public domain to avoid the necessarily circuitous line of the railway in the mountain districts.

The immediate electrification of 113 miles will include four sub-stations containing step-down transformers and motor-generator sets with necessary controlling switchboard apparatus to convert 100,000-volt 60-cycle three-phase power to 3,000 volts direct current. This is the first direct-current installation using such a high pressure as 3,000 volts, and this system was adopted in preference to all others after a careful investigation extending over two years. The 2,400 volt direct-current installation of the Butte, Anaconda and Pacific Railway in the immediate territory of the proposed Chicago, Milwaukee and St. Paul electrification has furnished an excellent demonstration of high-voltage direct-current locomotive operation during the past year and a half, and the selection of direct-current at 3,000 volts for the Chicago, Milwaukee and St. Paul was due in a large measure to the entirely satisfactory performance of the Butte, Anaconda and Pacific installation.

The equipment for this road was also furnished by the General Electric Co., of New York, and a comparison based on six months' steam and electric operation shows a total net saving of more than 20 per cent. on the investment or total cost of the electrification. These figures, of course, do not take into account the increased capacity of the lines, improvement to the service and the more regular working hours for the crews. The comparison also shows that the tonnage per train has been increased by 35 per cent., while the number of trains has been decreased by 25 per cent. with a saving of 27 per cent. in the time required per trip.



Typical Mountain Section to be Electrified

The sub-station sites of the Chicago, Milwaukee and St. Paul electrified zone provide for an average intervening distance of approximately 35 miles, notwithstanding that the first installation embraces 20.8 miles of 2 per cent. grade westbound and 10.4 miles of 1.66 per cent. grade eastbound over the main range of the Rocky Mountains. With this extreme distance between sub-stations and considering the heavy traffic and small amount of feeder copper to be installed, it becomes apparent that such a high potential as 3,000 volts direct current permits of a minimum investment in substation apparatus and considerable latitude as to location sites.

The sub-stations will be of the indoor type, the transformers being three-phase, oil cooled, and reducing from 100,000 volts primary to 2,300 volts secondary, at which potential the synchronous motors will operate. The transformers will be rated at 1,900 and 2,500 kva. and will be provided with four 2½ per cent. taps in the primary and 50 per cent. starting taps in the secondary.

The motor-generator sets will comprise a 60-cycle synchronous motor driving two 1,500 volt direct-current generators connected permanently in series for 3,000 volts. The fields of both the synchronous motor and direct-current generators will be separately excited by small generators direct connected to each end of the motor-generator shaft. The direct-current generators will be compound wound, will maintain constant potential up to 150 per cent. load, and will have a capacity for momentary overloads up to three times their normal rating. To insure good commutation on these overloads, the generators are equipped with commutating poles and compensating pole-face windings. The synchronous motors will also be utilised as synchronous condensers, and it is expected that the transmission line voltage can be so regulated thereby as to eliminate any effect of the fluctuating railway load.

The location and equipment of the several sub-stations is as follows :—

Station.	Miles from Deer Lodge.	No. of Units.	Kw. per Unit.	Total.
Morel	17.1	2	2,000	4,000
Janey	50.5	3	1,500	4,500
Piedmont	77.9	3	1,500	4,500
Eustis	120.6	2	2,000	4,000

The trolley construction will be of the catenary type, in which a 4/0 trolley wire is flexibly suspended from a steel catenary supported on wooden poles, the construction being bracket wherever track alignment will permit and cross-span on the sharper curves and in yards. Steel supports instead of wooden poles will be used in yards where the number of tracks to be spanned exceeds the possibilities of wooden pole construction. Poles for the first installation are already on the ground and thirty miles of poles are set. Work in this direction will be pushed with all speed and will be completed in the summer of 1915, ready for operation in the fall on the delivery of the first locomotives.

As the result of careful investigation and experiments, a novel construction of trolley will be installed, composed of the so-called twin-conductor trolley. This comprises two 4/0 wires suspended side by side from the same catenary by independent hangers alternately connected to each trolley wire. This form of construction permits the collection of very heavy currents by reason of the twin contact of the pantograph with the two trolley wires, and also insures sparkless collection under the extremes of either heavy current at low speed or more moderate current at very high speeds. It seems that the twin-conductor type of construction is equally adapted to the heavy grades calling for the collection of very heavy currents, and on the more level portions of the profile where maximum speeds of 60 m.p.h. will be reached with the passenger trains having a total weight of over 1,000 tons. The advantage of this type of construction is due partly to the greater surface for the collection of current, but largely to the very great flexibility of the alternately suspended trolley wires, a form of construction which eliminates any tendency to flash at the hangers either at low or high speed. Including sidings, passing and yard tracks, the 113 miles of route mileage is increased to approximately 168 miles of single track to be equipped between Deer Lodge and Three Forks in the initial installation.

The locomotives to be manufactured by the General Electric Co. are the first to be constructed for railroad service with direct-current motors designed for so high a potential as 3,000 volts. They will weigh approximately 260 tons and will have a continuous capacity greater than any steam or electric locomotive yet constructed. Perhaps the most interesting part of the equipment is the control, which is arranged to effect regenerative electric braking on down grades. This feature as yet has never been accomplished with direct-current motors on so large a scale. The general characteristics as proposed are tabulated below :—

Butte-Anaconda Electric Freight Train, Crossing C., M. and St. P. Tracks.

Total weight	260	tons.
Weight on drivers	200	tons.
Weight on each guiding truck	30	tons.
Number of driving axles	8	
Number of motors	8	
Total length of locomotive	112	ft.
Rigid wheel base	10	ft.
Voltage per motor	1,500	
H.P. rating one hour—complete locomotive ...	3,440	
H.P. rating continuous—complete locomotive	3,000	
Trailing load capacity, 2 per cent. grade ...	1,250	tons.
Trailing load capacity, 1 per cent. grade ...	2,500	tons.
Approximate speed at these loads and grades ...	16	m.p.h.

The Chicago, Milwaukee and St. Paul Railway, from Harlowton to the coast, crosses four mountain ranges: the Belt Mountains at an elevation of 5,768 ft., the Rocky Mountains at an elevation of 6,350 ft., the Bitter Root Mountains at an elevation of 4,200 ft., and the Cascade Mountains at an elevation of 3,010 ft. The first electrification between Three Forks and Deer Lodge calls for locomotive operation over 20.8 miles of 2 per cent. grade between Piedmont and Donald at the crest of the main Rocky Mountain Divide, so that the locomotives will be fully tested out as to their capacity and general service performance in overcoming the natural obstacles of the first engine division.

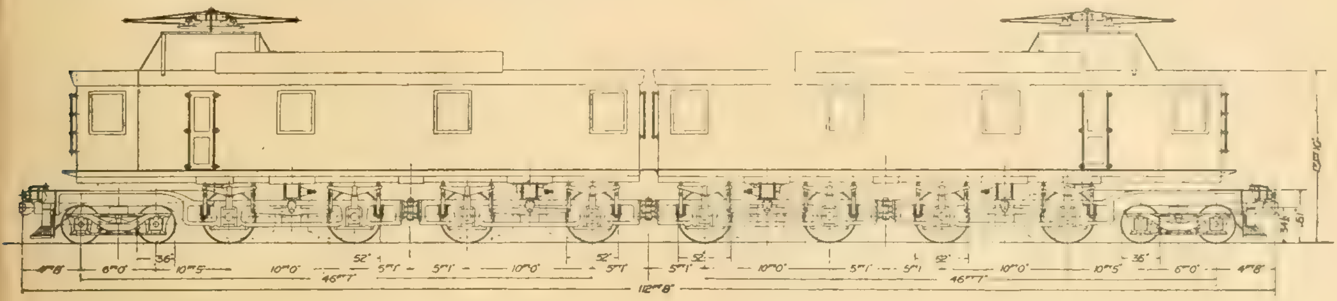
The initial contract calls for nine freight and three passenger locomotives having the above characteristics and similar in all respects, except that the passenger locomotives will be provided with a gear ratio permitting the operation of 800-ton trailing passenger trains at approximately 60 m.p.h., and will, furthermore, be equipped with an oil-fired steam heating outfit for the trailing cars. The interchangeability of all electrical and mechanical parts of the freight and passenger electric locomotives is considered to be of very great importance from the standpoint of operation and maintenance.

The cab consists of two similar sections extending practically the full length of the locomotive. Each section is approximately 52 ft. long and the cab roof is about 14 ft. above the rail exclusive of the housing for ventilation. The trolley bases are about 5 ft. above the roof, owing to the unusual height of the trolley wire, which will be located at a maximum elevation of 25 ft. above the rail. The outer end of each cab will contain a compartment for the engineer, while the remainder is occupied by the electric control equipment, train heater, air brake apparatus, etc.

The eight motors for the complete locomotive will be type GE—253—A. This motor has a normal one-hour rating of 430 H.P. with a continuous rating of 375 H.P. The eight motors will thus give the locomotive a one-hour rating of 3,440 H.P. and a continuous rating of 3,000 H.P., which makes it more powerful than any steam or electric locomotive ever built. The drawbar pull available for starting trains will approximate 120,000 lb. at 30 per cent. coefficient of adhesion.

Each motor will be twin-geared to its driving axle in the same manner as on the Butte, Anaconda and Pacific, the Detroit River Tunnel and the Baltimore and Ohio locomotives, a pinion being mounted on each end of the armature shaft. The motor is of the commutating pole type and has openings for forced ventilation from a motor-driven blower located in the cab.

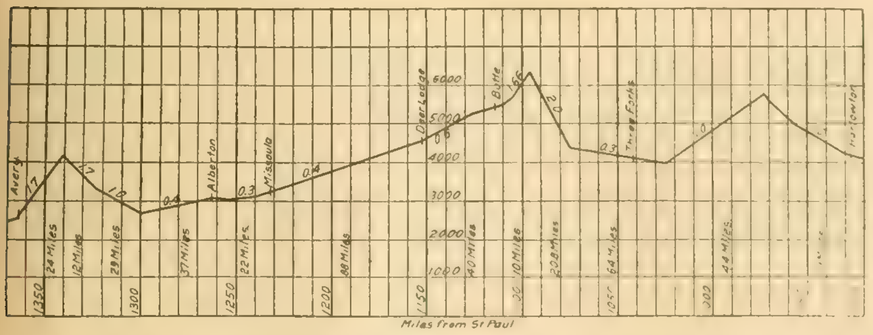
The freight locomotives are designed to haul a 2,500-ton trailing load on all gradients up to 1 per cent. at a speed of approximately 16 m.p.h., and this same train load unbroken will be carried over the 1.66 and 2 per cent. ruling grades on the west and east slopes of the Rocky Mountain Divide with the help of a second similar freight locomotive acting as pusher. Track provision is being made at Donald, the summit of the grade, to enable the pusher locomotive to run around the train and be coupled to the head end to permit electric braking on the down grade. In this case, the entire train will be under compression and held back by the two locomotives at this head end, the entire electric braking of the two locomotives being under the control of the motorman in the operating cab of the leading locomotive. It is considered that electric braking will prove very valuable in this mountain railroading, for, in addition to providing the greatest safety in operation, it also returns a considerable amount of energy to the sub-stations and transmission system, which can be utilised by other trains demanding power. In this connection, the electric locomotives will have electric braking capacity sufficient to hold back the entire train on down grade, leaving the air brake equipment with which they are also equipped to be used only in emergency and when stopping the train. There is, therefore, provided a duplicate braking system on down grades, which should be reflected in the greatest safety of operation afforded and the elimination of a considerable part of break-downs, wheel and track wear and overheating with consequent reduction in maintenance and improvement in track conditions.



3,000-Volt Direct-Current Locomotive for the Chicago, Milwaukee and St. Paul Railway.

With the completion of the remaining engine divisions, it is proposed to take advantage of the possibilities afforded by the introduction of the electric locomotive by combining the present four steam engine divisions into two locomotive divisions of approximately 220 miles length, changing crews, however, at the present division points. As the electric locomotive needs inspection only after a run of approximately 2,000 miles, requires no stops for taking on coal or water, or layover due to dumping ashes, cleaning boilers or petty roundhouse repairs, it is expected that the greater flexibility of the locomotive so provided will result in considerable change in the method of handling trains now limited by the restrictions of the steam engine.

In conclusion, we are indebted to the British Thomson-Houston Co., Ltd., whose allied concern in America is to carry out the contract, for the above particulars.



Profile of the Avery-Harlowton Section, Chicago, Milwaukee and St. Paul Railway.

ELECTRIC STEEL-MAKING FURNACES.

By T. D. ROBERTSON.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Manchester, January 26th,* 1915.)

The first electric furnaces to work on a commercial scale were all constructed about 1899, and all took their power from water-driven plants. These were the Stassano furnaces in Italy, the Héroult in Savoy, and the Kjellin in Sweden; from these three types have developed the three main classes of electric steel furnaces now in use.

In the earlier types of induction furnace the metal bath is in the shape of a ring, which is really the short-circuited secondary winding of a transformer contained in the body of the furnace itself. An example of this class is the Kjellin furnace. The disadvantage of this type lies in the fact that some of the molten metal must be left in the furnace at the conclusion of every "heat" in order that a complete circuit may be maintained to start the furnace again. Cold materials to form the charge are added to this residual metal, and a covering of slag is made to protect the charge from atmospheric oxidisation. Owing to the difficulty of keeping a suitable refining slag in a fluid condition, and also of removing it after it has taken up impurities from the steel, it is found in practice that very little refining can be done in the simple induction furnace.

In the Röchling-Rodenhauser furnace both legs of the transformer core are provided with primary windings surrounded by induction channels, which are joined in the centre to form a working hearth of ample dimensions. Auxiliary heating is accomplished by means of a secondary winding connected to pole plates which are embedded in the sides of the hearth.

Arc furnaces may be subdivided into radiation furnaces and conduction furnaces, the difference between them being that in the former the arc is struck between the ends of the electrodes themselves and the heat so produced is radiated on to the charge underneath, whilst in the latter the arc is struck between the ends of one or more electrodes and the charge itself.

The main furnace of the former class is the Stassano furnace. This was first developed in Italy, and is employed for steel melting in small sizes. Another furnace belonging to this class is the Rennerfelt furnace, in which three electrodes are used with two-phase current. Two horizontal electrodes, each carrying a separate phase, enter the ends of the furnace; a vertical electrode through the centre of the roof acts as a neutral return common to both phases. It is claimed that the arc in this case is deflected downwards on to the metal charge, which is thereby enabled to utilise the heat of the arc somewhat more efficiently than the Stassano furnace.

Coming now to the second and more important class of arc furnace, the earliest of these furnaces was the Héroult furnace. The current enters by one of two upper electrodes, passes first through the arc gap, then along the surface of the metal, and back by means of the other electrode to the generator. It has the important drawback of requiring single-phase current. Latterly, a three-phase Héroult furnace has been introduced suitable for construction in the larger sizes. The Héroult furnace has the disadvantage of surface heating. In other words, the upper layers of the charge are always much hotter than the lower, and this is undesirable when making high-quality steels requiring considerable quantities of ferro-alloys, as these sink to the lower portions of the furnace, where they melt only with difficulty.

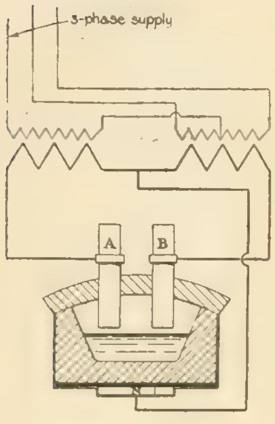


FIG. 1

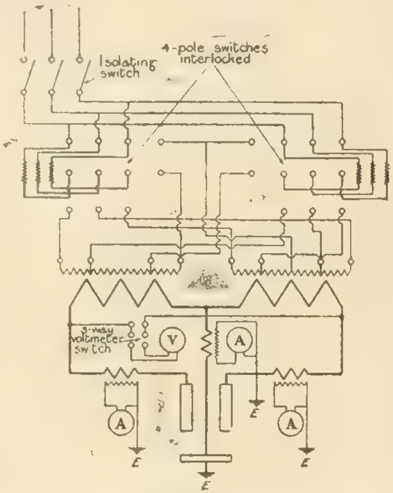


FIG. 2.

The Girod furnace is typical of the second class of arc conduction furnaces. There are one or more vertical electrodes according to the size of furnace and of like polarity. Embedded in the bottom and forming an integral part of the furnace are water-cooled steel studs, which project slightly above the bottom of the hearth and make contact with the charge itself, and so convey the current back to the generator.

Although this arrangement of steel studs in the furnace bottom is essential to the Girod system, it has its disadvantages, and in order to overcome these and at the same time obtain a furnace which will work from the usual supply mains through static transformers, the Electro-Metals furnace was designed a few years ago. The original inventors were the three Swedish engineers, Messrs. Grönwall, Lindblad, and Stälhane, who have designed and developed the Elektrometall shaft furnaces for the reduction of iron ores which have proved such a great success in Sweden. The development of their steel furnace has taken place mainly in this country where, after considerable time spent in experimenting, the furnace has now been thoroughly established for commercial working. Fig. 1 shows the main principles of the furnace.* Two-phase low-pressure current is employed, and this is obtained from a three-phase system through two single-phase transformers using the well-known Scott connection. There are two upper electrodes each carrying a separate phase, whilst in the bottom of the furnace beneath the basic lining is a third electrode which acts as a neutral return common to both phases. Thus the current flows, on each phase, starting from the transformer, along the copper leads to one of the upper electrodes, through this, across the arc gap, through the metallic charge, and thence through the basic lining to the bottom electrode, which consists of a layer of special carbon mixture covering the bottom of the furnace where connections are made to the neutral return leads, which are common to both transformers.

The electrical arrangement of the furnace is shown in fig. 2. The high-pressure supply, assumed in this case to be three-phase, is taken to an isolating switch inside the high-pressure cubicle, and from this it is divided into two circuits, each of which passes to a suitable oil switch, arranged with auxiliary contacts for charging resistances, to neutralise the effect of any sudden loads on switching in. It is found in practice that a fairly high pressure, say 80 volts, gives the best results during the melting stage, but that as much less power is required for the subsequent refining a lower pressure is desirable, as this gives much less wear and tear on the furnace roof and sides, especially during the latter stages of the process. In order to have these two pressures at the ready command of the operator, the switches mentioned above are connected to tappings on the high-pressure side of the transformers, one tapping to give a high pressure of say 80 volts and the other to give about 50 volts. These two switches are interlocked so that only one of them can be put in at one time, and the change from the high to the low pressure is made simply by tripping one switch and then moving along the interlocking bar and putting in the other switch.

As is the case in all arc furnaces, the current flowing in the furnace is controlled by raising and lowering the electrodes. In small furnaces this adjustment is made by hand, but in the larger ones where the moving portion of the electrode and holders, etc., weighs several hundred pounds a motor has to be used, in conjunction with some form of automatic regulator, preferably of the Thury type. In addition, a direct control is effected by tramway-type controllers, which in conjunction with speed regulators enable the electrodes to be quickly hoisted out of, or lowered into, the furnace.

Some of the difficulties which designers have to meet in electric furnace work are only brought out clearly by a consideration of the actual work that has to be done in the furnace itself. Assuming that the previous charge has been "teemed" and the furnace fettled, the cold scrap is thrown into the furnace hearth. This scrap, preferably of steel or wrought iron, is usually of very common quality and contains up to 0.1 per cent. of both sulphur and phosphorus. When the furnace is charged the current is switched on and the electrodes are lowered until an arc is struck between them and the upper portion of the charge. The automatic regulators are then switched on and set to give the required current. In the case of a four-ton furnace, the melting current is about 5,500 amperes, at 75 volts on each phase. The heat of the arc soon melts a large hole in the charge underneath and round each electrode, which continues to travel down as these holes become deeper until a bath of fluid metal is formed in the bottom of the furnace. This bath increases in depth as other portions of the charge melt into it, and the electrodes gradually rise with the level of the metal. By the time they have risen to the usual working level of the bath any unmelted portions of the charge are detached from the sides and pushed within the hot metal in the centre. During the melting the slag is added, consisting of a mixture of lime, fluorspar, sand, and either iron ore or hammer scale. This slag floats on the molten metal and the chemical actions of refining take place. The carbon in the scrap is oxidised by the iron oxide in the slag, and is given off in the form of carbon monoxide, which rising through the metal gives the appearance of boiling.

This boiling serves to bring the slag and metal into more intimate contact. The silicon and manganese in the scrap are oxidised, and their respective oxides dissolve in the slag. The phosphorus is oxidised and, in the presence of the lime in the oxidising slag, is formed into a phosphate of lime, which enters into the slag. A portion of the sulphur is also oxidised and passes away as a gas. When sufficient time for these reactions to take place has elapsed, the current is switched off and the furnace tilted backwards until most of the slag has run off through a small spout at the back of the furnace into a slag bogie. The remaining portions of the slag are pulled off by means of rabbles until the surface of the metal is practically free from slag. In this way phosphorus is removed. The recarburising additions are made to give the required carbon to the steel and another purifying slag is added. This consists of lime, sand, and fluorspar, and quickly melts when the current is switched on. The pressure is now reduced by changing over from one switch to the other, and the current at the same time is lowered to about 2,000 amperes. The phosphorus as stated above has been removed, but there remains among the injurious constituents in the metal the bulk of the sulphur and in addition a certain amount of oxide of iron which has come from the oxidisation of the scrap during the melting and from the oxidising slag that is necessary for the removal of the phosphorus. The metal must thus be freed from this oxide and from the sulphur. The oxide of iron in the metal is also soluble in this new slag, which takes it up until the solvent powers of the two fluids are equal. The oxide is then removed from the slag by means of the addition of finely-divided carbon in the form of powdered anthracite, which reduces the oxide of iron in the slag and at the same time makes a reducing atmosphere of carbon monoxide inside the furnace. In these circumstances the oxide of iron in the steel is continually passing into the slag as the carbon reduces it, and in this way the whole of the metal is gradually freed from its oxide. At the same time, under the reducing conditions and under the influence of the chemical composition of the slag, the whole of the sulphur is automatically removed from the metal into the slag. In this way the metal is purified into high-grade steel.

The steel being now purified is adjusted to what is required, by means of additions of alloys, the quantity of which is based on the result of a test analysis taken from the bath during the refining. A small addition of aluminium or an alloy of aluminium is usually added at the end in order to remove any trace of gases which may remain in the steel.

The ladle is brought under the tapping spout of the furnace, the small door above this is opened, and the furnace is tilted right over and its contents emptied into the ladle, from which it is teemed into the ingots or castings.

When deciding on which type of furnace to install, the questions of the initial cost of the plant, its suitability for running off existing power supplies, the cost of repairs to the furnace, and the ease with which these can be carried out are as important as the question of low power consumption. Much depends on the kind of raw materials used, upon the process employed, and upon the quality which is desired in the final product. Mild steel suitable for steel castings can be produced much more cheaply than the highest qualities of tool and alloy steels. When melting cold scrap, using two slags, and refining to a first-class quality, the approximate energy consumption decreases from 850 KW.-hours per ton, in the case of a two-ton furnace, to 700 KW.-hours per ton in the case of a five-ton furnace.

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* The Electro-Metals furnace was fully described in the Electrical Review of July 25th, 1913.—Eds.

In addition to the melting of cold materials, electric furnaces are largely used for refining fluid metal taken from open-hearth furnaces or Bessemer converters, this practice being more common in America and on the Continent than it is in this country. In America there is a big field open for the electric furnace in the manufacture of even such common material as steel rails. The specifications are continually becoming more severe, whilst the ores of the Lake Superior region are gradually becoming more impure; the steel made from them in the acid Bessemer vessels is gradually getting richer in phosphorus, so that a point has been reached when some purification will have to be made in order that the rails shall be capable of fulfilling the required tests. It is of interest to note that several thousand tons of electric steel rails have been in service on some of the main lines in America for some years and have up to the present given excellent results. The process of refining fluid metal is very similar to that employed in the ordinary way after the charge has become melted. A dephosphorising slag is added to the metal as soon as it is poured into the furnace, the finishing slag is added, and the process carried out in exactly the same way as that described earlier in this paper.

The electric furnace is also finding a field as an auxiliary to the open-hearth and Bessemer processes, being used to melt ferro-manganese additions, as it has been found that the saving in the amount of this alloy required more than pays for the cost of melting it electrically.

In this country the field for the electric steel furnace is mainly in the manufacture of tool and alloy steels, for making the smaller sizes of steel castings, and possibly in connection with the open-hearth and Bessemer plants for producing a superior product. Abroad, however, especially in those regions where water power is plentiful and electrical energy can be produced very cheaply, it is possible, in fact probable, that electric furnaces will be used to produce steel in large quantities instead of employing the older class of fuel-fired furnaces.

Discussion.

Mr. J. S. **Peck** said that the Electro-Metals furnace seemed to have a distinct advantage because it could be made for three-phase working down to comparatively small sizes, whereas the Héroult and other furnaces used three-phase for the large sizes only. Transformers of very special design were required for this work, on account of the number of low-tension coils in parallel to take the very high current. Tappings were also necessary from the high-tension winding in order to vary the voltage on the furnace. If these tappings were taken out in the ordinary way from part of the high-tension winding, there would be an unsymmetrical relation between primary and secondary, and very heavy local currents would probably occur. This difficulty could be overcome, and in general it was necessary to keep the positions of primary and secondary as symmetrical as possible. He asked a number of questions regarding the construction and use of electric furnaces.

Mr. K. M. **Faye-Hansen** considered the induction furnace the best type from the engineer's point of view; it was possible to make a Kjellin three-phase and arrange it so as to secure a fairly reasonable power factor in reasonable sizes. The steel makers looked at the problem from other points of view, and most of the commercial electric steel furnaces were on the arc principle. Regarding arc furnaces, the first consideration was to get a fairly steady load and a reasonably good power factor. These requirements acted against one another. For instance, a power factor of .97 would be reasonable, using a transformer with leads having very little induction, but immediately a short circuit occurred very heavy currents would flow and cause trouble with the supply company. Small furnaces admitted of power factors of, say, 90 per cent. with short-circuit currents not exceeding double full load, but with large furnaces it was not possible to obtain high power factors on account of the high induction effects. The manufacturer therefore arrived at certain limits of size dependent upon the voltage permissible at the arc.

Mr. D. S. **Panton** remarked that the author had recommended the Thury regulator; in his experience some of the other types were quicker in action in the case of large current variation.

Mr. **Eustace Thomas** spoke of the difficulty of obtaining steel of a particular quality in this country, whilst on the Continent higher grades were produced. One predominant feature, even with English firms of the highest repute, was their inability to reproduce the same steel at different times. A sample, not specially selected, but giving excellent results, might be obtained from the makers, but when the bulk was supplied, it might be totally different. Chemical and microscopical examinations seemed unable to reveal any difference, and it might be said that electrical tests had apparently proved far more searching than any chemical or physical tests which could be applied. Small quantities of impurities such as arsenic or sulphur, which subsequent chemical analysis would scarcely account for, might make an enormous difference. It would appear possible wih the electric furnace to make steel with much greater accuracy than with the ordinary furnace.

Mr. **Wilkinson** said that he was interested in a supply station in India which included an engineering works and foundry. Many hundred tons of scrap iron were lying useless, and it was considered possible to convert this by means of an electric furnace during the winter nights, when the load was comparatively small. An electric furnace might, in this case, be an ideal adjunct, and profitable to both departments.

Mr. G. L. **Rosser** asked whether only basic steel was manufactured in the electric furnace, and, if so, whether it was superior to that produced by the Siemens open-hearth acid process.

Mr. J. A. **Panton** wrote to say that some nine months ago he visited, at Sherbrooke, Canada, a works where electric furnaces were entirely used for smelting ordinary steel and manganese steel castings, including electrically smelted bronze bearings and ferro-manganese brake blocks, and for railway and tramway use. The type of plant in use was similar to the Héroult described by the author, but of the three-phase type, wherein the three vertical carbons were raised or lowered by hand gear into the square steel case, which was lined with special bricks, dipped in tar, and was mounted on curved rails for tilting purposes; the tilting was effected by hand power, and water cooling was provided round the electrode holes. The electrodes were 7 in. in diameter and about 3 ft. long, screwed male and female for continuous feeding. This represented a two-ton furnace, which invariably received a charge of 35-30 cwt. of metal. The power was supplied by a waterfall seven miles distant, arriving at the works at 6,600 volts, which was transformed down to 110 volts. The time taken for a cold charge was five hours, but as the plant invariably worked night and day the remaining heats took four to four and a quarter hours. The starting current represented 264 KW., or 2,400 amperes melting current on the low side, so that for a four hours' charge the consumption was about 900 KW.-hours for 30 cwt. of metal in the ladle; the cost per unit was 0.2 of a cent, contracting for large blocks of power annually. The chief difference between the castings made by the new and old processes was that owing to the low carbon in electric castings, many were used without annealing. He agreed with the author that a very fine field existed for electric steel rails, especially of the manganese or ferro-manganese type. Caution should be exercised not to reduce the conductivity of rails used for electric railway and tramway purposes, and with regard to tramways where magnetic slipper brakes were in use, manganese steel made by the electric process was practically non-magnetic, more so than manganese steel made by the ordinary process.

The **Author**, in reply, said that makers in the early days of electric furnaces had experienced a lot of trouble at the works of their customers, who expected immediate commercial results. This led to a deal of prejudice against the electric furnace; but now, fortunately, the prejudice was being overcome and furnaces were working steadily and continuously on sound lines. Fifteen-ton furnaces had been used in America, chiefly for refining metal for steel rails. Tests were now in progress with rails produced in this way, and there was every indication that the results would be very satisfactory. A big development was to be expected in the United States in the use of large electric furnaces for refining crude Bessemer steel. The largest electric furnace known to the author was a Girod furnace of 20-ton capacity installed in France previous to the war. The subject of ore reduction by electricity was treated in reports published at various times in Sweden, which possessed favourable conditions in the form of reasonably cheap power and suitable ore. At the present time Sweden [illegible] electric furnaces either working or being installed with a total capacity of 10,000 H.P. The price at which electric [illegible] permit economical working depended upon the quality of the product required. Generally speaking, with energy at ¼d. or .6d. per KW.-hour the electric furnace would compete in the small steel casting industry. It would certainly [illegible] high-grade tool steels. The heat in the induction furnace was generated within the metal comprising the ring round the transformer; consequently the slag, which rested on the top of the metal received its heat from the latter. This condition, together with exposure to the atmosphere, caused the slag to be cooler than the metal during the whole process, and for this reason certain slags which would otherwise be suitable could not be employed. In the arc furnace the conditions were reversed, as the arc passed on the slag, which in turn delivered heat to the metal. This condition ensured proper chemical reaction in steel refining. The power factor in large induction furnaces was very bad and generally low frequency had to be employed. A two-phase furnace should not be liable to suffer from shorts on both phases at once, so that the total disturbance was reduced. The worst [illegible] occurred during melting, when the metal became soft and fell against the electrode, and the usual procedure was to raise the electrode out of the way when this occurred. It was necessary to have the current passing through the bottom of the two-phase Electro-Metals furnace during the whole period. This [illegible] in the refining stages, as in the later stages the [illegible] the metal avoided inequalities in temperature of the metal. A modification of the two-phase furnace was to be introduced whereby the amount of current flowing in the bottom of the furnace would be under control. The Continental steel referred to by Mr. Thomas was probably electric steel, and very regular and uniform in quality. In the author's opinion the trouble with crucible steel was the fact that the crucibles themselves contained a small quantity of steel, and no two crucibles would smelt out exactly alike. In consequence, there was much more danger of variation than in the case of the electric furnace, where the sole charge was of uniform quality. The chief advantage of electric steel was that the injurious oxide of iron which was present in all molten steel could be effectively removed, owing to the reducing conditions in electric arc furnaces. In reply to Mr. Wilkinson, with a two-ton furnace the total time between teeming one heat and teeming the second heat would be about six hours. The melting period would be about three hours, during which time the full capacity, say 400 KW., would be taken. The second or refining period would probably take only 200 KW. and would last about two hours. Taking the case of a furnace working continuously, that is to say, 24 hours per day and five days per week, so as to allow for repairs, twenty charges per week of 45 or 50 working weeks per annum would be usual. The power factor depended upon the arrangement of leads, but in the case mentioned it would be about .9. One hour in the six referred to would be allowed for charging, removing slag, etc. The time table quoted would not apply to special tungsten steel, but for refining any scrap and making carbon steel with low sulphur and phosphorous, say .08-.1 per cent. sulphur and phosphorus in the raw material down to .02 per cent. sulphur and the same phosphorus in the finished product. With one or two exceptions all electric steel was made on a basic bottom. Dephosphorising could not be carried out on an acid bottom. The low carbon in electric steel castings was very important, as it admitted of such castings being subsequently machined without annealing. In the case of crucible steel castings, the carbon could not be brought so low, and consequently they were hard and required annealing before machining.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

[illegible] for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at [illegible] Bradford, to whom all [illegible] should be addressed.

1,14[illegible]. "M[illegible] compasses for [illegible] aviation, [illegible] purposes." [illegible] A. J. Hughes [illegible] & Son, Ltd. January 25[illegible]

1,157. "Means for the attachment of electric lamps or ceiling roses to [illegible] the like." W. D[illegible] & H. G[illegible]. January 25th.

1,1[illegible]. "[illegible] boxes." W. D[illegible] & H. G[illegible]. January 2[illegible]

1,173. "Tilting electric furnace for melting and refining metals." F. Bas[illegible]. January 25th. (Complete.)

1,214. "Electric generators and motors." M. M. Cardellino. January 25th. (Complete.)

1,221. "Electric arc-lamp carbon ferrules." T. Moore. January 26th.

1,234 "Stranded electrical conductors." M. Hochstadter. January 26th. (Convention date, January 28th, 1914, Germany.) (Complete.)

1,240. "Gyrostatic apparatus." J. Gray & J. Gordon Gray. January 26th.

1,249. "Microphone specially adapted to receive and to transmit with great intensity the particular sounds for which it is regulated." R. F. Bossini. January 26th.

1,275. "Pocket electric flash-lights." W. J. Mellersh-Jackson. January 26th. (Samuel Isaac Posen, United States.) (Addition to 18,809/14.) (Complete.)

1,284. "Electrically-controlled feed-operating mechanism." Vulkan Maschinenfabriks. Akt. Ges. January 26th. (Convention date, February 2nd, 1914, Germany.) (Complete.)

1,286 "Electrical heating devices." Joh. Kremenezky (firm of). January 26th. (Convention date, February 21st, 1914, Austria.) (Complete.)

1,316. "Means for controlling electrical illuminating or advertising devices." W. & T. Avery, Ltd., & R. Robert Gibbs. January 27th.

1,328. "Electric switches." H. Lucas & W. H. Edwards. January 27th. (Complete.)

1,340. "Central station generating plant." British Thomson-Houston Co., Ltd., F. H. Clough & F. Samuelson. January 27th.

1,341. "Illuminating apparatus." British Thomson-Houston Co., Ltd. January 27th. (General Electric Co., United States.)

1,346. "Insulation of telephone cables." K. W. Wagner. January 27th. (Convention date, January 20th, 1914, Germany.) (Complete.)

1,369. "Electric lamps for use on bicycles and the like." J. J. Rowe. January 27th.

1,376. "Electric ovens." I. T. Negus. January 28th. (Divided application on 9,213/14, April 14th.)

1,377. "Electric ovens." I. T. Negus. January 28th. (Divided application on 9,213/14, April 14th.)

1,402. "Wireless apparatus." E. R. Clarke. January 28th.

1,404. "Controlling dynamo-electric machines running at varying speeds." A. W. S. Pocklington & H. F. Foster. January 28th.

1,428. "Electrically-propelled motor vehicles." P. A. H. Mossay & Mossay [illegible]. January 28th.

1,435. "Dynamo-electric machines and electrical systems connected therewith." J. Stone & Co., Ltd., and A. H. Darker. January 28th.

1,453. "Mercury globule electrical contact-maker for releasing mine winding signal indicators, actuating indicators of the stopping, starting, and reductions of speed of machinery and the like." G. Saint. January 29th. (Complete.)

1,468 "Starting electrodes for vapour electric devices." F. Conrad. January 29th. (Convention date, January 30th, 1914, United States.) (Complete.)

1,470 "Automatic and semi-automatic telephone systems." Betulander Automatic Telephone Co., Ltd., & W. Aitken. January 29th.

1,471 "Automatic and semi-automatic telephone systems." Betulander Automatic Telephone Co., Ltd., & W. Aitken. January 29th.

1,472 "Semi-automatic telephone systems." Betulander Automatic Telephone Co., Ltd., & W. Aitken. January 29th.

1,480. "Manufacture and use of luminous radiations for therapeutical purposes." W. S. Simpson. January 29th.

1,483. "Intergrating electric wattmeters." J. Hikeley. January 29th.

1,500 "Lamp supports and casing, particularly designed for use with electric incandescent lamps." B. J. Grigsby. January 29th.

1,507. "Chocks or apparatus for the shaping of pottery." F. Hancock. January 29th.

1,520. "Miners' electric safety lamps." C. H. Elliott & G. Barstow. January 30th.

1,522. "Telautograph apparatus." A. Montgomery Low. January 30th.

1,525. "Construction of electric batteries. H. F. Joel. January 30th.

1,530 "Electric batteries." B. Pordes. January 30th. (Complete.

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24,422. Sockets for Electric Incandescent Lamps. C. A. Vetter. October 28th.

27,542. Apparatus for use in connection with the Electric Lighting of Automobiles. F. L. Wilson. November 29th.

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29,366. Limit Switches employed to Control the Movements of Electrically-operated Cranes, Hoists, Freight and Passenger Elevators, Winches, Turntables, and the like. Craven Brothers, Ltd., F. Garner, & A. E. Horrocks. December 20th.

1914.

123 Electric Accumulator Cells. Svenska Ackumulator Aktiebolaget Jungner. January 2nd. (January 16th, 1913.)

415. Clockwork Mechanism for Controlling Gas Valves, Electric Switches, and the like. E. H. Horstmann, G. O. H. Horstmann, A. Horstmann, S. A. Horstmann, & W. T. Edgar. January 7th.

590. Electric Resistances. G. Mascarini & A. Contardi. January 8th. (January 11th, 1913.)

796 Automatic Printing Register for Ships' Engine-room and Bridge Telegraph. T. Nicholson & L. R. Barron. January 12th.

815. Electric Resistances. H. Snowdon. January 12th.

816 Method of Operating or Actuating Audible Alarms. E. V. Gratze. January 12th.

1,008. Electric Switch. A. C. Greene. January 14th.

1,341. Dynamo-electric Machines. A. H. Midgley & C. A. Vandervell. January 17th.

1,556. Control of Moving Bodies by Radiant Energy. J. H. Hammond, Jun. January 20th. (Convention date not granted.)

1,587. Bonding Devices for Electrical Conduit Systems. D. L. J. Broadbent. January 21st. (Cognate application 6,811/14.)

3,192 Radio-telegraphic Stations. E. Girardeau. February 6th. (February 17th, 1913.)

3,217. Locks for Handles for Controllers and the like. British Thomson-Houston Co. (General Electric Co.). February 6th.

4,473. "Device for controlling the frequency of automatic intermittently-operated lighting apparatus." Aktiebolaget Lux. February 20th. (February 22nd, 1913.

5,456. Electric Incandescent Lamps. British Thomson-Houston Co. (General Electric Co.). March 3rd.

6,652. Composite Trolley Wheels. E. M. Taunton & Electro-Mechanical Brake Co. March 16th.

7,145. Heating Elements of Electric Stoves and the like. O. C. Hawkes. March 21st.

8,263. Toothed Wheels. British Thomson-Houston Co. (General Electric Co.). April 1st.

9,046. Production of Ultra-violet Rays. J. Von Kowalski-Wierusz. April 9th.

9,367. Methods of Coating Metals with Zinc and apparatus therefor. British Thomson-Houston Co. (General Electric Co.). April 15th.

10,364. Perforated-tape Controlled Automatic Impulse Transmitters. H. Pfannenstiehl. April 27th. (April 29th, 1913.)

11,084 Transport of Electric Searchlights or Projectors. Soc. Anon des Automobiles & Cycles Peugeot. May 5th. (May 6th, 1913.)

11,526 Devices for Maintaining Oscillating Movements of Submarine Mines and like Floating Bodies between [illegible]. I. Carlander. May 7th. (May 28th, 1913.)

11,355. Points for Tramways, Railways, and the like. Edgar Allen & Co., & E. Larmuth. May 8th.

11,564. Electric Impulse Transmitting Device. E. C. R. Marks (Canadian Independent Telephone Co.). May 11th.

12,005. Electric-ignition Plugs for Internal-combustion Engines. D. Roberts. May 15th.

12,656 Telephone Set. P. L. Jensen & E. S. Pridham. May 22nd.

13,018. Telegraph Receiver and Keyboard Telegraph Transmitter. E. J. K[illegible]. May 27th. (Addition to 21,332/12 and 3,582/13.)

14,0[illegible] Current Collectors for Electric Tramways. Compagnie Générale des Omnibus de Paris. June 11th. (June 13th, 1913.)

14,358. Means for Conveying Articles through the Bath of an Electro-plating or other apparatus. C. K. Mills (Hanson & Van Winkle Co.). June 15th.

14,[illegible]67. Means for Transmitting Rotary Motion. Jandus Arc Lamp & Electric Co., and A. Denman-Jones. June 17th.

15,456. Electrodes for Electric Furnaces. F. J. Machalske. June 27th. (June 27th, 1913.)

17,038. Systems and Methods of Electric Motor Control. L. G. Riley. July 17th. (October 3rd, 1913.)

18,[illegible]78. Compasses for use on Board Ship or on Aeroplanes or for other Purposes. W. D. Whyte. August 7th.

21,966. Magneto-electric Generators for Ignition Purposes. C. T. Mason. November 3rd. (Divided application from 29,655/13, December 23rd.)

THE
ELECTRICAL REVIEW.

VOL. LXXVI. FEBRUARY 19, 1915. No. 1,943.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: February 19, 1915. [No. 1,943.

Page
More about Co-operation 237
A Blank Specification 238
The Rubber Market 239
Delays in Delivery 239
A High-Pressure Transformer (*illus.*) 240
The Electrical Trade of Siam, by "L. A. de M." 241
The late Mr. William Bulloch (*illus.*) 243
The Industrial Position in the United States 243
Export Trade of Sweden 244
Polyphase Commutator Machines and their Application, by N. Shuttleworth (*illus.*) 244
War Items 245
Legal 246
New Electrical Devices, Fittings and Plant (*illus.*) 247
Business Notes 249
Notes 253
City Notes 256
Stocks and Shares 261
Market Quotations 262
Log Books and Sheets for Electricity Works, by "Interested" 263
Modern Wiring Work, Particularly in Bad Situations, by H. C. Tofield (*illus.*) (*concluded*) 264
Modern Methods of Electrical Wiring 266
Conditions affecting the Variations in Strength of Wireless Signals, by E. W. Marchant, (*illus.*) 267
Correspondence—
    The Government Electric Power Station of Bangkok ... 269
    The Capture of German Foreign Trade 270
    Salaries of Junior Engineers 270
    Wonderful Accumulator Cells 270
    Consulting "Engineers." 270
    Extra High-Tension Cable 271
Our Legal Query Column 271
Electrical Patents owned by Alien Enemies 271
New Patents Applied For, 1915 272
Abstracts of Published Specifications 272
Contractors' Column ... ... Advertisement page xx

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OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

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THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).
1915 EDITION
IN THE PRESS.
H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

MORE ABOUT CO-OPERATION.

WE print on another page to-day some interesting comments that were made last month by one of the leading electro-industrial authorities in America, which bring home to our minds more forcibly than any other observations that we have yet read, the extent of the depression in some trans-Atlantic industries. Mr. Trip shows that while the foreign works associated with his particular organisation—that is, the factories in England, France, Italy and even in Austria—are very busily engaged, partly, it is true, with war orders, those in the States, far removed from the war zone, are only operating at between 50 and 60 per cent. of their normal output. He also does not conceal the belief that if (we say *when*) the Allies win, England will derive greater permanent commercial benefit from the war than the United States will do. While all the world save perhaps the lie-deceived people of enemy countries, knows well enough that England did not, nor never would have done, enter upon this colossal conflict for the mere sake of economic interests, it would be absurd for us to affect to believe that the future course of inter-Colonial and international trade will not be very materially influenced by what has been happening. The Colonial and Allied sentiment is undoubtedly strongly in favour of England at the moment, and the future interests of all these parties will be to a very large extent bound up together, so that that favourable sentiment will, failing unforeseen and improbable mishaps, become increasingly strengthened. We firmly believe that the overwhelming majority of opinion in the United States is faithful to the cause of general freedom and to the suppression of the monster of militarism, and if coming events do not contribute any serious reason for removing that belief from the minds of the nations that are now trying to free both hemispheres from the menace, the United States as an industrial people should also stand to gain. But, of course, it must not be suggested that that should be advanced as an inducement to Brother Jonathan to drop his attitude of neutrality.

It is clearer than ever from Mr. Trip's remarks that American depression is far from being entirely due to the war: our cousins' troubles were already well begun months before the outbreak, and the trade position had become very unfavourable. Under such circumstances, it is but natural that the disorganisation of world affairs due to Prussian and Austrian ambitions, should have brought serious effects upon a people already industrially under a cloud.

What the States seems to need for the assistance of its industries is a revival of confidence, and to engender that confidence Mr. Trip lays emphasis upon the usefulness of "co-operation." Let us co-operate, he says, by joining hands to "bring about a better business state of mind"; let everybody make a cautious start, taking a little risk, and a general movement will result which will be surprising. One of the directions in which he advises Americans to assist such a movement is by taking advantage of these "dull times" to "overhaul your roadbed, plant and machinery, and make small additions against future growth." Roadbed was mentioned because the speaker was addressing the members of a Street Railway Club, but the proposal in principle is similar to that advanced by Mr. T. Roles in his I.E.E. Sectional Address. The latter gentleman referred to the possibility of municipal electricity works and manufacturers adopting a measure of co-operation in the ordering of certain requirements. We discussed the matter favourably in an editorial entitled "Co-operation," in the ELECTRICAL REVIEW for November 20th, 1914, and we referred in the same article to certain proposals for co-operative electrical dealing which came to an ignominious end some years ago. Of course when one refers to the events that happened years ago and proved failures, one does not expect it to be necessary to say why they had "no burial." Having thus referred to the ignominious end of one particular scheme, we, as editors, could only be amused when a writer, who apparently knew but little about the matter, allowed himself to flounder so helplessly by describing us as having "attended the funeral" of the "great principle" of co-operation.

Those who have closely followed their ELECTRICAL REVIEW in its discussion of trade and industrial affairs, do not need to be reminded that we have consistently advocated co-operative measures for alleviating the troubles and assisting the expansion of the electrical industry, and we have consistently supported worthy efforts on the part of our manufacturers in such directions. We were regular attendants at the gatherings of the old National Electrical Manufacturers' Association, and our pages in those early days show how earnestly we worked and wrote in its interests; more than once it thanked us for our assistance. That Association, whatever defects it had, and it certainly had some, formed the nucleus of the other organisation which, we are now pleased to learn from the first number of its *Journal*, is actively engaged upon a programme of co-operative aggression in the Colonial and foreign markets, the like of which has never been adopted by the British electrical industry in the past. Has it not inaugurated "everyone of the suggestions" contained in our editorial of November 20th, 1914? Let the reader who wants to know whether the British electrical manufacturers are doing anything, and what, along co-operative lines, refer to our aforesaid article, tabulate the suggestions therein contained, and, leaving the ranks of the critics and the grumblers, let him forever hold his peace.

Independent of the assurance that is thus conveyed—though it may be that we are wrong in assuming that our suggestions have been adopted, as the paper referred to is not named, but is merely described as "one of our contemporaries," and some editorial other than our own may be referred to—we are very pleased to know that groups of British electrical manufacturers are deeply engaged upon co-operative schemes for enterprisingly dealing with the requirements of some of the great markets that are expected to offer such brilliant opportunities. We confidently anticipate that the most gratifying results will sooner or later, perhaps immediately, reward the efforts of those who have had the courage and patience to develop schemes and are prepared to make the necessary initial sacrifice. It is many years ago now, when manufacturers were only just beginning to "get together," that we published appeals from China, Australia, and from Canada, from expert contributors of our own who had travelled the world over in the interests of trade, and from Governmental trade representatives whom we interviewed when home fresh from their Colonial investigations, urging British electrical and engineering firms to come together in groups, and by dint of the strong organisation and backing thus obtained, secure for us a more reasonable command of excellent markets. It is with pardonable pride that we see that our suggestions, which were sometimes received with contumely, but nevertheless were consistently supported by means of editorials and by contributions of expert students of world trade, are, in this year of grace 1915, being adopted at any rate by some of our firms.

Though we have never attended the "burial" of the principle of co-operation, we have recorded the liquidation of some projects inaugurated with that great word upon their banners, and it has been our painful duty to observe what has happened when the reader of, or the advertiser in, an electrical publication has been afforded an opportunity of being a shareholder in the same. Publications in which the advertisers are the shareholders cannot hope to possess the smallest shred of independence, though they may have special functions to fill in which that important quality does not count. While we advocate co-operation, we recognise that it has its limitations; only last year we witnessed the inability of avowed apostles of the principle of co-operation to co operate among themselves.

The reader will observe that "that blessed word" co-operation has led us a long, long way from where we meant to go when we started to write this article. Mr. Trip urges Americans to co-operate and revive home industries by an effort to engender widespread confidence—ordering requirements ahead so as to fill the blank spaces in their works. We continue to urge manufacturers, whether organised or not, to do their utmost to ensure a splendid position for British electrical and engineering industries in the future, by adopting and pursuing unceasingly measures which will gain for us a firm hold upon Colonial, European and other foreign markets—individually, if they are strong enough, as some undoubtedly are, but co-operatively, in groups, if they cannot tackle the business alone. We believe that they will be able to rely upon the co-operation of the British people for a time as regards the home market, especially if there be some modification of Government policy so as to favour the purchase of British products with British public money. Even if that, when granted, only continues for a time, it will materially assist until the benefits of campaigns abroad bring a large and continuous volume of new business from Colonial and European markets.

A Blank Specification. To record a protest against methods of procedure which impose unjust burdens upon firms tendering for contracts is no new policy with us; but in the past we have usually taken up the cudgels on behalf of manufacturers of electrical machinery, whereas the case to which we now wish to direct attention concerns installation contractors only.

The matter arises in connection with the electric lighting of a new sanatorium at Thingwall, for the Corporation of Birkenhead, under the superintendence of the borough engineer and surveyor (a M.Inst.C.E.); from original documents we gather that the engineer invited a number of contracting firms to tender for the work, by means of a circular letter which stated that plans might be seen, and specifications, bills of quantities, and form of tender obtained at his office, on payment of a deposit, to be returned on receipt of a *bonâ fide* tender. Fourteen days from the date of the circular were allowed for the lodging of sealed tenders—including eleven working days.

There was nothing extraordinary in this; but the so-called specification, when obtained, was found to consist mainly of general conditions, and a list of the rooms to be lighted, with their dimensions. A key plan to the district, and a plan of the laundry block, accompanied the "specification," but no other drawings were provided. The main buildings comprised 38 rooms, including two wards, and there were, in addition, 12 rooms in other buildings, two large shelters, and the grounds to be lighted. From the meagre data supplied, it would be impossible to prepare even an approximate estimate of the cost of the installation; no scheme was obtainable, and the borough engineer, we are informed, stated that he was asking a number of firms to draw up schemes, with the intention of selecting one of these and then asking the firms to tender. In other words, he invited these firms to act as honorary consulting engineers, and did not even promise to place the order with the winner in the preliminary competition or to remunerate him in any way.

The whole procedure was objectionable on various grounds. In the first place, the engineer, if he felt himself unqualified to draw up a proper scheme and specification, ought to have called in the aid of a competent consulting electrical engineer to do so; such a proceeding would have been in no way undignified, he being a civil not an electrical engineer, and it would have safeguarded the public interests against waste and inefficiency. Secondly, a deposit ought not to have been demanded, seeing that a *bonâ fide* tender obviously could not be submitted, and indeed was apparently not desired. While the practice of placing the whole matter in the hands of a selected contracting firm of high standing might have been adopted in the case of a private contract, it is not permissible in the case of a municipal contract, which *must* be put up to public tender; but such tendering should be based upon uniform requirements, which cannot be the case when no definite scheme is placed before the tenderers. And lastly, to require a number of firms to incur the expense and loss of time involved in preparing separate schemes is not only an undesirable proceeding at any time, but is unpatriotic when we are at war and when the services of every engineer should be utilised in the most efficient way.

The proper course in such a case is for every contractor to decline to tender under such conditions.

The Rubber Market.

THERE has not been any change of importance in the prices ruling from day to day for crude rubber, but the tendency of the market appears to have been quietly towards improvement. The home trade demand has continued good, which is quite in keeping with the well sustained activity shown in pretty well all branches of the manufacturing trades, the state of things in the various tire plants all over the country being absolutely unprecedented. The immense orders given out for life-saving equipment for distribution to all those employed in the Fleet, has put manufacturers in a difficult position on account of the terrible pressure which exists for deliveries, and this at a time when all other departments of works are running night and day on State orders. As regards export business, the American demand has not been quite so active as it was recently, which is only natural, for quite heavy quantities were dispatched some time ago to New York. Moreover, it is understood that certain big consumers at Akron, in Ohio, have taken very large deliveries. A good deal of this rubber was, during the embargo, diverted to Toronto, where it was temporarily held up, but big consignments have also been shipped from Liverpool by mail steamer, so urgent was the need for raw material at the American plants. The difficulties of obtaining supplies of finished goods for the troops would have been rendered exceedingly acute had not the embargo been relieved by the resumption of exports of rubber from here to the United States. As it was, the price of crude rubber in America practically doubled during the duration of the embargo, but now things are assuming a more normal appearance. The following guarantee has to be signed by American firms importing rubber from the United Kingdom :—

We will not export from the United States any raw rubber, reclaimed rubber, or waste rubber, whether the same has been imported from the British Dominions or not, otherwise than to the United Kingdom or to a British Dominion.

We will not sell the rubber now delivered by you to any dealer or other person or persons in the United States, but will use it for our own manufacturing purposes.

All orders received by us for manufactured or partly-manufactured rubber goods to be sent to neutral European countries shall be executed from stocks maintained by us in the United Kingdom or be executed by shipments to the United Kingdom, and reshipped from there under licence to be obtained for export therefrom.

We will not execute any orders for manufactured or partly-manufactured rubber goods to be sent either directly or indirectly to any country or State at war with Great Britain.

We will not sell any manufactured or partly-manufactured rubber goods to any person in the United States without satisfying ourselves that there is no intention on his part to export or resell the same for exportation to any countries in Europe other than Great Britain, France, or Russia, otherwise than by shipping to the United Kingdom and reshipping from there, under licence to be obtained for export therefrom.

If we export any manufactured or partly-manufactured rubber goods to a destination outside Europe, not being in a British possession, we will prior to or simultaneously with this shipment, give particulars of the goods so shipped and their destination.

All rubber tires exported by us or sold by us for export shall bear a distinctive name or mark which we will communicate to you, so as to identify them as being our manufacture.

The strenuous efforts made by Germany to obtain rubber are shown by the detection on the steamer *Cretic*, loading in the United States for German ports, of bales of cotton-waste each containing 4 lb. of rubber. The fraud was discovered by the X-ray examination always now conducted in connection with the loading of vessels for Germany at American ports.

According to official information issued, the export of rubber from the Federated Malay States during January was 3,473 tons compared with 2,542 tons in January, 1914, and 3,361 tons in December last. The returns for January constitute an absolute record, and testify alike to the progress of production there and to the clean sweeping of the seas by the British Navy.

Delays in Delivery.

IT is a matter of common knowledge that certain of our electrical manufacturing firms have been called upon by the Government to carry out urgent orders in connection with the operations of the naval and military authorities; in some cases almost the whole output of the works has been devoted to this pre-eminently important service since the commencement of the war, greatly to the detriment of the ordinary business of the firms concerned. The prices paid by Government for such work have not been gilt-edged, and it would be a mistake to suppose that the manufacturers were greedily taking advantage of the nation's need. Moreover, large numbers of skilled workmen have been called up to the Colours or have enlisted, with the result that workshop organisation has been seriously embarrassed, though the authorities, recognising this fact after a time, declared that such men would serve their country no less effectively by continuing their ordinary avocations. The manufacturers under these difficult conditions have uttered no complaint, but have patriotically endeavoured first to satisfy the military requirements at all costs, and afterwards to do what they can to supply the needs of their regular customers.

The latter, unfortunately, have not always evinced a disposition to exercise patience and to make due allowance for the urgency of Government orders. The difficulty of their situation commands our sympathy, but some of them—like so many others of our fellow-countrymen—apparently fail utterly to realise that this nation is now engaged in the most violent struggle recorded in history—a fight for its very existence as a nation. The idea still seems to prevail in some quarters that there is "a sort of war" in progress—but that it is on the Continent and need not trouble us much. There could hardly be a greater or more dangerous error. The war is going on *right here – in our workshops*—and on their efficiency and productiveness the issue of our fate depends.

Millions of men and millions of money are powerless to gain the victory unless our forces are provided with equipment and munitions of war of the highest quality, in ample quantity, and at the earliest possible moment. We therefore appeal to those would-be purchasers, who are tired of the constant reiteration of the plea that delays in delivery are due to urgent Government demands, to accept that plea without demur, and to subordinate their own requirements to the imperious necessities of the nation. The plea is genuine—let them not think it a mere excuse; and those who worry the hard-pressed manufacturers in question with their complaints are guilty of a grave disservice to their country.

A HIGH-PRESSURE TRANSFORMER.

For testing cables, porcelain insulators, &c., very high pressures are required, and a number of transformers for this work have been built by the Oerlikon Co. giving pressures of 200,000 to 250,000 volts. The constant rise in working pressures, however, which now run upwards of 100,000 volts in Central Europe for long transmissions, has necessitated still higher test pressures, and we illustrate herewith a transformer which the company has recently constructed for its own test room, giving secondary pressures of 250,000 and 500,000 volts.

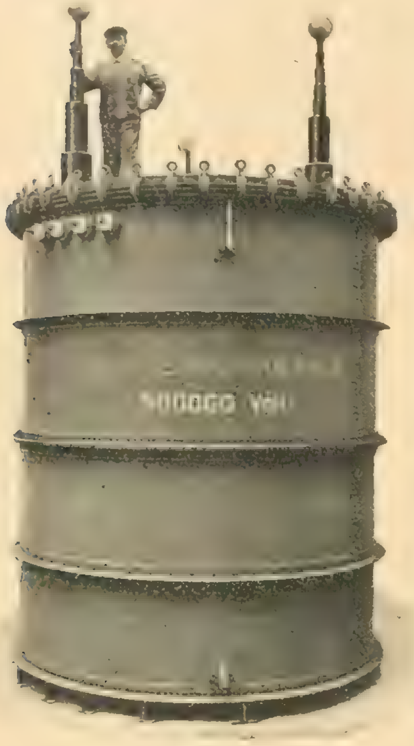

Fig. 1.—Oerlikon High-pressure Transformer.

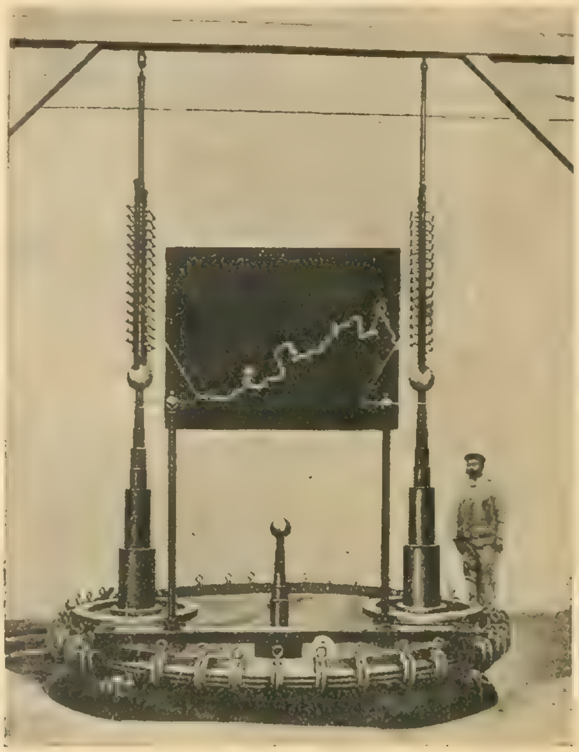

Fig. 2.—Transformer in Use.

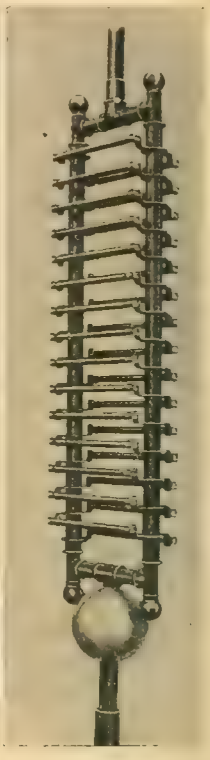

Fig. 3.—Damping Resistance.

The continuous rated load is 500 KVA. at 500 volts on the primary. The oil tank is 3·6 m. high × 3·3 m. in diameter: the height over the terminals is 5 75 m., and over the suspension frame 8 9 m. The weight of the active part of the transformer is 10 tons, and of the tank over 5 tons; the latter holds 19 tons of oil, the total weight of the transformer being about 34 tons.

Fig. 1 gives some idea of the dimensions of the apparatus. The third terminal represents the mid-point of the secondary winding, which is normally earthed, but for special tests (up to 200,000 volts) can be insulated. One pole of the primary is always earthed. The maximum pressure attainable is 600,000 volts, and the output can be raised to 2,000 KVA. momentarily.

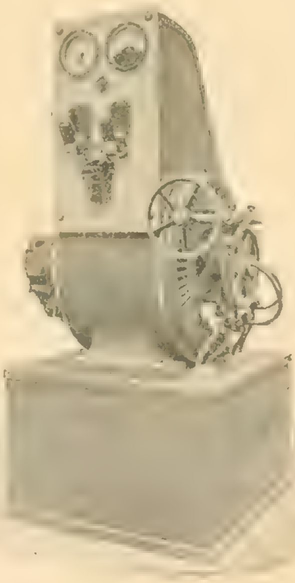

Fig. 4.—Induction Regulator.

The pressure is gauged by means of a spark-gap, which is seen in operation in fig. 2; this is preferred to the use of a voltmeter on the primary. Discharge between points takes place across a maximum distance of 244 mm. at 100,000 R.M.S. volts; 514 mm. at 200,000 volts; 774 mm. a 300,000 volts; 1,050 mm. at 400,000 volts; 1,320 mm. at 500,000 volts; 1,580 mm. at 600,000 volts, and 1,850 mm. at 700,000 volts. The electrodes are mounted on a graduated scale, bolted to the top of the tank.

The discharging poles are not connected to the main terminals directly, but through a carbon resistance, which is kept always in circuit to damp out the dangerous oscillations of pressure which occur when the spark jumps across the gap. The resistances, which are shown separately in fig. 3, are bolted to the terminal spheres and are suspended with them by insulating tubes from an iron frame. The voltage is controlled by an induction regulator, fig. 4, in the primary circuit, giving a continuous variation in the secondary circuit from 0 to 500,000 volts.

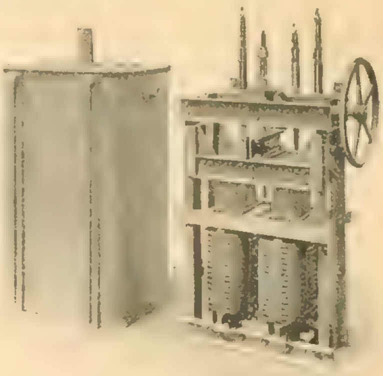

Fig. 5.—Variable Inductance.

When testing cables or insulators of large capacity, the capacity current can be completely balanced by connecting a variable inductance, fig. 5, across the terminals of the transformer primary, and adjusting it so that the current flowing is only sufficient to make good the losses. When this is done, the regulator need only be large enough to provide for the losses in the transformer.

THE ELECTRICAL TRADE OF SIAM.

By "L. A. de M."

British electrical firms have for many years neglected the possibilities as regards trade in Siam, indeed most, or at least many, firms are so wanting in knowledge as to send out catalogues addressed Bangkok, India—this actually occurs month after month. Hence the writer ventures to give a few notes on the trade conditions of Siam.

The capital of Siam is Bangkok, which is situated immediately alongside the River Menam, large steamers being able to get right up the river, even as far as the Samsen end of the city [population of Bangkok about 635,000], while river boats can reach a point inland some 120 miles from the river mouth.

Much useful information may be obtained from Mr. W. A. Graham's book on Siam, published by Alex. Moring, Ltd., London, and from the Bangkok and Siam Directory, published by the *Bangkok Times* Press, Ltd., at a price of 10 ticals per year, which is obtainable from Messrs. Algar, 11, Clement's Lane, London.

Shipment of Goods.—The East Asiatic Co. run a direct line of large steamers from Antwerp and Middlesbrough to Bangkok, where they can discharge alongside the company's wharf. The journey takes about seven weeks. The P. and O. Steamship Co. also ship to Bangkok, but goods have to be transhipped at Singapore, from which port there are steamers running weekly to Bangkok.

Banking Houses.—The principal banking houses are :—

Hong-kong and Shanghai Bank.
Chartered Bank of India, Australia and China.
Banque de l'Indo-Chine.
Mercantile Bank of India, Ltd.

Electrical Power Stations.—There are two electricity supply stations in Bangkok, viz. :—The works of the Siam Electricity Co. The Government power station, Samsen. A third—a tramway station—put down some few years ago proved to be a financial failure, and has been practically dismantled.

The Siam Electricity Co.—This station is a very old one, and until quite recently supplied single-phase current at 2,000 volts, 100 cycles, transformed down to 100 volts.

The company has recently changed over to three-phase, 50 cycles, and adopted a station voltage of 3,500 volts, the old single-phase supply at 100 cycles being almost entirely done away with. Two 1,000-kw. turbo-alternators recently installed supply the three-phase power, the tramway being fed from a motor-generator, and alternatively from a steam engine-driven direct-current machine. Manager, Mr. W. L. Grut ; chief engineer, Mr. H. Hansen.

The Government Samsen Power Station.—In 1911 the Siamese Government invited tenders for the construction of a large power station at Samsen, Bangkok, the contract being secured by the A.E.G., the B.T.H., and the G.E. Co. of America, who put forward a joint tender.

The station was started up in December, 1912, but the contractors have to run the plant until the end of March, 1915, on behalf of the Government, under the control of the contractor's chief engineer, Mr. Noël E. Dufty.

Although the A.E G., of Berlin, were the chief contractors, the whole of their staff are English.

This station is very well equipped with most modern plant, even down to CO_2 recorder and Lea water recorder. The boiler house is fitted with eight Babcock & Wilcox land type water-tube boilers fired with rice husk (also known as paddy husk) and, alternatively, oil fuel. The power house plant comprises three A E G. turbo-alternators of 1,335 k.v.a., 3,500-volt, 50-cycle, 3,000 r.p.m., and a motor-generator having an output of approximately 375 kw., together with a Tudor storage battery.*

The station voltage is 3,500 to 3,850 volts, the distribution lines being kept at 3,500 volts.

The distribution area is very extensive, there being over 120 km. of high-tension distribution line in operation.

So far the load on this station is far below that anticipated, being under 300 kw., and the management are trying very hard to increase the load by introducing motor driving to the local rice mills and saw mills. In this direction there should be a field for British firms, as some of the saw mills have already taken up electric driving. At the moment, the chief load on the station is the waterworks, where all pumping is done electrically.

The low-tension distribution is at 110 volts, except the street lighting, where the more modern practice of 220 volts has been adopted. Current is supplied for lighting at 40 satangs per unit, and at half rate, *i.e.*, 20 satangs, for power purposes. [Note.—One pound sterling is approximately ticals 13, satangs 11, and one tical equals 100 satangs.]

Hence it will be noted that the cost of current is very low, especially for a country where coal is dear.

The following notes should be carefully borne in mind in connection with Siamese trade.

Language.—Very few Europeans have more than a slight knowledge of Siamese, whereas nearly every educated Siamese speaks English more or less fluently, so that for the most part English catalogues can be safely sent out.

Weights and Measures.—By a Decree issued in 1912, the King of Siam introduced the metric system into Siam, and the older weights and measures are now almost defunct. The old unit of weight, the picul or haph (equal to 133⅓ lb. avoirdupois), is still used by the old rice mill men, and some of the older cubic measures are retained to some extent in the teak wood trade.

Siamese Coinage.—The 1908 Gold Law introduced the new metric coinage, as follows :—

Gold. —	Dos, or 10 tical piece.
Silver. —	1 Tical.
	2 Salung piece and
	1 Salung piece.
Nickel. —	10 Satang piece.
	5 Satang piece.
Bronze.—	1 Satang piece.

Climate.—In connection with the rating of motors, &c., it must be borne in mind that the climate is tropical ; during the hot and the rainy seasons (March to October) the temperature variation is from 108° F. to 79° F. In the cold season, from the end of October till February, the maximum temperature is between 94° and 106° F., while the minimum temperature may reach 55° F. The climate is also very humid, and leather work, &c., is liable to suffer badly from mildew, while steel and iron work rusts very badly. Electric meters are very liable to become useless owing to rusting of the magnet-pole faces, unless such iron parts are well protected. Nickel plating does not stand well, and the only really satisfactory way to prevent rusting appears to be the "Coslettising" process. Hygroscopic insulation materials such as fibre should be carefully avoided.

Fauna, Insects, &c.—In common with all tropical countries, insects are liable to cause considerable trouble, the writer having come across one instance where mud ants caused an entire failure of a small telephone installation, while in a second instance a batch of arc lamps gave trouble owing to flies clogging up the regulating magnets.

White ants attack all European woods, and therefore only teak wood should be used for instrument cases, &c., especially where such woodwork is a fixture. Cases are by no means unknown where white ants have attacked the woodwork of even motor-cars that were not in constant use, while cable drums are often completely ruined before the cable has been laid : hence such drums and all packing cases that may have to be stored for a time should be treated with white ant-resisting compound. The local firms usually place all packing cases on a floor or bed of paddy husk, which to a great extent prevents white ants reaching the woodwork.

Lead-covered cable, especially telephone cable, has proved quite a failure in Siam due to the existence of a small insect that bores holes through the lead covering. This insect has caused a great deal of trouble with the overhead lead-covered telephone cables in Bangkok and elsewhere, and has also been responsible for the complete failure of a lighting system using lead-covered cable, although such system is well known and quite reliable in Europe. This trouble is not by any means confined to Siam, being experienced in China and other parts of the East. So far as can be ascertained, lead-covered cable laid in the ground is protected from attack provided the cable is steel tape armoured, or alternatively laid in bitumen.

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* This station was fully described in the Electrical Review of the 6th, 13th and 20th November, 1914.—Eds.

Industries of Siam.—The main industries of the country are fishing and agriculture, where for some years to come little opening will exist for the introduction of machinery.

Just on the outskirts of Bangkok there have been one or two electrically-driven pumps installed for the irrigation of rice fields on a more or less experimental scheme. Now that electric power is available it is possible that some extension of this nature may be developed, especially in view of the fact that the large Government irrigation scheme, which was to have cost some three million sterling, has had to be partially relinquished owing to the war in Europe. At present the methods of irrigation used are crude in the extreme, but probably an enormous amount of spade work will be required to introduce much in the way of modern methods. As a matter of fact, the implements and methods used at the present date differ little, if at all, from those used in the remote history of Siam.

Time was when Siam was a great sugar-producing country, but in recent years this industry has quite died away, and only a small amount of cane sugar is grown for local consumption. As regards cotton growing, nearly all the cotton produced is used locally, little or none being exported.

The teak forests of Siam are, of course, known all over the world; most of the teak logs are floated down the river to Bangkok for treatment at the various large sawmills there, many of which have already taken up electric driving and adopted electric cranes. Even up country one finds many small lighting plants at the various teak logging forests.

There must, in the near future, be considerable development as regards Siam's mining industries; already there are signs of considerable activity in tin mining, and the Government have at last woke up to the fact that the country can no longer neglect its mineral fields development. The most important industry is that of rice milling, and here the British have sadly neglected trade. Not so many years ago practically every bit of the rice-milling machinery came from England, but in recent years German firms, with engineers resident on the spot, have captured the whole of the trade.

The mills are mostly owned by Chinese; in fact, most of the trade of Siam is in the hands of the industrious Celestial. It takes time and patience to work up a trade with the Chinese mill-owners, but once a connection is well established, the Chinaman may be regarded as a sure customer who is not easily led away by any chance firm that happens to come along. Up to now very little attempt has been made to introduce spinning and weaving machinery, the native cloth being produced on a crude loom made out of wood and bamboo poles. In spite of the crude nature of the looms, the work done by the natives is of very good quality, and there should be a field for the introduction of proper weaving machinery.

Just recently one or two hand-looms have been imported, so that a beginning has been made, and there is no reason why this trade should not develop, even to the extent of electrically-driven weaving sheds.

Railways.—The recent orders for bridges and rolling stock for the Siamese railways have drawn manufacturers' attention to the possibilities of trade in this direction. The orders for the new signalling gear and other railway electrical apparatus for the new Bangkok Station were secured by the A.E.G., of Berlin, who had an engineer and office on the spot; English firms appear to have taken very little trouble regarding this offer. Train lighting is also a neglected field, although the Siamese are very much in favour of electric lighting on the railroads. A very plainly-worded history of the railway development of the country will be found in Mr. Graham's book already referred to, which also lays bare the early methods adopted by the Germans to secure the railway trade.

The first railroad in Siam was the line from Paknam, at the mouth of the River Menam, up to the capital of Bangkok, which was opened in 1893, and has a length of only 12 miles. In 1901 the Northern line was finished from Bangkok to Karat, some 165 miles, while in 1903 the Southern line, from the west side of the river to Petchaburi, 94 miles, was completed. Since the above dates the railway development has been quite rapid, and a few years' time will see the linking up of the Siamese railway system with that of the British Federated Malay States.

The Royal Railway Department Northern Line (broad gauge) is under German control, the director-general being Kgl. Baurat L. Weiler, while the Royal State Southern Line (metre gauge) is under English control, the controlling engineer being Mr. H. Gittins.

In conclusion, a few brief notes regarding the chief electrical goods sold in Siam may prove useful.

Lamps.—Arc lamps, mostly replaced by metal-filament lamps; trade chiefly in the hands of the supply stations themselves.

Motors and Fans.—Sold through local firms; nearly all the fans are of Italian and American manufacture.

Cable and Wires.—All house wiring is carried out with cable on cleat insulators; market flooded with German cable of low grade with which C.M.A. wires cannot compete. Much of the wiring and especially the ceiling roses, &c., are of a very poor quality that would never be allowed at home, fuses being frequently placed in both tumbler switches and ceiling roses.

Shades, Glassware, and Fittings.—These are mostly of German origin, but there is an opening for the various more modern and scientifically designed fittings in the better class houses.

Conduit Systems of wiring have not found favour, principally due to lack of good workmen, and to heavy condensation of moisture causing trouble.

Rice Mill Lighting.—Dust and damp-proof fittings of strong design are badly required, and would be welcomed by the insurance people. All switches should be thoroughly well enclosed, as the dust is very penetrating.

Illumination Material, Electric Signs.—Owing to the various and frequent ceremonies and the Siamese love of brilliant illuminations, there is an extensive market for all material for such illumination work, especially the various forms of illumination strip, cheap coloured reflectors, thermo flashers, &c.

Motor-Car and Motor-Boat Lighting.—Bangkok and the river are thronged with motor-cars and motor-boats, and electric lighting on these is now most popular, as is also the use of electric horns.

The number of motor-cars in Bangkok (excluding Royal cars which are not registered) is just over 1,000. Electrically-driven cars are used to a limited extent, and the electrically-propelled motor-lorry appears to be about to gain favour, owing to the low rates at which current for charging can be obtained from the supply stations.

In the past the German firms have worked up the trade in a most systematic manner, keeping a fully-equipped office in Bangkok, and having also the advantage of securing the local supply company as agents. The Samsen power station contract, which went to Germany, cost over £48,000, exclusive of the station buildings and conveyor machinery, in addition to which, of course, the A.E.G. having once obtained a firm foothold, naturally secured all the extra orders for material, even down to the telephone cables for the Government Postal Department, the value of which has never been made public.

Tools for the workshops (English manufacture), fire hydrant service, oil tanks, &c., were all secured by the A.E.G., who appeared able to quote and supply particulars for the local erecting office, while local agents were helpless. This is precisely the German method from start to finish; they send out to the Colonies the very pick of their staff, who, by having a free hand, are able to "strike when the iron is hot" without the loss of valuable time that is too often taken up by our men in getting information or instructions from home. These men they carefully back up with ample supplies of both technical literature and catalogues. Moreover, every little detail as regards the requirements of the local market is carefully sent home for future use.

Only too often one finds that home firms send out untrained men, very often ex-ship engineers who have been discharged from the shipping firms, and imagine that a Colonial representative needs no other qualification than the ability to spin yarns and make himself generally sociable at the inevitable "Club."

THE LATE MR. WILLIAM BULLOCH.

[By a Member of his Staff.]

In last week's Electrical Review there appeared a notice of the death of Mr. William Bulloch, with a brief account of his connection with the Electric Construction Company, Limited. May a member of his works staff be permitted to add a few details to the account of Mr. Bulloch's career, and to record, through the publicity of this journal, the extraordinary esteem in which their late Chief was held by his staff and workpeople?

William Bulloch was born in 1870 and educated at Aberdeen Grammar School. Upon leaving school, he was articled to the firm of James Meston & Company, Chartered Accountants, Aberdeen, and in due course was himself registered as a chartered accountant. In 1893 he joined the staff of the Electric Construction Company, Limited, at its Head Office in London. In the following year he took over the management of the commercial department at the Company's Works, Bushbury, Wolverhampton. Here he entirely re-organised the system of book-keeping, introducing a costing method of his own which is still in use.

In 1901 he became General Manager of the works, and two years ago (still retaining his position as Manager) he was elected to a seat upon the Board of Directors. There is no need to remind readers of this journal of the anxious times through which the electrical industry passed during Mr. Bulloch's period of Management at Bushbury; the fact that the E.C.C. came successfully through that period, and is now in a better position financially, and has a higher reputation as a manufacturing concern, than at any other time in its history, is a fitting monument to his skill as organiser and wisdom as manager.

Mr. William Bulloch.

Whitlocks, Ltd. Wolverhampton.

Big in frame, and of commanding personality, Mr. Bulloch was every inch a man and a master of men; withal, he possessed a simplicity and directness of character and a charm of manner which ensured a rule of respect unmixed with fear. Level-headed and confident, he was seldom ruffled, and, on those rare occasions when he did show anger, one felt that it was of deliberate intent. In the darker days, when we of his staff and works were constrained to shake our heads, as little men will, and to discuss anxiously this or that matter which seemed to threaten the welfare of our business, almost invariably we ended with the comforting assurance, "Oh, well, the Chief seems quite happy about it!" And this confidence in him he repaid by confidence in us. He indicated broad lines of policy, but seldom interfered, unasked, in matters of detail. Yet there was little that escaped him; he grasped instantly any problem that was put before him; nothing was too big or too small for his attention; with all his duties and responsibilities he always found time to discuss in his deliberate manner any difficulty that might be brought to him. Accessible at all times to any of his employees, from departmental head to office boy, works superintendent to yard labourer, no one with a legitimate need of guidance ever hesitated to apply to him. Many and extraordinary were the stories of private troubles that were told to him; much and valuable the assistance that he so ungrudgingly gave. Can it be wondered at that we at Bushbury feel we have lost more than a master, more than a chief?

What was the secret of his success as a business organiser and a commander of men? I think he himself unconsciously put it into words a few days before he died. The staff and workpeople had been exercised in their minds over some detail in connection with a fund to which they were contributing. A meeting was held; a meeting, by the way, which was remarkable for the sheer *affection*—there is no other word for it—for their Chief which ran as an undercurrent through the speeches of blunt working-men who were there to say what they had to say without fear or favour. Mr. Bulloch, who presided, explained briefly the purpose of the meeting, and with a "Well, gentlemen, I have thought a good deal about this," propounded a safe and equitable solution of the difficulty.

There I think you have it: *Well, gentlemen, I have thought a good deal about this!*

The remains of the late Mr. William Bulloch were laid to rest at Bushbury Parish Church on Saturday amid many manifestations of regret. The formal obsequies were attended by a large number of personal friends and representative of public bodies including the Wolverhampton Chamber of Commerce, the Wolverhampton and District Engineering Society, the Wolverhampton Conservative Association, members of the E.C.C. staff, and a numerous body of workmen. The officiating clergyman was the vicar of the parish, Rev. Percy Scott. The chief mourners were the family and relatives of the deceased.

THE INDUSTRIAL POSITION IN THE UNITED STATES.

Our American contemporary the *Electrical World* contains the following report of part of a speech on the present condition of electrical and industrial affairs, which was delivered in January at Boston by Mr. Guy E. Trip, chairman of the American Westinghouse Electric & Manufacturing Company:

"A most serious situation confronts us. The country finds its industries generally in an unparalleled state of prostration, and it is worth while to speculate a little over what, if anything, we can do to mitigate this paralyzing depression. It is quite probable that we should have had very great business stagnation or worse even if there had been no war, and the effect of the war itself has been a surprise.

"The prevailing feeling in England and France, when the war broke out, was that a terrible situation confronted Europe, but that great benefits would come to the United States; nevertheless, after six months, we find the situation just the reverse. So far as I can learn, the experience of the companies I represent is typical of present manufacturing conditions in the countries where we are situated.

"Our company in England is running at full capacity, while in this country our works are operating between 50 and 60 per cent. of normal output. The English company is not working upon war orders but upon its usual character of goods. This, of course, is due to the fact that England has been able to keep the seas clear for her commerce and that her colonies, and other countries which had been in the habit of dealing to a considerable extent with Germany, have transferred their entire business to England. It seems to me that this will be a permanent condition; that is to say, if the Allies should win, England will derive greater permanent commercial benefit from the war than the United States will do. Our works in France are running full time, but to a very large extent on orders for the French war department. Our Italian works are running full time; and, judging from the very infrequent and vague news we can get through from Austria, our Vienna company is enjoying usual prosperity.

"Therefore, so far as our own interests are concerned, they are very much more prosperous in Europe than in the United States. It is true that there have been some war orders received in this country, but the effect has been a great deal more than offset by the great disturbance of foreign exchange and the difficulty of handling our large indebtedness to Europe.

"The war has also obscured the effect of the recent anti-trust legislation and tariff reduction, and will obscure the effect of the proposed bill for government ownership of a merchant marine, should such a bill pass Congress, which I hope it will not do. We are asked to believe that these laws remove all barriers and that it only remains for us to get busy and seize the markets of the world from England and Germany.

"Anything that helps our export trade is good and we are all trying to increase foreign commerce, but our prosperity still rests upon our home markets. There are 100,000,000 people in the United States and in consumptive or purchasing capacity they weigh a great deal heavier than their numbers; and the removal of any measure of encouragement and protection of home industries on the theory that the injury will be repaired by any increase in foreign trade that we are likely to retain permanently in competition with England and Germany is a colossal mistake.

"The recent reduction in the tariff had, before the war, shifted the balance of trade against us. [illegible] the new tariff went into effect October 4th, 1913, with the result that, after many years with the balance of trade being continuously in our favour, in April, 1914, it swung the other way and imports began to be greater than exports. In addition to depriving the government of revenue, which resulted in the income tax law, this would have had a very severe effect on our home industries, and upon the market for labour, even if there had been no war. It is true that the balance is now in our favour, owing to exports of war materials needed by the countries now at war, but the period between April 1st and August 1st of last year may have been a demonstration of the real effect of tariff reduction. It should be remembered that the export of raw material as distinguished from manufactured goods is a distinct disadvantage to labour.

"It is vital that this great market of ours should be in a fair degree protected against foreign competition even if we have to let export trade take care of itself, and to that end I believe your organisation and we ought to co-operate in encouraging a popular demand for a tariff commission which can intelligently pass upon this complicated and delicate question. While this is being done, and it will take some time, say until 1916, home industry needs a stimulant; and, after all, the most important thing for us to do, and the most sensible way in which we can co-operate at this time, is to join hands in bringing about a better business state of mind.

"When we come to think of it, there have been plentiful crops to feed and clothe the people, the railroads are ready and anxious to transport them, the mills are waiting to fabricate them, and labour is waiting to do the work. Is there not something we can do to help set these agencies in motion? It will help if we all agree that it is time to let up a little on conservatism and take some chances by beginning some of the work which is being held back. If there should be a general movement and everybody should make a cautious start, taking a little but not too much risk, the result would be surprising.

"The manufacturer might begin the manufacture of a reasonable reserve stock of standard goods, and you can all utilise these dull times to overhaul and repair your roadbed, plant and machinery and make small additions against future growth. I hope you will not think that these ideas are impracticable and mere idle theorising; for, if there can be such a thing as co-operation in the business world which is worthy of the name, this suggestion is the simplest form it can take."

EXPORT TRADE OF SWEDEN.

The following figures, showing Sweden's exports of electrical and allied goods during 1912, are taken from the recently issued official trade returns. These, combined with the comparative figures for 1911 which have been added, afford an interesting view of the growth and diversity of Swedish competition in classes of goods and countries in which we also are interested.

	1911. Kronor.	1912. Kronor.	Inc. or dec. Kronor.
Electric dynamos and motors.—			
To Russia	120,000	85,000	— 35,000
,, Great Britain	253,000	353,000	+ 100,000
,, Norway	1,455,000	265,000	— 1,190,000
,, Finland	229,000	147,000	— 82,000
,, Denmark	98,000	173,000	+ 75,000
,, Spain	130,000	221,000	+ 91,000
,, Germany	98,000	72,000	— 26,000
,, Canada	315,000	375,000	+ 60,000
,, Other countries	201,000	625,000	+ 424,000
Total	2,899,000	2,316,000	— 583,000
Transformers.—			
To Norway	260,000	400,000	+ 140,000
,, Spain	96,000	72,000	— 24,000
,, Canada	124,000	—	— 124,000
,, Other countries	75,000	59,000	— 16,000
Total	555,000	531,000	— 24,000
Electric incandescent lamps.—			
To Germany	44,000	32,000	— 12,000
,, Denmark	44,000	46,000	+ 2,000
,, Great Britain	15,000	28,000	+ 13,000
,, Russia	41,000	13,000	— 28,000
,, Other countries	53,000	46,000	— 7,000
Total	197,000	165,000	— 32,000
Telephone apparatus.—			
To Norway	46,000	107,000	+ 61,000
,, Finland	514,000	419,000	— 95,000
,, Russia	1,231,000	1,069,000	— 162,000
,, Denmark	132,000	78,000	— 54,000
,, Holland	349,000	424,000	+ 75,000
,, Great Britain	1,688,000	628,000	— 1,060,000
,, Mexico	155,000	177,000	+ 22,000
,, British South Africa	199,000	373,000	+ 174,000
,, Other countries	721,000	1,884,000	+ 1,163,000
Total	5,035,000	5,159,000	+ 124,000
Gas, oil, etc., engines.—			
To Norway	884,000	1,174,000	+ 290,000
,, Russia	2,308,000	2,823,000	+ 515,000
,, Denmark	133,000	190,000	+ 57,000
,, Germany	652,000	759,000	+ 107,000
,, Great Britain	291,000	508,000	+ 217,000
,, Other countries	1,883,000	2,733,000	+ 850,000
Total	6,151,000	8,187,000	+ 2,036,000
Petroleum and benzine motors.—			
To Norway	884,000	1,174,000	+ 290,000
,, Finland	249,000	239,000	— 10,000
,, Russia	2,308,000	2,823,000	+ 515,000
,, Denmark	133,000	189,000	+ 56,000
,, Germany	652,000	759,000	+ 107,000
,, Holland	206,000	317,000	+ 111,000
,, Great Britain	291,000	509,000	+ 218,000
,, Italy	103,000	125,000	+ 22,000
,, Austria	291,000	315,000	+ 24,000
,, Other countries	1,034,000	1,868,000	+ 834,000
Total	6,151,000	8,318,000	+ 2,167,000
Water Turbines.—			
To Finland	12,000	58,000	+ 46,000
,, Great Britain	104,000	56,000	— 48,000
,, Canada	111,000	107,000	— 4,000
,, Japan	118,000	67,000	— 51,000
,, Other countries	179,000	110,000	— 69,000
Total	524,000	398,000	— 126,000
Cranes, etc.—			
To Finland	44,000	90,000	+ 46,000
,, Russia	91,000	175,000	+ 84,000
,, Other countries	63,000	245,000	+ 182,000
Total	198,000	510,000	+ 312,000
Copper wire.—			
To Russia	366,000	70,000	— 296,000
,, Finland	169,000	100,000	— 69,000
,, Great Britain	190,000	—	— 190,000
,, Norway	116,000	32,000	— 84,000
,, Other countries	114,000	76,000	— 38,000
Total	955,000	278,000	— 677,000
Steam turbines.—			
To Russia	184,000	265,000	+ 81,000
,, Finland	29,000	47,000	+ 18,000
,, Holland	11,000	20,000	+ 9,000
,, Other countries	30,000	182,000*	+ 152,000
Total	254,000	514,000	+ 260,000

* Includes Great Britain 56,000 kr.

Kronor = 1s. 1⅓d.

POLYPHASE COMMUTATOR MACHINES AND THEIR APPLICATION.

By N. SHUTTLEWORTH, M.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, February* 10*th*, 1915.)

While polyphase systems may have two, three, six, or more phases, reference will be made in every case to a 3-phase machine, and it will be understood that the principles involved apply to any other number of phases.

It will expedite matters first of all to enumerate the fundamental qualities possessed by an armature fitted with a commutator connected in series with a stator compensating winding in the presence of a rotating field. For 3-phase current the brush spacing on a commutator is naturally 120 electrical degrees. The closed circuit winding of the armature, so far as 3-phase currents passing in and out at the brushes are concerned, is equivalent to a delta-connected winding. The three separate phases of a compensating winding are placed in series with three brushes respectively, and they are distributed on the stator in such a manner that the currents passing through them neutralize the armature currents at all points along the periphery. Let it be now supposed that the delta armature-winding is replaced by an equivalent star-connected winding terminating in the brushes; it will be found that the three phases on the armature possess exactly the same number of turns as the compensating winding, and that they are wound immediately beneath and opposite in sense.

For most purposes it is simpler to consider, instead of the true windings represented in fig. 1, the equivalent windings shown by fig. 2. Each phase may then be considered separately, and it is sufficient to remember that the equivalent star phase of the armature O A has the same number of turns, but is wound in the opposite sense to the compensating winding represented by A D.

The presence of a rotating field causes an induced voltage to appear at the terminals of each winding. Since, however, the armature turns O A are opposed to the compensating turns A D, the induced voltage O A must be opposite in sense to the induced voltage A D, with the result that there can be no voltage between the terminal D and the star point O. These relations are shown in the voltage diagram, fig. 3, from which it will be seen there can be no voltage between the terminals of the machine D E F, but that an appreciable voltage will be present at the armature brush studs represented by A B C. The frequency of the voltage at A, B, C, depends of course upon the frequency of the rotating field.

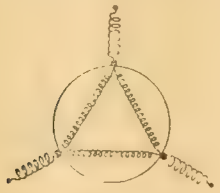

Fig. 1.

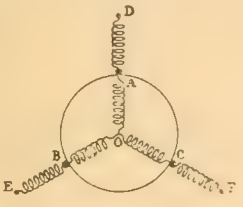

Fig. 2.

If it now be assumed that the armature rotates slowly in the same direction as the rotating field, the relative velocity of the field to the armature has decreased, and the voltage induced in the armature must decrease also; no change can have taken place in the frequency of the voltage at the brushes, or in the magnitude of the voltage induced in the compensating winding, and the result will accordingly be as shown in the vector diagram, fig. 4, where A B C is the armature voltage, and D E F the terminal voltage.

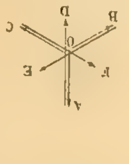

Fig. 3.

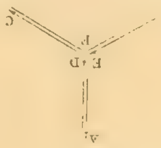

Fig. 4.

Proceeding further, examine the result when the speed of the armature attains to that of the rotating field, namely, synchronism. The field has now no motion relative to the armature conductors, hence there can be no voltage induced in the armature, and the voltage in the compensating winding remains the same as in the previous cases; the results represented by fig. 5 are then obtained.

The only remaining case is that of an armature speed higher than that of the rotating field; the direction of cutting of the field by the armature conductors becomes reversed, and the phase of the voltage generated at the armature brushes is of opposite sense to the previous cases. Fig. 6 depicts the armature and terminal voltages under this condition.

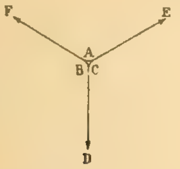

Fig. 5.

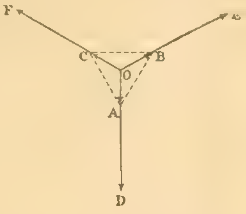

Fig. 6.

There are two observations to make from figs. 3 to 6; one is that there is a different ratio of armature voltage to terminal voltage at every speed, and the other that the terminal voltage is exactly the same as regards magnitude as it would have been with a stationary field.

The rotating field determines two things; first, the seat of the voltage, namely whether it appears in the stator or the rotor; and second, the frequency of the voltage appearing at the armature and terminals of the machine.

With these simple facts in mind the mode of operation of all commutator machines will become more clear.

Broadly speaking, there are two main types, classified according to the method of excitation, namely:—(1) Shunt, (2) Series. The former implies constant field, which is usually associated with constant speed under load, and the latter with compound excitation with varying speed under load.

Machines of the shunt type will be considered first.

It is evident that a single-speed commutator motor is practically useless; the only advantage over an induction motor is an improved power factor, but this is not sufficient to merit the increase in cost. The real advantage of a commutator machine is the possibility of speed variation, which can be accomplished without loss of efficiency. A variable-speed polyphase shunt commutator motor is the prototype of the continuous-current variable-speed shunt motor. The many speeds are obtainable by simple regulation of the field excitation.

The first motor to be considered is one built to the design of M. Latour in France. The motor proper (fig. 7) is fitted with a 3-phase compensating winding (1), and a 3-phase armature (2). Instead of using a separate shunt exciting winding the armature winding is used for this purpose, and an exciting voltage is impressed between the brush studs from the secondary (3) of a transformer, the primary of which (4) is connected to the supply system. The armature winding of the motor therefore carries in addition to the load current an exciting current, which produces the working field of the motor. The windings of the transformer (3) carry only a wattless current, which is at right angles in phase to the voltage induced from the primary. The latter fact enables a very simple means to be employed for varying the terminal voltage of the secondary of the exciting transformer, and for this purpose the star point of the secondary is completed through a variable reactance (5). A voltage-drop due to the magnetizing current flowing through the reactance (5) is exactly opposite in phase to the voltage induced in the secondary of the transformer; since the voltage appearing in the windings (3) is constant under all conditions, the terminal voltage impressed on the brushes of the motor will depend upon the magnitude of the voltage-drop in the reactance, and the reactance is therefore a means of varying the impressed voltage on the field winding of the motor—this being done also without any change in phase. It will be observed that the reactance (5) is strictly analogous to the field rheostat of a continuous-current shunt motor.

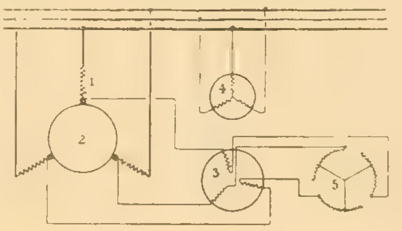

Fig. 7.

The transformer (3-4) must be made with a movable secondary, after the manner of an induction regulator. The phase of the voltage obtained from the secondary (3) may then be varied at will relative to the voltage in the primary (4).

A constant voltage is impressed on the terminals of the motor, and if it be assumed that the counter-voltage of the machine cannot differ appreciably from this value, the conditions are similar to those of a continuous-current shunt motor, the speed remaining constant so long as the field strength is constant, and varying inversely as the strength of the field.

(*To be continued.*)

WAR ITEMS.

Russian Electric Lamp Industry.—At the last meeting of the Russian Electro-Technical Society, after a long and interesting discussion on the protection of the Russian Electro-Technical Industry, resolutions were adopted in favour of a more detailed classification of electro-technical goods imported into Russia, and more suitably adjusted tariffs on such goods as are imported in large quantities and would constitute separate branches of industry: and for the successful development of the National Lamp industry, it was resolved that it was essential that capitalists and industrialists should co-operate in the exploitation of wolfram, nickel, &c.: and that during the period of the development of an electric lamp-making industry in Russia, the Government should grant patent rights to foreigners with extreme circumspection, avoiding the issue of patent rights which in foreign hands would hinder the development of such an industry in Russia: and finally, that the Russian lamp industry should be protected under customs duties sufficiently high to insure success to those engaged in it.

Tuckers at the Front.—Messrs. J. H. Tucker & Co., of Birmingham, send us the following copy of a letter that they have received from the Front: "I am writing you from the front, and before I was called up for mobilisation, I was working as an electrician with . . . . of . . . . Passing through different parts of the country, I have noticed the different installations in the electrical world, and to my amazement I saw some of your goods in . . . . The electrician could not say where these fittings came from, but as soon as I saw them I knew that they were yours. So I told him, and he asked me if I would write to you, and ask you to send out a catalogue. I said I would, and then I would let him have it. He said that he never had any trouble with your things, and this makes him all the more keen to deal with you. I would like you to send these price lists in French if possible."

Board of Trade Inquiries.—The Commercial Intelligence Branch of the Board of Trade has issued a list of inquiries received during the week ended January 30th, for articles which buyers at home and abroad desire to purchase in the United Kingdom.

Franco-British Trade Tour to South America.—We recently reported the organisation of an American business men's tour to South America in the interests of trade cultivation. It is now reported in the "Standard" that some 50 French merchants and 100 leading business men from different parts of England will shortly sail in the "Argonaut," a specially chartered French liner which has been renamed, for calling at numerous ports in South America. The ship will load samples at Southampton. The tour has been arranged by Kelly's British Trade Intelligence Department. Public meetings and receptions are being arranged by Chambers of Commerce, municipalities, &c., at different stopping places. The "Standard" adds that the project will doubtless be followed at a later date by Government action of a similar character in Russia and other markets.

Proposed Russian Tax on Electricity.—The Imperial Russian Technical Society has presented a report to the Ministry of Trade and Industry on the proposed tax to be laid on electricity as its contribution to the war funds. The report shows that electricity has developed considerably in Russia, and that there are 102 stations in Russian towns producing electricity for lighting and power, amounting to 114,000,000kw.-hours per annum, value 24,000,000 roubles. The value of the annual output of the four stations of the capitals is stated to be 17,000,000 roubles. The report, or memorandum, presses for the lowest possible tax, so as not to prevent the growth of electric lighting and power consumption in Russia. It suggests an excise or tax as follows: for street lighting —0.5 copeck (1c. = $\frac{1}{4}$d.), for factories and workshops —1c., and for other purposes —2c. per kilowatt hour.

Higher Wages.—The cost of living and the scarcity for skilled labour have led to demands for higher wages from the engineering and shipbuilding workers on Tyneside. Conferences are taking place. The employers have in some cases offered advances at the rate of 2s. per week immediately, and a further 1s. if the war lasts for six months. The "Times" says that the north-east coast engineering employers also had before them on 11th inst. the highest demand which probably has ever been made by unskilled men in the engineering trades of the district—namely, 5s. a week on time rates, and 15 per cent. on piece rates.

French Relief Fund.—This fund which has offices at 83, Pall Mall, S.W., has been established for the purpose of giving British assistance to French non-combatants rendered destitute by the war, and especially to alleviate the terrible distress caused by the inhuman conduct of the Germans to the ill-clad, suffering, and homeless women and children in the devastated provinces of France. Assistance is urgently needed, and cash donations should be forwarded to the bankers, Messrs. Cox & Co., 16, Charing Cross Road, W.C., all cheques being made payable to the Committee, The French Relief Fund. Gifts of clothing and provisions to be sent to 495, Oxford Street, W.

Manchester Tramwaymen.—Over a thousand wives, mothers and children of Manchester tramway employees who are serving the colours were entertained at Belle Vue last week. The Lord Mayor of Manchester in a brief speech, stated that 35 per cent. of the corporation employees available for service had joined the forces, and he believed the tramways department had given the largest proportion. The general manager (Mr. J. M. McElroy) stated that there had enlisted 276 drivers, 442 guards, 179 trolley-boys, and 517 men from other branches of the tramways department.

Warning to Manufacturers.—The Admiralty has issued to all contractors engaged on Government work, advice not to admit any persons to their works unless notice of their coming has been received in advance. The need for precautions arises from the fact that suspects, wearing the khaki uniforms of an officer and sergeant respectively, are attempting to visit military works making inquiries as to the presence of anti-aircraft guns in the vicinity.

Badges for War Workers.—In reply to a question asked in Parliament, Dr. Macnamara said that badges had been issued to employés engaged in works carrying out Admiralty contracts, fifty such works in the Lanarkshire district having been so supplied, for the use of men who were engaged continuously upon H.M. ships and armaments and whose skill and experience rendered their services absolutely indispensable.

Germany's Need of Copper.—The "Times" correspondent at Copenhagen says that a Danish merchant has been arrested for attempting to smuggle 40 tons of copper plates to Stettin and Lubeck in a schooner ostensibly laden with sugar.

Personal.—The following announcements appear in the "London Gazette":—Admiralty: Royal Marines, Submarine miners, February 5th, 1915. Lieut.-Col. Frederick George Scott, Tyne Electrical Engineers (Territorial Royal Engineers) to be temporary colonel.

Territorial Force: London Electrical Engineers. The undermentioned to be second lieutenants. Dated February 13th:—Sergeant H. G. G. Clarke; Private C. H. Silvester Evans; Sergeant W. H. Mather.

Mr. G. A. Ayre, shift engineer at the Watford Electricity Works, has joined the Royal Naval Division for active service.

The following communication comes from Gloucester:—When on duty the other evening the following conundrum occurred to me, which I though might interest you: An "Electrundrum."—Why do the British Forces offer such a good "Resistance" to the enemy? Because they are all "O H M S."—R. C. HILL (Switchboard Attendant).

Roll of Honour.—Private Sam Willan (29), assistant electrician in the employ of the Pearson & Knowles Colliery Co., Coppull, who has been serving with the Coldstream Guards, has been killed in action.

Private Robert Adams, of Preston, up till recently employed at the works of Messrs. Dick, Kerr & Co., Ltd., Preston, has been killed on the battlefield.

Private Richard Ashcroft, of the Scots Guards, has been killed in action by a rifle bullet in the head. He was only 18 in December, and formerly worked for the Electric Car Company, Preston.

LEGAL.

Edwards v. Mexican Light and Power Co., Ltd.

In the City of London Court, on Thursday and Friday, last week, David R. Edwards, miner, made a claim against the Mexican Light and Power Co., Ltd., 21, Manning Arcade, Toronto, Canada, and 34, Bishopsgate, E.C., to recover £50 13s. 10d. for damages for breach of contract, he having been a miner in their service. Mr. Slesser was counsel for the plaintiff, and Mr. W. Stewart appeared for the defendants.

Mr. Stewart said they would pay the debt and costs into Court if the case were adjourned until defendants obtained evidence from Mexico, without which they could not get a fair trial. Defendants employed hundreds of miners, and it would be very serious to them if they lost that case without a proper hearing.

Mr. Slesser opposed any adjournment, as the case had already stood over for two months for defendants to get what they wanted.

Judge Atherley-Jones said he would hear the case.

Mr. Slesser observed that the dispute arose out of the plaintiff's employment in Mexico in connection with tunnelling works for the defendant company. Plaintiff, who had had experience as a miner, was engaged by the defendants to go to Mexico for them. He was told that the work would take three months at least, that he would be paid U.S. $4 a day, plus expense, and board and lodging, payment being made in American currency. He was told that he would have £10 advanced on account of wages, that he would have half-pay until arrival, free passage out and home, and full pay while working. When he arrived at New York he was given a new contract, but it was not read to him before he signed it. He found it contained several grave alterations to the terms agreed to in this country. One clause was that if the company thought his services were unsatisfactory they would be dispensed with. He was to forfeit all rights for various reasons specified, one being that men who were incapacitated from work would have their pay stopped, and forfeit their return passage money, &c. Plaintiff worked at St. Lorenzo until the tunnelling was finished, when, owing to bad ventilation and improper precautions at the works, he fell ill, and was told he was discharged. He now claimed for his passage home and half wages for some of the time occupied.

Plaintiff was called.

Mr Stewart said that the plaintiff was discharged for wrongfully absenting himself without leave. He had used some disrespectful language.

Judge Atherley-Jones thought it was very creditable of the plaintiff if he did so. If a company gave a man notice that he forfeited not only his benefits of employment, but his passage home, when he fell ill, it deserved stronger language than he (the Judge) could employ.

Mr. Stewart: There was nothing about illness in the notice.

Plaintiff said it was not true that he was suffering from the jollification which followed the finishing of the junction of the work.

Mr. Stewart said he could not call any evidence until the revolution in Mexico ended.

The Judge found for the plaintiff for the amount claimed, with costs.

Electric Utility Co., Ltd.

In the Companies' Winding-up Court, Mr. Justice Astbury had before him on Tuesday, February 16th, a motion by the original liquidator of the Electric Utility Co. to discharge an order made in Chambers, appointing Mr. John Edward Corfield as additional liquidator to act with him.

The company, it was stated, was formed in 1913, with a capital of £20,000, to take over the business of another company then in liquidation. The Master in Chambers had acted upon a resolution duly passed at a meeting of creditors, but the applicant's contention was that the resolution did not really represent the view of the creditors, as proxies were admitted which should not have been.

His Lordship thought there should be further evidence, and directed the motion to stand over generally with liberty to apply to restore it.

Zucker *v.* Peters.

In the Shoreditch County Court, on Tuesday, before his Honour Judge Cluer, Wm. Zucker, a hair-dresser, sued Sam Peters, also a hair-dresser, to recover £5, or the return of an electric motor hair-brush. The defendant pleaded that he should not have to pay for the electric motor. The one to buy the shop first was A. Roth, who bought the motor from the Electric Motor Co., Ltd., and it became a fixture. On October 17th Roth sold to Zucker, with the motor, and on December 18th, Zucker sold to the defendant, he contended, with the motor brush, but now he was asking for £5 for it.

Plaintiff went into the box, and produced a note from the defendant, saying he would pay £5 if the brush was not given up by January 3rd.

Defendant denied that he had had any dealings with the man in the box, and protested that his transaction was with the father. He produced an agreement to show that he purchased the business for £40, but directly his Honour saw it he said it was unstamped, and a penalty would have to be paid on it before it could be used.

Defendant: But it has outside the saloon "hair-brushing by electric brush" and to take it away is like removing a tool.

Judge Cluer: Go and get that agreement stamped, and pay the penalty, and I can hear you. Adjourned.

Plaintiff: But he agreed in this letter to give it up if he did not pay by January 3rd.

Judge Cluer (looking at it): That is so, and that makes it an agreement. That will need stamping also; you have both been cheating the Revenue, so I will adjourn this case to enable the Revenue to come into their just due; that is, if you want to go any further.

Day *v.* Willard and Others.

In the Court of Appeal on February 10th, the Lord Chief Justice Lord Justice Swinfen Eady, and Mr. Justice Bray, heard the appeal of the plaintiff in this action, from a judgment of Mr. Justice Pickford. The plaintiff in the action was Mr. Wm. Thos Day, of Shepherd's Bush, and the defendants were Mr. Chas. D. Willard, of Cromwell House, Surrey Street, E.C., Mr. F. H. Haviland, of Bournemouth, and Mr. Otto Stalmann, of 21, Tavistock Square, W.

Mr. Patrick Hastings, appearing for the appellant, Mr. Day, said Mr. Justice Pickford had given judgment for the defendants. It appeared that the plaintiff's case was that he entered into an agreement with the defendants under which they were to become co-adventurers in the promotion of a company for the exploitation of the patent of an electric smelting machine, the invention of a Mr. Marcus Ruthenburg. The parties were to participate equally in the shares of the company, and plaintiff alleged that although the agreement purported to be limited to a certain option, it was, in fact, one to carry out a transaction not limited to the duration of partnership, and notwithstanding that the matter had been completed by the other defendants, he was entitled to remain in the partnership. He also contended that the defendants went behind plaintiff's back and induced Ruthenburg to renew the option to them to the plaintiff's exclusion, and the Judge found as a fact that defendants had obtained the renewal of the patent from Mr. Ruthenburg by making a statement that was untrue. Mr. Ruthenburg, in his evidence, said he was told that Mr. Day had made default in his agreement, and although the Judge found against the defendants on the ground that they had made statements that were not true, he decided against the plaintiff, holding that he had not made out his case. Mr. Hastings added that the company formed had a factory in Newcastle-on-Tyne for the purpose of making the electric smelters, called the North-Eastern Electric Smelting Co. His contention was that the Judge was wrong when he held that the plaintiff must prove a continuing partnership.

Mr. Schiller, K.C., argued that, seeing that the contract with the plaintiff for the option of the patent fell through, the plaintiff could not claim when a new contract was entered into with the defendants simply because he introduced the matter to them.

The Lord Chief Justice, in giving judgment, said the plaintiff claimed a declaration as he was kept out of the legitimate fruits of a project in which he was a co-adventurer. But the foundation of his case went when the facts were clearly brought out, and they held that the judgment of Mr. Justice Pickford was the right one, and the appeal failed.

The other Judges concurred.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Automatic Lamp Cell Charging Apparatus.

In view of the success of the Thomson electric pocket lamp, Messrs. L. E. Wilson & Co., of 10, Corporation Street, Manchester, have decided to place on the market a simple recharging apparatus, shown in fig. 1, for the cells used in the lamps.

Where direct current is available, the patent porcelain holder can be screwed on the wall preferably adjacent to a switch, which should be changed for a special duplex switch. This switch will operate a lamp in the ordinary way, or connect the patent recharging apparatus to the electric light circuit, with the lamp as a resistance. In other words, this recharging apparatus in no way interferes with the existing installation, but is always ready for use, and when once the poles are correctly defined and connected up, no chances of a reversal in polarity are possible. The introduction of a cell for recharging purposes makes very little difference to the light. By this means the process of recharging the Thomson accumulator is quite simple and easy, it being only necessary to add some distilled water and slip the cell into the holder. A number of these patent holders can be connected up in series; whether a cell is inserted or removed the circuit is still maintained, and therefore either one or several cells can be recharged simultaneously.

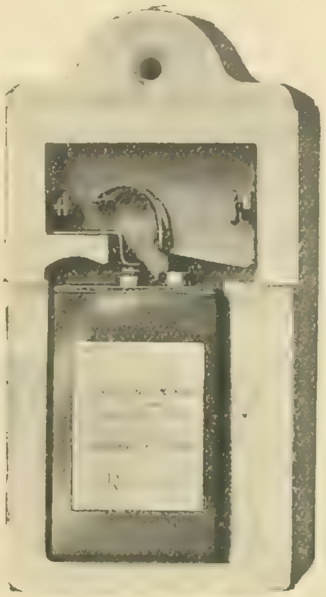

Fig. 1.—Lamp Cell Charging Apparatus.

Public Electric Vehicle Charging Station.

A compact charging station for electric vehicles, which is enclosed in a weatherproof box and is mounted on a pedestal so that it can be placed near the curb, is shown in the accompanying illustration. A charging cable and plug are provided, and while the battery is being charged the door can be closed and locked. A regulating rheostat, ammeter, polarity indicator, lamp, switches, &c., are mounted on a slate panel, as shown in fig. 2. The box is of sheet-steel, and is electrically welded. The pedestal is of cast-iron. Connection with the direct-current supply is made through conduit passing underneath the pavement. A prepayment meter may be used if desired, but on account of the numerous sizes and kinds of batteries and varying conditions an attendant is usually required.

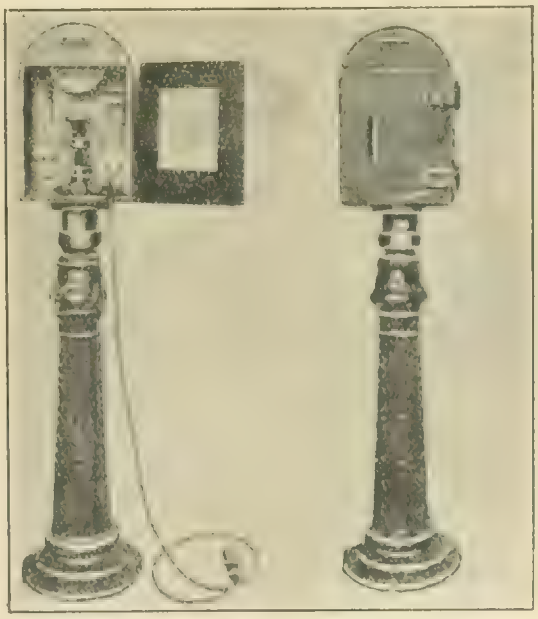

Fig. 2.—Street Charging Station for Electric Vehicles

This device for charging electric cars at the curb is made in two sizes, with ratings of 100 amperes and 150 amperes, and is being placed on the market by Clarence E. Ogden, Cincinnati, Ohio.—*Electrical World.*

Quarter-Turn Rod Coupling.

Our American contemporary, *Power*, describes an ingenious quarter-turn coupling, which has been invented by a Chicago engineer to replace a noisy bevel gear drive on a pump; this consists of two heads, bored to receive six rods of equal length. The jackshaft is horizontal and the pump shaft vertical; the coupling heads are merely solid pieces, bored for and keyed to their respective shafts. Within ½ in. of the circumference and spaced evenly around it, six holes are drilled to receive the rods comfortably. These rods are twice the length of a head plus the shortest exposed length shown in fig. 3. They are free to turn in their sockets and slide lengthwise as the relative movements of the heads demand. When in the extreme position A, the ends of a rod are midway in the heads and in position B the ends are flush with the outer faces.

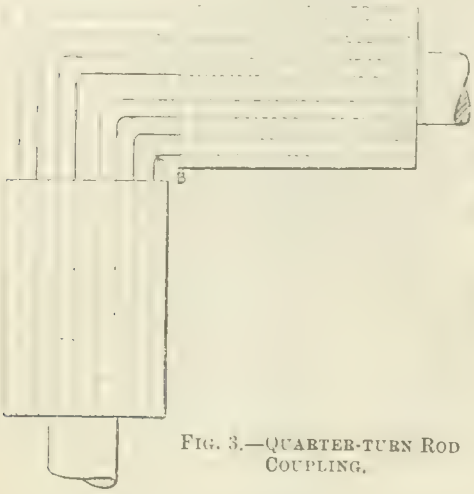

Fig. 3.—Quarter-turn Rod Coupling.

At first glance it would look as though the rods would twist together in a single turn of the heads, though this is not so. Several couplings of the same kind are in use. A 3 h.p. motor drives a 3-in. centrifugal pump; the speed is 500 r.p.m., and at a distance of only a foot it is impossible to detect any noise from the coupling. The rods are well greased and as a precautionary measure a hood is placed over the coupling. The largest coupling is for a 10-h.p. motor, but there is no reason why higher powers could not be transmitted; it is merely a question of size. To be safe the combined area of three rods should be equal to the area of the shaft.

Ediswan Fan and "Dimmer" Switch.

We illustrate in fig. 4 a recently introduced pattern of Ediswan fan, which has been specially designed for steamship and train use, by the Edison & Swan U.E.L. Co., Ltd., of Ponder's End, Middlesex. It has been constructed with a view to withstanding the action of sea air and hot climates, and to give sparkless and silent running.

The feature of this fan is its combined supporting device and connection; supports (or bases) can be installed where desired and the fan and motor fixed by the passenger in any support to suit his convenience, a bayonet-socket connection and clamping nut providing an easy means of doing this.

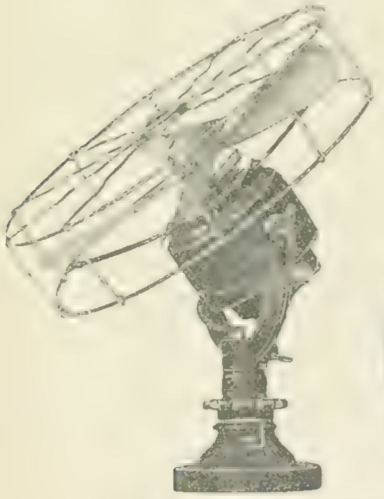

Fig. 4.—Ediswan Patent Fan.

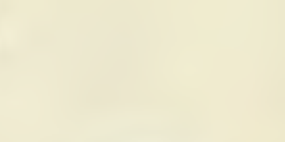

Fig. 5.—Ediswan Dimmer or Regulating Switch.

The swivel and trunnion movements enable the fan to be set to blow in any direction.

The fans are constructed with 12-in. diameter blades and for pressures of from 50 to 250 volts, and can be provided with the switch illustrated in fig. 5, which is designed for use either as a starting and regulating switch, or as a dimmer switch for night lighting purposes.

This switch is made up of a two-way and off position Ediswan wedge type switch, fitted with a resistance wound on porcelain, and enclosed in a ventilated brass cover.

The switch absorbs about 15 watts, enabling a 12-in. fan to run down to about half speed, or a 25-c.p. metal lamp to be dimmed to 1 c.p.

The Runbaken Ignition Magneto.

Among the several new ignition magnetos for use on motor-cars that have been introduced since the stoppage of supplies from Germany is the Runbaken lately put on the market by the J. H. Runbaken Co., of 7, Peters Street, Manchester, the head of which concern is well known as a specialist in electrical ignition apparatus. The new magneto is stated to embody his experience with various types of foreign magnetos, and to be manufactured entirely of British materials. The machine presents a thoroughly workmanlike appearance, and although outwardly resembling the normal German-made magneto, it differs therefrom in various constructional features. Gun-metal is employed for the end plates and base; cast-iron for the pole-pieces; and aluminium for the weather-proof internal housing.

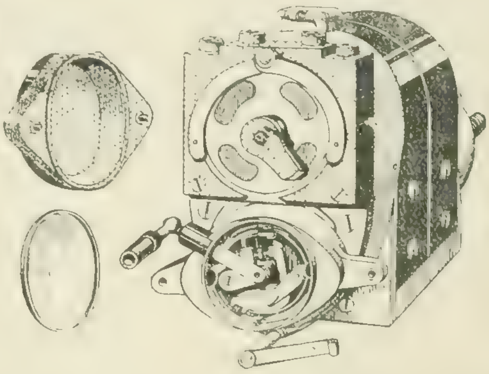

Fig. 6.—View of Distributor End of Runbaken h.t. Ignition Magneto.

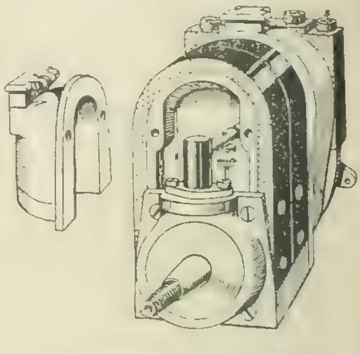

Fig. 7.—Rear-end View, Runbaken Magneto, showing Aluminium Waterproof Lining.

One feature of the design is that the condenser is deeper than usual, and is accommodated entirely beyond the magnetic field, thus leaving the full length of the pole-pieces to produce magnetic lines that may be cut by the rotation of the armature, the result being that a powerful spark is obtained at low as well as at high engine speeds; the full range of movement of the advance and retard from one extreme to the other is 35°. The distributor plate is a composite slab of ebonite with a special quality of soapstone-like insertion, in which are affixed the bronze segments for the distribution.

The make-and-break mechanism is very similar to, and is interchangeable with, that of the Bosch magneto. In place of the usual cams, however, a pair of roller-like pins are employed; these do not rotate, but are hardened and may be adjusted for wear. The contact heel of the rocker-arm of the make-and-break consists of a dove-tailed block of red fibre.

The question of accessibility of the various parts has been carefully considered, while the method of collecting the current from the armature and passing it to the central portion of the distributor is also interesting. A spark-gap is provided to prevent any damage being done to the windings should there be no path for the current to get to earth through the sparking plug. It may also be mentioned that the earthing bush is located over the armature instead of beneath it, so that there is no risk of it being affected by oil. The high-tension leads are inserted in the fixed portion of the distributor, instead of on the removable cover-plate. The latter may thus be removed to expose the distributor for examination, without in any way disturbing the cables. The magneto is waterproof, and in this regard it is interesting to note that the magnets themselves are not used as part of the enclosing material, the necessary protection from wet being secured by an aluminium casting located inside the magnets. Another point of note is the use of a disk of soft pliable metal riveted to the centre of the larger pinion of the two-to-one gear to prevent any possibility of the gears giving rise to a ringing noise. Again, all the screws that may require to be removed from time to time are hardened, while, as regards lubrication, this is secured by means of two conveniently-arranged oil baths on top of the magneto, whence the requisite small amount of oil passes to the three bearings needing it.

Bradford.—Tramway Wages.—At a meeting last week of tramway men employed by the Corporation it was decided to recommend the Executive of the Tramwaymen's Union to consider the advisability of making application for a general advance in wages of 15 per cent. The suggested increase is desired on account of the extraordinary circumstances created by the advance in food prices, and it is understood that the Executive have considered the recommendation and have decided that the suggested application should be made.

BUSINESS NOTES.

Australia.—A Sydney firm wishes to secure Australasian representation for British manufacturers of switches, electrical accessories, insulating material, &c. A merchant firm also wants agencies for British makers of electrical fittings and glazed presspahn. The names can be ascertained at the Board of Trade Commercial Intelligence Branch in London, but letters may be sent direct to H M. Trade Commissioner for Australia, 81, Pitt Street, Sydney, N.S W.

Callender's Hospital Fund.—A general meeting of Callender's Hospital and Distress Fund was held on February 13th at the Belvedere Works, Mr. T. O. Callender presiding, at which the accounts for the year 1914 were approved. Though the membership had decreased owing to 42 members joining their regiments and ships, and 127 enlisting, yet the aggregate subscriptions reached the highest figure since inauguration year 12 years ago, and a larger sum than in any previous year has been awarded to the hospitals. The excellent service rendered by the fund in other ways may be gathered from the following :—288 hospital letters were issued, 9 letters for special nursing homes, 81 surgical appliances were supplied, 17 surgical aid letters were given, 13 adults and 6 children were sent to convalescent homes, in 89 cases spectacles were provided, and 44 grants of financial assistance were made. The penny-a-week subscriptions produced £281, which is £9 better than in the previous year. The Callender Co. donated £50, Mr. T. O. Callender £5 5s., and several others two guineas each. The various sums awarded to hospitals and other institutions aggregated £283, as compared with £241 in the previous year. We learn from Mr. W. E. Wimhurst, the hon. sec. and treasurer, that in addition to the above the Callender employés have subscribed over £200 to the Prince of Wales's National Relief Fund. We congratulate those responsible for the conduct of the affairs of the fund upon so excellent a showing in what must have been a very trying year.

Book Notices.—Report No. 69 of the Engineering Standards Committee (London: Crosby Lockwood. Price 2s. 6d. net) on British Standard Tungsten Filament Glow Lamps (Vacuum Type) for Automobiles has just been issued. The subject was referred to the Committee by the Society of Motor Manufacturers and Traders, and was put in the hands of a Sub-Committee in May last year. The lamps dealt with are intended to have an approximate efficiency of 1 watt per candle; the newer gas-filled lamps will be covered in a later report. The standard voltages are 6 and 12 volts, and dimensions are fixed for the lamp bulbs and caps.

"*Journal* of the Institution of Electrical Engineers." Vol. LIII, No. 242. February 15th, 1915. This issue contains papers on Lord Kelvin's work on "Gyrostatics," by Prof. A. Gray, and "Separation of No-Load Stray Losses in a C.C. Machine by Stroboscopic Running-down Methods," by Prof. D. Robertson. There is also a "Second List" of 140 members of the Institution serving with H.M. Forces.

"Consumers' Accounts and Meter Department Routine." By A. C. Glover. London: Electrical Press, Ltd. Price 5s. net.

"*Bulletin* de la Société Internationale des Electriciens." Vol. V, No. 38. January, 1915. Paris: Gauthier-Villars. Price 3 fr.

"Sell's Directory of Registered Telegraphic Addresses." London: Henry Sell. 25s.

Bankruptcy Proceedings.—James William Tattersall and Tom Whittaker Tattersall, residing at 4, Hillside Gardens, Highgate, and carrying on business at Kimberley Road, Willesden Lane, N.W., electrical engineers.—At the London Bankruptcy Court on Friday of last week, before Mr. Egerton S. Grey, the first meeting of creditors was held. In dealing with the proofs of debt lodged the Official Receiver said he had received a proof for £3,000 from Imperial Motors. It appeared that the directors invented an electrical starter for motor-cars and entered into an agreement with Imperial Motor Industries, Ltd., under which the latter were to act as selling agents. A number of the starters were made, but it was alleged that they did not work properly, and the claim arose in regard to goods returned, money advanced, and money paid under a guarantee. After a long discussion, in the course of which directors said the amount should be £1,830 instead of £3,000, the Official Receiver eventually decided to admit the proof for voting purposes at £1,830. The Official Receiver further stated that the debtor, James William Tattersall, informed him that prior to joining his brother in partnership he was in employment, and for some years was in New York. When he returned to this country he joined his brother in partnership and they commenced business as electrical and motor engineers. They afterwards invented an electrical starter and took out patents in England and France. When war broke out their business went down considerably, and they were only able to sell a few starters each month. They placed their affairs before their creditors, who promised not to press them, and, in fact, some had since advanced them money in order to enable them to pay wages. They continued until December last hoping the war would soon end, but seeing no prospect of it doing so, they decided to file their petition in bankruptcy. They returned their liabilities at £3,653, and their assets at £480. Eventually it was decided to leave the estate in the hands of the Official Receiver for summary administration in the usual manner.

Italian Electrical Trade.—According to the *Revistà Tecnica d'Elettricistà*, in October international traffic resumed almost its normal course, and during that month machines, weighing over 1 ton, were received to the amount of 1,200 quintals, against 960 in the previous year, thus compensating for the deficiency in the two previous months. Lighter machines were imported in round figures to 1,200 quintals, against 1,400 in the previous year; transformers 883 quintals, against 1,200. Of lighter apparatus the imports were practically normal. The imports of electrical machinery in November amounted to 4,861 quintals, against 4,102 in the same month of 1913. Machines weighing above 1 ton were imported to 884 quintals, against 1,106 in 1913. Lighter machines were imported to 980 quintals, against 1,341. Only in the case of transformers was a noteworthy rise observable, imports totalling 2,570 quintals against 1,477. Electrical apparatus were generally in decline—those weighing above 1 ton being imported to 514 quintals against 769; lighter apparatus were 134 quintals against 212.

Copper.—In view of the importance attaching to the German copper position and to the attitude of the British Government towards copper shipments from America to neutral European countries, returns have been issued by the Metal Information Bureau (L. H. Quin), 3, East India Avenue, E.C., showing that from August 5th to December 28th, 1914, 32 vessels carrying copper from America were detained, the total quantity involved being 19,550 tons. Of these vessels, one, the *Belgia* (a German ship), sailed before war broke out and was headed for Hamburg. From September 26th to October 9th four vessels for Rotterdam were held up, their cargo being purchased by Great Britain. Fourteen boats for Italy have been detained, all at Gibraltar, carrying about 9,000 tons of copper, 13 vessels for Sweden with about 5,500 tons have been detained in various British ports.

Catalogues and Lists.—Messrs. Kohler Bros., 56, Ludgate Hill, E.C.—Illustrated descriptive pamphlet concerning the N.K S. two and four-motor combined push-button and hand-speed control equipments.

Messrs. Musgrave & Co., Ltd., St. Ann's Ironworks, Belfast. Folding card giving specification and tabulated dimensions, outputs, &c., of enclosed double-acting engines.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Pamphlet A 706, giving a brief illustrated description of their watertight door indicators for ships.

Sir W. H. Bailey & Co., Ltd., Albion Works, Salford.—Eight-page illustrated pamphlet (No. 2,614), giving particulars and prices of their "Silver Star" pump lubricators.

Foster Engineering Co., Ltd.—Mr. William Nicholson has been relieved from his appointment as Receiver on behalf of the first and second debenture-holders from February 10th, and the company is in possession of its assets and is trading on its own account.

Trade Announcements.—As announced in our last issue, the E.S. Co., Ltd., has been registered to take over the business of the Electrical Supplies Co. The growth of the business has necessitated increased office accommodation at 53, Victoria Street, S.W., and premises for showrooms and stores have been obtained at 10, Spencer Street, Westminster. The company will, as its name suggests, deal in electrical supplies, and manufacturers' price lists are invited.

The Efandem Co., Ltd., of the Fallings Park Works, Wolverhampton, have acquired the whole of the business of the Scott Starter Syndicate, of Norwich, and will continue the manufacture of the Scott electric lighting and engine-starting dynamo motor for motor-cars.

Liquidations.—Molybdenum and Tungsten Traders, Ltd.—This company is winding up voluntarily, with Mr. P. B. Smyth, of 638, Salisbury House, E.C., as liquidator. A meeting of creditors is called for February 24th.

Salsbury Lamps, Ltd.—Particulars of claims must be sent in by March 20th, to the liquidators, Messrs. F. Westcott and A. Riding, at 15, Eastcheap, E C.

The High Peak Magneto, Ltd.—A meeting will be held at 32, Union Road New Mills, on March 17th, to hear an account of the winding up from the liquidator, Mr. J. G. Collier.

LIGHTING and POWER NOTES.

Abingdon.—Street Lighting.—The T.C. has decided to invite the Gas and Electric Supply Companies to tender for lighting the street lamps from Midsummer, on similar terms and conditions to the present contract, and also for a lighting installation in the new fire station.

Argentina.—The Rosario Electric Light Co. has accepted the conditions of the Municipality for a new contract for the supply of current for a period of 18 years.—*Rev. River Plate.*

Ashton-under-Lyne.—Public Lighting.—During the past month 17 street lamps have been converted from gas to electric lighting.

The T.C. has decided to oppose the Stalybridge Joint Tramways and Electricity Board's Bill for the construction of additional tramways and extension of the area of electricity supply.

Australia.—During the past 12 months the Perth (W.A.) City Council sold 3,929 423 units, an increase of 7·2 per cent. over the previous year. Electric street lamps numbered 131 in the city and 35 in the Maylands and Mount Lawley districts. The new power station is expected to be available late in the year, and the erection of sub-stations is proceeding.

The Council has decided to supply municipal councils or road boards, within a radius of five miles of the G.P.O., with bulk alternating current at the actual cost to the city (which includes price paid to the Government for energy, together with distributing, management, and financial charges).

Barnes.—Electric Cooking.—The U.D.C. has decided to install electric cookers in its workmen's dwellings. The electrical engineer reported that an apparatus, consisting of a small oven, 14 in. × 12 in. × 12 in., with a boiling plate, would meet the requirements, and could be installed at £4 per cottage, including all wiring and fitting charges. The charge will be made through a pre-payment meter, and will be adjusted to cover cost of cooker and meter, in addition to the energy consumed.

Boroughbridge.—E.L. Scheme.—At the Parish meeting of the town and Aldborough, which was held to consider the proposed electric lighting scheme, it was decided to request the local authorities to give reasonable assistance to the promoters in their endeavour to carry the scheme into effect.

Boston.—E.L. Scheme.—The T.C. has accepted terms offered by the promoters of the E.L. order, by which the Council is to have the option of purchasing the undertaking at the end of 21 years from the date of the order, and at every subsequent seven years, as a going concern by valuation. If practicable, the Council is to have the option of taking the whole of the undertaking, and if not, the Boston R.D.C. is to have a similar option as to that part of the undertaking in the rural area.

Burton-on-Trent.—Restricted Lighting.—The Gas and Electricity Committee has decided to reduce the whole of the street lighting by one-half, and to reduce the illumination of those lamps in use by shading them. The Committee also recommends that the tradesmen should discontinue outside shop lighting.

Carlisle.—Special Tariff Rejected.—The T.C. has again rejected the recommendation of the Electricity Committee that in the case of bulk supplies of energy under agreement on the restricted hour system, the fixed charge be reduced from £4 15s. to 15s. per kw. of demand per annum. The Gas Committee strongly opposed the proposal.

Carrickmacross. — Workhouse Lighting. — The members of the B. of G. have decided to install the electric light in the workhouse as soon as possible. The general wiring of the streets of the town has not yet been completed; a number of shopkeepers and also residents of private houses will use the electric light.

Chapel-en-le-Frith.—The B. of G. has been informed that the cost of installing electric light in the workhouse would be about £850.

Charleville.—The valuation of the Charleville Electric Lighting Co.'s station premises has been reduced from £30 to £20, and the valuation of £80 on posts and wires to £10.

Cleckheaton.—Works Extensions.—The U.D.C. has decided to extend the generating station at an estimated cost of £20,000, as recommended by the Council's consulting engineer. It was stated that the sanction of the L.G.B. could not be obtained until the new Spenborough Council (the combined townships of Cleckheaton, Liversedge, and Gomersal) was elected.

Combe Martin.—The P.C. has passed a resolution to the effect that the Bill of the Ilfracombe Gas Co., by which E.L. powers are sought, is detrimental to the interests of the parish, and is asking Sir Godfrey Baring, M.P., to oppose the measure in Parliament.

Continental Notes.—Norway.—The town of Notodden, which is one of the largest centres of the electrical industry in Norway, has, up to the present, been dependent on the purchase of all the energy required for municipal purposes. It is now reported that the municipality has unanimously decided to acquire the Saga Waterfall, which is situated within municipal territory; this will produce about 4,000 e.h.p., of which only 150 h.p. is used by the present owner.

Spain.—A concession has been awarded for the utilisation of the waters of the Rio Dulce for the production of electric power for the lighting of the town of Mandayona, and for industrial purposes.

A further concession authorises use of the waters of the Rio Isbor for the production of electric power for industrial purposes in the town of Isbor.—*Board of Trade Journal.*

Italy.—A new central station has just been completed and put in operation at Follonica by the Societá Elettrica Maremmana, of Leghorn, for the supply of current to the various mines and townships in the district. The plant comprises three gas engines (two of 250 h.p. and one of 180 h.p.) coupled to three 3,600-volt alternators. The current is stepped up for transmission to a pressure of 15,000 volts, and then transformed to 260 volts for power purposes and 150 volts for lighting.

Germany.—It is reported that owing to the shortage of petroleum, the Government is recommending the substitution of electric lighting as far as possible, and insulated iron wire is being introduced on account of the shortage of copper.

Sweden.—For some time the erection of a transmission line from Untra to Stockholm, with the view of transmitting electrical energy from the former place to the metropolis has been discussed, and it now appears that the project will be realised, as an application for the necessary concession has been made. The scheme will involve a capital expenditure of no less than £750,000.

Belgium.—It is reported that as a result of the British air raid on Zeebrugge, the Rombach Central Electric Works was obliged to stop work, and for want of motor power the bridges could not be worked.

Darlington.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £18,550 for extensions to the electricity works, and for the period of the loan of £9,500 granted for mains, services, and transformers, to be extended from 15 to 25 years.

Dublin.—Proposed Increased Tariff.—The Electricity Supply Committee has agreed that the increased cost of coal for the Pigeon House generating station, and the maintenance of a regular supply, will have to be met by an increase in charge to consumers.

East Sussex.—Prov. Orders.—The C.C. has decided to oppose the application of the Tunbridge Wells T.C. for a prov. order extending the area of supply to rural parishes in the Council's area, and also the East Grinstead Urban District prov. order for E.L.

Glasgow.—The Cattle Markets Sub-Committee is to consider, in view of the considerable rise in the price of carbons, whether it will alter the system of lighting.

Hayward's Heath. — Prov. Order. — The Urban Council has requested the B. of T. to postpone the Mid-Sussex Electric Lighting Order until six months after the termination of the war.

Heywood. — The Corporation has decided that from March 31st next a minimum rate of 20s. per annum shall be charged for electrical energy for any four quarters, and that the hire of motors be for 12 months certain, six months' notice to be given of the intention to discontinue hiring.

Holme. — E.L. Scheme. — A Committee has been appointed to go into the question of providing an electricity supply. The district, at present, has neither gas nor electricity, and it is understood that already there are 50 persons who are willing to become subscribers to the supply.

Holmfirth.—Loan Sanction.—The Council has received from the L.G.B. sanction to borrow for electric lighting purposes:—£3,591 for buildings; £3,228 for generating plant, &c.; £549 for meters and battery; and £132 for street lamps. The Council decided to complete the contract with Mr. Broadbent, of Huddersfield.

Ipswich.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £3,100 for purposes of the electricity undertaking.

London.—Woolwich.—In response to the Borough Council's request, the Finance Sub-Committee of the L.C.C. has considered the postponement of accelerated loan repayments in regard to the Plumstead plant, &c., and now proposes that such accelerated repayments should commence when the Council's new turbine plant is brought into use. This short postponement, however, does not meet the views of the B.C.; the Finance Committee has decided to urge the L.C.C. to sanction, without delay, the borrowing of £35,000 on account of the £48,000 now being applied for, in view of the serious overdraft incurred. In regard to the further application for borrowing powers for £10,000 for a 3,000-kw. turbine set, the L.C.C. Finance Committee has intimated that it does not propose to deal with it pending further information in connection with loan repayments and plant, which will be supplied as soon as Sir John Snell has prepared a memorandum on the matter.

Shoreditch.—The B.C. is recommended to avail itself of the offer of a loan for the electricity undertaking of £11,481, at 4¼ per cent. per annum, from the Rational Association Friendly Society. The application to the L.C.C. for the loan at 4½ per cent. per annum has been withdrawn.

L.C.C.—The Finance Committee recommends the Council's sanction to the application of the Poplar B.C. for £8,173 for mains for the electricity undertaking.

The L.C.C. Fire Brigade Committee is installing electric radiators in the appliance rooms at the Bishopsgate, Brompton, Euston, Holborn, Old Kent Road, Redcross Street, Shadwell and Shoreditch fire stations.

Bermondsey.—The B.C. has been recommended to enter into an agreement with the County of London Electric Supply Co. to supply energy for the pumping purposes at the Vine Street depôt, on a sliding scale, varying from a maximum of 1½d. to a minimum of 1d. per unit.

Manchester.—Restricted Lighting.—The Tramways, Gas and Electric Lighting Committees have decided that all street lamps are to be shaded at the top, also the top lights in tramcars. Arrangements have also been made for turning off all lights in the city, or parts of the city, if necessary.

Ormskirk.—As the result of negotiations, the differences between the U.D.C. and the Ormskirk Gas Light Co. have now been settled, and the Council has withdrawn its opposition to the Lighting Bill now before Parliament. The Gas Light Co. has agreed that, in consideration of laying extension mains to the Parbold district, it will undertake on no account to charge more for gas supplied to any consumer in the Ormskirk area, and that any new electric lighting mains shall be placed underground; further, that Clauses 45 and 46 of the Bill shall be withdrawn. It was contended that if Clause 45 had gone through, the company would have been empowered to buy out the present electric light undertaking, and thereby would have created a monopoly in regard to the lighting of the town.

Queensferry.—E.L. Scheme.—At a recent meeting of the parishioners it was decided that the suggested scheme for lighting the district by electricity should be a municipal one.

Ripon.—E.L. Scheme.—A petition is to be presented to the City Council requesting it to arrange with the Army authorities for the supply of electricity from the camp generating station. The neighbouring townships of Bedale and Masham have electric lighting, and the Boroughbridge authorities have been urged to adopt this mode of lighting, and at Ripon there is a strong feeling in favour of a supply of electric current.

Rochdale. — Street Lighting. — The B. of G. has decided to proceed with the lighting by electricity of Birch Hill Lane as soon as possible.

Stockton-on-Tees.—Loan Application.—The T.C. has applied to the L.G.B. for a loan of £4,000 for two new rotary converters, &c., for the electricity works.

Slaithwaite.—E.L. Scheme.—The Council has decided to apply to the B. of T. for approval of the use of overhead lines, and the Council's electrical engineer has been instructed to prepare plans, &c. A Sub-Committee has been appointed to report on steam and suction gas for motive power, and decide as to which of these forms of power should be employed.

Swansea.—The extensions at the Corporation electricity works are nearly completed, and represent an outlay of £40,000. The Electricity Committee is extending the cables to Town Hill to light the new workmen's cottages.

Swinton and Pendlebury.—Street Lighting.—The bulk of the electric street lighting scheme has been carried out, but owing to difficulty in obtaining material, it is impossible to estimate the probable date of the completion of the work. The lamps along Manchester Road, Chorley Road, and part of Bolton Road have been switched on, but lamps for the remainder of the fittings have not yet been delivered.

Swindon.—Alterations are to be made to the flues and a water baffle is to be fitted at the electricity works, with a view to preventing the escape of grit and dust from the chimney.

Tipperary.—Workhouse Lighting.—Mr. A. E. Porte has furnished a supplementary report on the cost of improving the electric lighting plant of the workhouse. The total amount given is £625; but there is an addition of £25 for tuning up the existing plant and cells, with a further £10 to £15 for buildings or foundations.

Tottenham.—Restricted Lighting.—The D.C. is recommended to accept the offer of the North Metropolitan Electric Power Supply Co. for a reduction of 50 per cent. in respect of arc lamps which were not lighted during the December quarter.

Truro.—Prov. Order.—The City Council has been informed that the B. of T. would be prepared to favourably consider an application, in August, for the postponement of the revoking of the prov. order for a period of 12 months, on certain conditions.

Urmston.—Proposed E.L.—A Sub-Committee has been appointed to report upon the question of introducing electric lighting in the district.

Worcester Park.—The South Metropolitan E.L. Co. is re-applying for a prov. order for E L. at Worcester Park.

Wednesbury.—Increase of Price.—The Electricity Committee of the Corporation has given notice that, as from January 1st, 1915, the price of current would be increased by the addition of 15 per cent. on the net amount of the account, as the Mond Gas Co., which supplies gas for generating purposes, has notified its intention to raise the schedule prices for gas. The Committee states that the ability of the Mond Gas Co. to continue its supply to the Corporation depends on the length of the war and the conditions of industry, but the Committee hopes it will be unnecessary to announce any further increase in the price of electricity, and that it may be possible within a short time to reduce the temporary increase of 15 per cent. now rendered necessary. The increase will seriously affect big manufacturers in the district, several of whom take a large supply of current, both for lighting and power purposes.

Yorkshire Electric Power Bill.—Following the meeting of the West Riding Urban and District Councils and the subsequent action of some authorities in regard to the Bill promoted by the Yorks. Electric Power Co., decisions have been arrived at by the following Councils:—The Huddersfield and Wakefield Corporations have resolved to oppose the Bill; the Rawdon District Council has decided to support the Bill on conditions; the Denby and Cumberworth District and Wharfedale Rural Councils have decided to support the West Riding District Councils' Association's opposition; the Holme U.D.C. has decided to take no action; and the Meltham U.D.C. has decided to request the company to strike its area out of the Bill. The Shepley U.D.C. is also opposing.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. Cars.—At a meeting last week of the Corporation Tramways Committee on the question of abolishing the P.A.Y.E. cars, a decision was deferred until August.

Cardiff.—Traffic Results.—The accounts for 1914 of the city tramways showed an increase to July last of £3,000, as compared with the corresponding period of 1913. Since the war this gain has been changed to a decrease of nearly £2,000. But for the war the increased traffic receipts, it is estimated, would have amounted to nearly £6,000.

Edinburgh.—Female Conductors.—A scheme has been discussed by the Edinburgh Tramways Co. to employ women as conductors on the cars, and it is expected that it will shortly be put into operation.

Hindley.—The Wigan Tramways Committee is to consider the extension of the tramways by constructing a new line from the present terminus along Market Street, Hindley, and up Castle Hill.

Huddersfield.—The T.C. has decided to oppose the Halifax Corporation Parliamentary Bill, which deals with various tramway extensions.

Glasgow.—Assessment.—The T.C. has been informed that the valuation of the tramway undertaking, by the Assessor of Railways and Canals for the year 1915-16 is £281,770, as against £280,490 for the previous year.

L. and Y. Railway Electrification. — The annual report of the company states that progress is being made with the electrification of the line between Bury and Manchester. During the past year £42,698 has been spent on the power station which is being erected at Clifton Junction and on sub-stations, and £14,788 has been expended on the conversion of the line. The new line will be run on the third-rail system, in the same way as the Liverpool-Southport line, but at a different voltage. Intervening stations are to be made at Woodlands Road, Crumpsall, Heaton Park, Prestwich, and Radcliffe. With regard to electric traction, the company's returns show that the number of trains worked by electric power has increased from 159 to 174. The mileage of electric trains has advanced from 1,765,879 to 1,848,923, an increase of over 83,000 miles.

London.—The G.N. and City section of the Metropolitan Railway has now been provided with 1st class accommodation between Moorgate Street and Finsbury Park, this being the first "tube" to cater for 1st class passengers. The time of the journey has been reduced to 9 minutes.

L.C.C.—The one mile of experimental conduit side slot on the Shoreditch to Stamford Hill section of the Council's tramways is to be replaced by the centre slot system.

Manchester.—As a result of the discussion of the Executive Committee of the Tramway and Vehicle Workers' Union, the members of the Manchester branch on Sunday decided to apply to the Corporation Tramways Committee for an increase of 15 per cent. on the present wages. The application is made on the ground of the high prices of food, and the Committee will be asked to concede the increase until such period after the war, when food prices shall have returned to the normal.

Mansfield.—The Mansfield and District Light Railways Co. has applied for an extension of time until April, 1918, for completing the lines in Sutton-in-Ashfield and Skegby.

N.E. Railway Electrification.—In their annual report the directors of the North-Eastern Railway Co. say that it is anticipated that the electrification of the line between Shildon and Newport will be completed in the summer.

The mileage of electric trains was 1,257,581 as against 1,255,235 in 1913.

Northampton.—Far Cotton Extension.—The T.C. is making representations to the B. of T. concerning the delay on the part of the L. & N.W.R. Co. with regard to the opening of the tramway track to Far Cotton, owing to the non-completion of that portion of it which crosses the railway at a level crossing. The lines have been laid down for a month or two, but the signalling apparatus has not yet been fixed in order to allow the cars to cross.

Scarborough.—Fire.—Damage to the extent of £200 was caused to the premises and electrical apparatus at the electric tramway depôt by a conflagration which broke out in the early hours of Saturday last.

TELEGRAPH and TELEPHONE NOTES.

Basingstoke.—On the recommendation of the Fire Brigade Committee, the Council has accepted the quotation of the Post Office telephone authorities, at £4 per annum per mile of fire alarm wire, and 5s. per point.

United States.—The Government has permitted the Marconi Wireless Telegraph Co., of America, to re-open its station at Siasconset, Mass., which was closed on September 25th, 1914, by order of the President.—*T. and T. Age.*

China.—Hitherto the Japanese Consulate and the Japanese residents in Shanghai have depended on the Great Northern Telegraph Co. for telegraphic communication with their country. As the term of the 25 years' contract has expired, the Japanese have made arrangements to take the cable under their own control. As, however, many of the intermediate posts are in Chinese territory, the Japanese and Chinese Governments have agreed to co-operate in working the cable, and to form a special company, with the title of the Sino-Japanese Telegraph Co., for the purpose.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 6th. U.D.C. Twelve months' supply of cables, meters, joint-boxes, &c., lamps, uniforms, tickets and other stores. See "Official Notices" February 5th.

Australia.—BRISBANE.—March 10th. Motor-generator, power board, &c., for Postmaster-General. See "Official Notices" January 15th.

April 7th. Wheatstone receivers and transmitters, for the Postmaster-General. See "Official Notices" to-day.

MELBOURNE.—March 16th. White Wheatstone receiving tape, for Postmaster-General. See "Official Notices" February 5th.

Bedwas.—March 4th. Electrical goods for 12 months, for the Bedwas Navigation Colliery Co., Ltd. Forms of tender from the Secretary.

Belfast.—March 15th. Twelve months' supply of stores for the Tramways and Electricity Committees. See "Official Notices" to-day.

Blackburn. — Iron, steel, bolts, screws, &c., for the Tramways Department. Mr. J. H. Cowell, General Manager.

Bolton. — March 4th. Corporation. Twelve months' supply of stores for the Electricity Department. See "Official Notices" to-day.

February 22nd. Corporation. Twelve months' supply of tramway stores, including lamps, carbons and insulating material, for the Tramways Committee. Forms of tender from Mr. J. Barnard, Tramways Manager.

Bradford. — February 22nd. B. of G. 800 electric incandescent lamps, for the North Bierley Union. Particulars from Mr. W. G. Cooper, Clerk, Union Offices, 4, Town Hall Street.

Cardiff.—February 22nd. Installation, 750 points, at new Technical Institute, Cathays Park, for the City Council. See "Official Notices" January 22nd.

Gloucester. — April 1st. Twelve months' supply of stores, for the Electricity and Light Railways Committee. Forms of tender from Mr. F. H. Corson, General Manager, Light Railways Offices, Bristol Road.

Guildford.—Water softening and filtering plant, 50,000 gallons per hour, for Guildford Electricity Supply Co., Ltd. See "Official Notices" to-day.

Huddersfield.—March 2nd. Corporation. Electricians' work at new Tuberculosis Hospital. Forms of tender from Mr. K. F. Campbell, Borough Engineer.

Hull.—March 2nd. Air-space telephone cable, for the Telephone Committee. See "Official Notices" to-day.

Ilford. — February 23rd. U.D.C. Twelve months' supply of stores for the electricity works. See "Official Notices" February 5th.

Leeds.—February 20th. Corporation. Twelve months' supply of stores for Electric Lighting Department. See "Official Notices" January 22nd.

February 22nd. Corporation. Twelve months' supply of electrical sundries, for the Tramway Department. Forms of tender from the Tramway Manager.

London.—ISLINGTON.—February 24th. B.C. Twelve months' supply of electrical stores. See "Official Notices" February 5th.

WIMBLEDON.—February 22nd. Corporation. Twelve months' supply of stores for the Electricity Department. See "Official Notices" February 12th.

FULHAM.—February 24th. B.C. Twelve months' supply of electrical stores. See "Official Notices" February 12th.

HAMMERSMITH.—February 24th. B.C. Twelve months' supply of general electricity stores. See "Official Notices" February 12th.

BATTERSEA.—March 2nd. B.C. Supply of stores for Electricity Department. See "Official Notices" February 12th.

WESTMINSTER.—February 24th. B. of G. Six months' supply of electric lamps, fittings, &c., for the Westminster Union. Forms of tender from the Clerk, Princes Row, Buckingham Palace Road, S.W.

HORNSEY.—March 16th. Meters, cables and stores, &c., for the T.C. See "Official Notices" to-day.

Macclesfield.—March 10th. Cheshire County Asylum, Parkside. Electrical goods for one year. Forms of tender and particulars from Mr. Wm. Tingay, Clerk of Asylum.

Manchester.—March 2nd. G.C. Railway Co. Six or twelve months' supply of wires, cables, carbons, electrical accessories, lamps and telegraph material. Forms of tender from Mr. W. Williams, Stores Superintendent, G.C.R., Gorton.

February 23rd. Two low-pressure circulating water pumps, for Stuart Street generating station. Specifications from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Newport (Mon).—March 2nd. Electric light fittings, for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

New Zealand.—May 3rd. Electrically-driven turbine pumps of 80,000 and 100,000 gallons capacity per hour, together with direct-coupled motors. Commercial Intelligence Department, Board of Trade, London.

Oldham. — February 24th. The Electricity Committee invites tenders for the erection of an accumulator stores in Churchill Street East. Borough Surveyor's office.

Pontypridd. — March 8th. U.D.C. Twelve months' stores for Electric Light and Tramways Department. See "Official Notices" to-day.

Rotherham. — February 22nd. Corporation. Two water-tube boilers, automatic mechanical stokers, economisers, superheaters, foundations, steel chimneys, steam valves, steam pipes, induced-draught plants, and all auxiliaries. See "Official Notices" January 29th.

Salford.—February 22nd. Twelve months' stores for the Tramways Department. General Manager, 32, Blackfriars Street.

March 6th. Three motor-converters or rotary converters and transformers of 1,000 KW., and one motor or rotary converter and transformer, of 500 KW., for the Borough Electricity Department. See "Official Notices" to-day.

Swindon.—March 13th. Corporation. Twelve or six months' stores for Electricity and Tramways Departments. See "Official Notices" to-day.

Wigan. — March 2nd. Twelve months' stores and materials for the Tramways Department. Mr. F. Buckley, General Manager, Market Place.

CLOSED.

Barnes. — The U.D.C. has accepted the following tenders:—

Siemens Bros. & Co., Ltd.—Feeder cable, £145.
Edison Accumulators, Ltd.—Four electric dust-vans, £915 each.

Bolton.—The Tramways Committee has accepted the tenders of the following firms for the purchase of scrap metal:—H. Bessemer & Co., T. Mitchell & Sons, R. E. Roberts, O. A. Ryder, Kay & Co.

The Electricity Committee has accepted the tender of Messrs. B. Talbot & Sons for alterations at Spa Road generating station.

Bristol.—The Docks Committee of the Corporation has accepted the tender of the Wells Electrical Co. for the supply of arc lamp carbons.

Connah's Quay.—Messrs. Johnson & Phillips, Ltd., have received a provisional order from the U.D.C. for overhead and underground mains, public lighting and services.

Halifax.—Messrs. Lewin & Murray, of Halifax, have secured the order for the electric light installation at the Bermerside Institution.

Glasgow.—The Tramways Committee has recommended the acceptance of the following :—

Trolley cord.—W. C. Yuille & Co., Ltd.
Special trackwork.—Lorain Steel Co. ; Titan Trackwork Co., Ltd. ; Edgar Allen & Co , Ltd.
Three-core cable.—British Insulated & Helsby Cables, Ltd.

Messrs. Allan, Arthur & Ure have secured the contract for the electric lighting of Corporation-owned tenements in Gallowgate and Hill Street, at £171.

Heywood.—The following tenders in connection with the bulk supply scheme have been accepted :—

Converting plant, E.H.T. switchgear and sub-station plant.—British Westinghouse Co., Ltd.
Overhead mains.—B.I. & Helsby Cables, Ltd.
Switchboard and cables.—Bertram Thomas.
Battery booster.—Phœnix Dynamo Co.

Holmfirth.—The District Council has decided to complete the contract with Mr. Broadbent, electrical engineer, of Huddersfield, for carrying out the electric lighting scheme of the Council, involving an expenditure of £7,500.

Ilford.—Owing to the difficulty in obtaining supplies of coal under contract, the electrical engineer has accepted an offer of 200 tons of Kingsbury nutty slack at 12s. 11d., 160 tons of Pinxton ½-in. slack at 14s., and 170 tons of Pinxton slack at 14s. 6d. per ton.

Ipswich.—The T.C. has accepted the following tenders :

Fraser & Chalmers.—Steel bunkers, elevator and coal-conveyor plant, including a wagon tipper, at the electricity works, £2,320.
Catchpole & Co.—Enlargement of the refuse destructor, £1,630.
Heenan & Froude.—Destructor cells, boiler-flue connections, &c , £3,137.
Royce, Ltd.—Electric crane, £185.

Keighley.—The Joint Hospital Board has accepted the tender of Messrs. H. Spence & Sons for electrical work.

London. — Camberwell.—The Borough Council has accepted the tender of the Brimsdown Lamp Works, Ltd., for an annual supply of electric lamps.

Woolwich.—The B.C. has accepted the tender of Messrs. Bruce Peebles, Ltd., for a 1,000-KW. motor-converter, at £2,150.

Newport (Mon.). — The Electricity and Tramways Department has placed a contract for the next 12 months' requirements of certain electrical accessories, including switches, with Messrs. J. H. Tucker & Co., of Birmingham.

Swansea.—The tender of the British Thomson-Houston Co., Ltd., has been accepted by the E.L. Committee, at £55, for the supply of an earthing resistance.

West Bromwich.—The T.C. has accepted the tender of the B.I. & Helsby Cables, Ltd., for cable, and that of Edison Accumulators, Ltd., for four electric chassis for 'buses, at £3,560.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, February 19th. At 8 p.m. At Storey's Gate, S.W. Annual General Meeting. Paper on "Convertible Combustion Engines," by Mr. A. E. L. Chorlton.

Royal Institution of Great Britain.—Friday, February 19th. At 9 p.m. At Albemarle Street, W. Paper on "The Visit of the British Association to Australia," by Prof. H. E. Armstrong, F.R.S.

Saturdays, February 20th and 27th. At 3 p.m. Lectures (I and II) on "Recent Researches on Atoms and Ions," by Prof. Sir J. J. Thomson, F.R.S.

Association of Mining Electrical Engineers.—Saturday, February 20th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Some Experiences in the Handling of Electricity," by Mr. A. Smellie.

(**South Wales Branch**).—Saturday, February 20th. At 6.30 p.m. At Technical College, Swansea. Paper on "Typical Breakdowns in Colliery Electrical Plant and their Prevention," by Mr. L. Foster.

Saturday, February 27th. At 6 p m. At Carlton Café, Queen Street, Cardiff. Paper as above, by Mr. L. Foster.

(**Notts. and Derbyshire Branch**).—Saturday, February 20th. At 3.30 p.m. At University College, Nottingham. Discussion on paper by Mr. L. Foster.

At 6 15 p m. Lecture on "Firedamp and its Detection," by Prof. McMillan.

Royal Society of Arts.—Monday, February 22nd. At 8 p.m. At John Street, Adelphi. Fothergill Lecture (II) on "Motor Fuel," by Prof. V. B. Lewes.

Wednesday, February 24th. At 8 p.m. Paper on "The Economics of the War," by Dr. W. J. Ashley.

Association of Supervising Electricians.—Tuesday, February 23rd. At 8 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "D.C. Motors," by Mr. E. F. Butler.

Institution of Civil Engineers.—Tuesday, February 23rd. At 8 p m. At Great George Street, Westminster, S.W. Paper on "The Electrolytic Action of Return Currents in Electric Tramways on Gas and Water Mains; and the Best Means of Providing against Electrical Disturbances," by Mr. H. E Yerbury.

Institution of Electrical Engineers —Thursday, February 25th. At 8 p m. At Victoria Embankment, W.C. Paper on "Electricity Applied to Mining," by Mr. C. P. Sparks.

(**Manchester Local Section**).—Tuesday, February 33rd. At 7.30 p m. At Engineers' Club, 17, Albert Square. Paper on "Training for the Industrial Side of Engineering."

(**Western Local Section**).—Tuesday, February 23rd. At 5 p.m. At Institute of Engineers, Park Place, Cardiff. Chairman's address by Mr. D. E. Roberts. Paper on "Electricity Applied to Mining," by Mr. C. P. Sparks. Informal Dinner.

(**Yorkshire Local Section**).—Wednesday, February 24th. At 7 p.m. At Philosophical Hall, Leeds. Paper on "Electricity Applied to Mining," by Mr. C. P. Sparks.

Physical Society of London.—Friday, February 26th. At 5 p.m. At Imperial College of Science, South Kensington. Papers on "Magnetic 'Character' Figures, Antarctic and International," by Dr. C. Chree, F.R.S.; "The Electrification of Surfaces as Affected by Heat," by Dr. P. E. Shaw: "Electromagnetic Inertia and Atomic Weight," by Prof. J. W. Nicholson.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, February 26th. At 7.30 p m. At Bolbec Hall, Newcastle-upon-Tyne. General Meeting.

(**Graduates' Association.**)—Saturday, February 27th. At 7 15 p.m. Paper on "Electric Lighting and Power for Ships," by Mr. O. Holmes.

NOTES.

The Electric Vehicle Committee.—At the last meeting of this Committee it was reported that the sales of the first number of "The Electric Vehicle" showed a considerable increase over the number given at the previous meeting, and it was decided to increase the size of the second issue. The sales of publicity mail cards published by the Committee show a considerable increase since the last meeting.

It was decided to offer, through the Commercial Motor Users' Association, prizes aggregating £10, to be awarded to electric vehicle drivers in the examinations for drivers which the Association is arranging to hold this year.

An offer by the Commercial Motor Users' Association to provide space in the next edition of its "Handbook of Night Shelter Accommodation for Commercial Vehicles," for particulars of electric vehicle charging stations and a map, conditional upon the Electric Vehicle Committee preparing the matter to be inserted, was accepted.

About 25 of the illuminated and 46 of the enamel plate charging station signs will be required by the various undertakings, and the Secretary is to get in offers and to appoint for one year, in connection with each sort of sign, a maker as the official manufacturer and to notify the name, in each case, in the forthcoming issue of "The Electric Vehicle."

An intimation was received from the Car and General Insurance Corporation, Ltd., that it had in preparation a special prospectus for electric vehicles.

A communication was submitted from the Secretary of the I M.E.A , requesting the Electric Vehicle Committee to prepare a report on "The Use of Electric Vehicles in Municipal Service," for discussion on June 17th next, one of the two days fixed for the Annual Business Meeting of the I.M.E A., and asking the Committee to arrange for a parade and demonstration of electric vehicles to follow upon the reading and discussion of the report. It was agreed that the Committee should comply with this request.

As to proposed standardisation of glow lamps for electric vehicles, the Technical Sub-Committee held a joint meeting with a Sub-Committee appointed by the Tungsten Lamp Association, but a stage was not reached at which any report could be formulated.

The Relation of Supply Prices to Profits.—The price movements in connection with the production and disposal of electrical energy in Germany for a number of years past form the subject of a work which was recently published by Gustav Siegel, at Munich. It is shown, in the first place, that the number of KW.-hours sold by the electricity supply works increased from 1,200,000,000 in 1900 to 11,300,000,000 KW.-hours in 1913, or from 21·4 KW.-hours per head of the population, to 169 KW.-hours in the same years respectively. The latter circumstance indicates that the large and constant reduction in the sale prices is of decisive importance to the country from an economic point of view. Apart from the considerable direct saving which has been effected by consumers through the operation of lower charges for supply, the steady fall in the average sale prices is found to have been of great significance to the supply works themselves, the remunerativeness of which has by no means been diminished by the concessions made in the prices. The difference between the works' costs and the average sale prices per KW.-hour becomes smaller year by year, or, in other words, the gross surplus per KW.-hour decreases as sale prices in general fall to a greater extent than the works' costs recede. Under these circumstances the surplus of the works would be reduced were it not for an expansion taking place in the turnover simultaneously with the better utilisation of the generating plant. If the case of the Nuremberg supply works is taken as an example and applied to all the electricity works, Mr. Siegel shows that while the average gross surplus per KW.-hour has diminished from 2·63d. to 2·31d. between 1900 and 1912, the gross surplus has risen in percentage of the capital invested from 14·48 to 20·06 per cent. in the same years respectively. In support of the contention that price reductions exercise a favourable effect upon the dividends of company-owned works as a result of the expansion in the business, reference is made to nine undertakings or groups of undertakings, each of which owns a number of works and which indicate a progressive dividend increase in a period extending over a number of years. It is submitted, further, that the company works, in contradistinction to those in the possession of local authorities, in general charge lower prices than the latter, and this fact is attributed to the circumstance that under private enterprise great importance is attached to the supply of energy for power purposes and the price policy is arranged accordingly.

Canada and the Exportation of Electrical Energy.—Holding that the interests of Canada are paramount, and that whenever the Canadians feel that they can use to advantage the energy now generated for export they can, and no doubt will, cancel the licences permitting its export into the United States, the Privy Council of the Dominion of Canada has declared that a contract to export electrical energy from Canada to the United States may be revoked at any time. As is well known, the Dominion Government grants licences yearly to certain electrical corporations of Canada near the border to export electricity into the United States.

All of the large generating systems at the Niagara frontier line export a large part of the energy generated into New York State, and when the Canadian-American Power Co. applied to the Public Service Commission, Second District, New York, about a year ago, for the right to issue stock on a contract made with the Electrical Development Co., of Ontario, for a large block of electricity to be used in the United States, there was a sharp difference of opinion between the Commissioners as to whether the companies should be allowed to capitalise the contract. Commissioner M. S. Decker granted the right of the company to capitalise the contract.

Commissioner Decker's discussion at the time on the yearly licences from the Dominion Government is of interest now, in view of the decision of the Privy Council. Mr. Decker wrote :—

"The formality of securing a licence yearly from the Dominion Government is required by the Dominion law, but such licence has been granted yearly to the great producing electrical corporations of Canada, and no reason appears for apprehension that any discrimination will be made against the Electrical Development Co. or the Toronto Power Co., lessees. We have nothing before us but the suggestion that the Dominion of Canada may at some future time forbid this exportation. The Commission must assume that international relations affecting so important a subject as the means of continuing great industries which have grown up in reliance upon the use of this imported power, and, as well, the interests of the Canadian producing companies, thus have become fixed, and subject only to such changes as will protect the great commercial and industrial interests and rights now served by this power brought from Canada. The time has long since passed when Governments proceed ruthlessly, from purely national rashness or anger, to destroy the settled, accepted commercial relations and formal vested rights of business corporations. . . . Without going into details, it seems sufficient to say that the prohibition of exportation from Canada of this present electric power which now comes into this country, would paralyse business and industries of many kinds, and would deprive numerous localities of electricity for light."—*Electrical World.*

Parliamentary.—*Standing Orders.*—The whole of the Bills promoted for this year's Session have now been before the Examiners for proof of compliance with Standing Orders. Amongst those which have failed to prove compliance are the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, the Dunfermline and District Tramways, the London County Council Tramways and Improvements, and the Aberdare Urban District Council's Tramways. These have been referred to the Standing Orders Committee, who will decide whether they shall be allowed to proceed.

London Electric Supply.—Now that the London County Council has decided not to go forward with its Electricity Bill for consolidating the electrical interests of London, the field is left to the promoters of the London Electric Supply Bill, who will, however, be vigorously opposed. Notice of opposition has been given by no fewer than 42 petitioners, amongst whom are the London County Council, the Borough Councils of Fulham, St. Marylebone, St. Pancras, Shoreditch, Woolwich, Finsbury, Southwark, Bermondsey, Hackney, Camberwell, Hammersmith, Hampstead and Lambeth ; the Corporation of London, Croydon, Ealing, and West Ham ; and a number of Urban District Councils, including Penge, Twickenham, Chiswick, Isleworth, and Slough ; and the County of London Electric Supply Co., the South London Electric Supply Corporation, Egham and Staines Electricity Co., and the City of London Electric Lighting Co. ; the principal electrical engineers of local authorities supplying electricity whose undertakings might be acquired under Clause 61 of the Bill ; and the chief assistant electrical engineers of local authorities supplying electricity whose undertakings might be acquired.

Opposition to Private Bills.—Most of the petitions against the Private Bills which will originate in the House of Commons this Session have now been deposited in the Private Bill Office. Nine petitions are deposited against the Metropolitan District Railway Bill, including one from the L.C.C. and one from the Metropolitan Railway Co. There are six against the Rhondda U.D.C. (Tramway Extensions).

Industrial Electric Heating.—A. K. Young, new-business manager of the Toledo Railways and Light Co. is deeply impressed with the possibilities of industrial electric heating from the standpoint of the central station, and believes that there is a dire lack of authentic data available on the subject. To remedy this situation Mr. Young recently recommended the establishment of an industrial heating association, the chief purpose of which would be the collection and compilation of data on the subject. This matter was proposed at the recent conference of the Committee on New Business Co-Operation of the Ohio Electric Light Association, held in Cleveland, and it was decided to call a preliminary organisation meeting in Dayton, O., on March 16th.—*Electrical Review and Western Electrician.*

Fatalities.—Manchester.—John Harvie Nevin, 38, electrical engineer, was the victim of a fatal accident at the Stuart Street generating station, Manchester, on February 12th.

At the inquest held on Monday it transpired that Nevin, who had been employed at the works for six months, and had had 12 years' experience altogether, received a shock whilst attending to the high-tension gear. Thomas Baxendale, assistant resident engineer at Stuart Street, said Nevin had been instructed to attend to the transformers, and had performed that duty satisfactorily. Then he appeared to have gone to the high-tension switchboard for some reason which the witness could not explain. Instead of making the cubicle, which he had apparently examined, quite safe by earthing the switchgear, he appeared to have taken a great risk without reason, thereby breaking the rules. Witness explained that for dangerous tasks of that kind rubber gloves, galoshes, and an insulated stick were provided, but Nevin had not used these. There was a very high voltage, and he must have received a very severe shock which caused him to fall from a ladder on which he had to stand to reach the cubicle. After the accident he was put in a special respiratory machine for two hours, and ether was also administered, but without avail. Mr. Baxendale added that he was afraid there had been a little mental aberration on Nevin's part. The jury returned a verdict of "Accidental Death."

Tram-Conductor's Fraud.—At the Bradford City Police Court last week, a tram conductor named Herbert K. Smith (28), of 44, Royd Street, Bradford, was sent to prison for three months on a charge of stealing a tin box containing a bell punch and a number of tramway tickets, value £3, the property of the Bradford Corporation. According to the statements of Mr. J. G. Gunter, who prosecuted, a quantity of unused tramway tickets were sent to the Bowling Depôt on November 5th, and were missed the next day. They could not be traced until the tramways manager (Mr. C. J. Spencer) noticed an alteration on a way-bill which had been used by the prisoner. Afterwards it was found that 16 other way-bills had been altered, and the number of tickets stolen was 2,917. The tramway manager described the fraud as the most ingenious he had come across in the course of his experience.

Copper.—European supplies for January 30th, as tabulated on Messrs. Merton's statistical circular, are 307 tons less than at the end of December. English stocks show a decrease of 2,757 tons from December 31st to January 30th, the difference in the European stocks being made up by larger incoming shipments. Detailed supplies show a large increase in arrivals from North America, and an unusually strong supply from Spain and Portugal. Chile shipments are even better than for December, 1914, and considerably exceed the monthly average for 1913. Australian shipments were not so heavy during January. The large increase in demand received a better response from deliveries last month, as is shown by the total deliveries, which exceed those for December by 4,101 tons.

Electric Vehicle Demonstrations.—Messrs. Drake and Gorham, Ltd., of 47, Spring Gardens, Manchester, are conducting an energetic campaign towards popularising the use of electric vans in Lancashire and Cheshire, for which counties they have acquired the sole agency for vehicles with the Edison battery and to that end have acquired a 2-ton demonstration van, which we illustrate herewith. This vehicle is of robust construction, the body being so arranged that it can be used as a covered van, open wagon or flat lorry.

The Edison battery is carried in a cradle below the body, and the motor is of the totally-enclosed traction type, driving through a differential gear to a lay shaft, and thence by roller chains to the rear wheels. The electric truck excels as a vehicle for heavy haulage, and there is no doubt that in the manufacturing area in which Messrs. Drake & Gorham are now endeavouring to introduce the electric vehicle, there exists great scope for its employment, apart altogether from its uses in connection with the retail trades.

Mails to the Far East. — Prof. C. A. Middleton Smith, writing under date January 11th from the University of Hong-Kong, says :—"Owing to the war the mail services to the Far East have been very much interrupted, and in some cases correspondence has gone entirely astray or has been lost at sea. I should be very glad if any of your readers who may have sent letters out here, and have had no reply after a reasonable lapse of time, would kindly send copies or communicate again. It may also be of advantage to inform correspondents who send to this colony that the mails now often take six weeks instead of the 17 days in the anti-war days. It is, of course, always an advantage to send duplicate letters by the following mail."

Professional Classes and the War.—On Tuesday last a meeting was held under the chairmanship of the Lord Mayor of London, who was supported by many distinguished persons, to promote the aims of the "Professional Classes War Relief Council." This body, to whose programme we have previously referred, has been formed to ascertain the amount of distress in the professional classes due to the war, and to organise assistance for necessitous cases, by providing temporary employment, hospitality, education for children, and maternity assistance. As the Archbishop of Canterbury pointed out in the course of a speech, very many members of the professional classes have been hard hit by the war, and are without the scope of the ordinary relief organisations; in many cases projected public works have been deferred until after the war, and the men thus thrown out of employment find it exceedingly difficult to obtain other means of livelihood. Sir J. McClure explained the methods adopted, which were partly based on the principle that the prosperous should help the unlucky ones. The matter was a delicate one, as relief must be given without wounding the self-respect of the recipient, and for this reason doles of money were avoided. On the other hand, work was not made; openings were sought in which the training and ability of the men could be usefully employed. Help could be given by loans, and the Council would be glad to receive money on loan for this purpose. The sympathetic attitude of the schools, many of which were accepting children at reduced fees, had greatly assisted the Council. It was important to remember that the need of assistance would continue after the war had ended.

Help is asked for in the shape of offers of employment, and of funds, which should be sent to the treasurer, 13 and 14, Prince's Gate, S.W.

Petrograd Electricity: Proposed Monopoly.—A Committee appointed to study the relations of the Petrograd Town Council with the electrical companies, came to the conclusion that the Petrograd municipality should concentrate the city's electrical equipment in its own hands, either by constructing its own central station and extending the cable system along the streets of the city, or by buying up the existing electrical concerns. One member of the Committee—M. P. Phedoroff—suggested the reconstructing of existing companies and modifications in the terms of their concessions. Such steps required a previous decision on the system to be adopted in the future for supplying Petrograd with electricity; that is, whether by municipalisation or private concession. One expert—V. I. Zazersky—calculates the net profit to the city by buying out existing concerns, at several million roubles per annum, beginning with 1917; whilst another expert—A. L. Wolf—calculates that the profits from the year 1920, assuming that the present tariff for power will be reduced from 33 copecks to 15 copecks per KW.-hour, will be about 2,500,000 roubles a year more than is at present obtained as the town's share of the existing companies' profits. As these are considered reliable estimates, it is looked upon as safe that the city will make a profit out of the venture. According to the report of the Committee, the consumption of power for private use increased between 1904 and 1913 from 16,383,000 to 43,533,000 KW.-hours, or at the rate of 16·5 per cent. per annum; for industrial purposes the increase registered during the period named was from 12,433,000 to 42,123,000 KW.-hours, or 24·7 per cent. per annum. [1 rouble = 2s. 1½d.; 1 copeck = 1 farthing.]

Institution and Lecture Notes.—Royal Society of Arts.—The following evening lecture arrangements are announced up to the end of March:—

Prof. Vivian B. Lewes, lectures on "Motor Fuels." Mondays, February 22nd and March 1st.

Prof. W. J. Ashley, "Economics of the War." Wednesday, February 24th.

Prof. J. W. Gordon, "Patent Law Reform and the War." Wednesday, March 10th.

Mr. H. M. Thornton, "Industrial Uses of Coal Gas." Wednesday, March 17th.

Igranic Engineering Society.—A course of three lectures on "Ancient Engineering in Peace and War" was recently delivered by Mr. R. P. Howgrave-Graham, M.I.E.E., at Bedford. The arrangements were made by the Society, and resulted in raising a substantial sum in aid of the Prince of Wales's and Belgian Relief Funds.

Patents and Alien Enemies.—Licences have been granted by the Board of Trade to Messrs. Bi-Metals, Ltd., in respect of patents No. 13,557/03 (Callmann) and No. 17,624/04 (Leisel).

Inquiry.—Makers of papier-mâché bobbins are asked for.

Appointments Vacant.—Assistant electrical engineer (£170), for Redditch U.D.C.; office and line telegraphists, for Divisional Signal Company, Royal Engineers (Reading), new Regular Army; junior assistant electrical engineers, over 19 years of age (15s.), for Newcastle-upon-Tyne Electric Supply Co.; overhead linesman for car-shed repairs, for Burton-upon-Trent Tramways. Particulars are given in our advertisement pages.

Miners' Dispute.—Last week's conferences at Leeds resulted in the settlement of the Yorkshire miners' dispute, the men's demands being agreed to for the duration of the war.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At the Islington electricity works last Friday MR. JARRATT (the assistant mains engineer) was presented with a music cabinet to contain automatic music rolls, on his leaving to take up the post of mains superintendent at the Swansea Borough Council electricity works, under Mr. Burr. The presentation was made by Mr. MacAlister, the chief assistant, on behalf of Mr. Gay, who sent an apology for his absence. Mr. MacAlister referred to the satisfaction that Mr. Jarratt had always given in the testing department and the mains department. Mr. Marks, the present testing engineer, who is serving with the Forces, has been appointed to the post vacated by Mr. Jarratt (subject to the Council's decision), at the conclusion of the war. Mr. Bradshaw (mains superintendent) endorsed very heartily all Mr. MacAlister's expressions in regard to Mr. Jarratt. Mr. Jarratt feelingly responded, and said that although it seemed very nice to leave and take up a new post, when it came to the point it was like turning away from home.

The Greenock Corporation Electricity Committee has unanimously recommended the appointment of MR. W. B. SMITH, A.M.I.E.E., as chief assistant engineer of the electrical undertaking, consequent upon the appointment of Mr. J. H. Parker as chief assistant at Croydon. Mr. Parker has been granted an honorarium of £25 for his services as interim manager of the Greenock works before the new chief took up his duties.

MR. A. C. GLOVER has been appointed to a position on the staff of the Cornwall Electric Power Co., and commences his duties on 1st prox.

Mr. V. A. WOODLAND has resigned his position as chief meter inspector to the Watford U.D.C., and has taken a position as meter tester, &c., at the Hampstead Corporation Electricity Department.

General.—MR. OSCAR MOLL, director of the German Atlantic Cable Co. at Cologne, Germany, retired from the service at the end of 1914, after 46 years of successful work in cable telegraphy. He was born at Berlin, in 1850, and, in 1867, he joined the Electric and International Telegraph Co. of London, and, two years later, the Indo and European Telegraph Co. as clerk-in-charge of the London station. On the formation of the Direct United States Cable Co. in 1874, Mr. Moll occupied the position of assistant to the manager, and became manager in 1888. In 1889 he undertook the management of the Deutsch-Atlantische Telegraphengesellschaft of Cologne. For the last 15 years Mr. Moll has been director of the company and his broad knowledge of cable matters, and his great abilities, contributed considerably to the rapid development of this concern. Mr. Moll took part in the International Telegraph Conferences at Budapest, for the Direct United States Cable Co., and at London and Lisbon for the Deutsch-Atlantische Telegraphengesellschaft. — *Telegraph and Telephone Age.*

MR. A. HATTON, electrical engineer on Government work at Portsmouth, was married at Southsea a few days ago to Miss Frances Boyle, of High Lea, New Mills.

The staff of the Burton and Ashby-de-la-Zouch Light Railway Co. have presented a rosewood inlaid drawing-room clock to MR. W. J. MCDONALD, traffic superintendent, who is leaving for Wakefield. His successor is Mr. W. Barton.

Obituary.—MR. EDWARD CHAPMAN, a member of the Crewe Town Council, and chairman of the Electric Light Committee, died on February 12th.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Burnham and District Electric Supply Co., Ltd.—Deb dated February 3rd, 1915, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders Lloyds Bank, Ltd., 71, Lombard Street, E.C.

Torquay Electric Light and Power Co., Ltd. Particulars of £1,000 second deb. created February 8th, 1915, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Bourton-on-the-Water Electric Light and Power Co., Ltd.—Mortgage dated February 5th, 1915, to secure £[illegible], charged on certain lands and premises at Bourton-on-the-Water, Glos. Holders: Cheltenham and Gloucestershire Permanent Mutual Benefit Building Society, 18, Clarence Street, Cheltenham.

Walsall Electrical Co., Ltd. (37,696).—Capital £[illegible] in £1 shares; return dated December 25th, 1914; 12,[illegible] shares taken up; [illegible] paid; £[illegible] considered as paid. Mortgages and charges, £[illegible].

Railless Electric Traction Co., Ltd. (98,728).—Capital £5,000 in 4,750 ord. shares of £1 each and 5,000 def. shares of 1s. each. Return dated January 14th, 1915; 2,571 ord. and 5,000 def. shares taken up; £1 per share called up on 2,046 ord. shares; £1,[illegible] paid, leaving £[illegible] in arrears; £765 considered as paid, being £1 per share on [illegible] ord. and 1s. per share on 5,000 def. shares. Mortgages and charges, nil.

United Electric Car Co., Ltd. (57,082).—Capital, £[illegible] in £1 shares (£150,000 pref.). Return dated September [illegible]th, 1914; 150,000 ord. and 100,000 pref. shares taken up; £250,000 paid. Mortgages and charges, nil.

CITY NOTES.

Central London Railway Co.

The report submitted at the annual meeting held yesterday gave the following results for the year ended December, 1914:

		Decrease compared with 1913.
Gross receipts of railway, etc. ...	£244,691	£10,146
Expenditure	144,359	3,183
	£100,332	£6,963
Miscellaneous receipts, (net) from rents, interest, etc.	32,685	3,578
Total net income	£133,017	£10,541
Add balance from last account ...	20,879	6,340
	£153,896	£16,881
Deduct interest, rentals and other fixed charges	38,133	165
	£115,763	£16,716
Deduct dividend on 4½ per cent. preference stock	21,600	—
Balance available for dividend on ordinary, preferred ordinary and deferred ordinary stocks	£94,163	£16,716

After paying the dividends reported in our last issue, £15,413 is to be carried forward. The capital expenditure amounted to £52,099. The decrease in the traffic receipts is mainly attributable to the war conditions. Owing to the war the work in connection with the extension railway between Wood Lane and Ealing Broadway has not progressed very rapidly, and the date of completion will therefore be delayed.

The company's Bill, which sought powers to construct four subways, the installation of escalators at Shepherds Bush, Oxford Circus and the Bank, and the enlargement of tunnels at Holborn, received Royal Assent last July, as did also the London Electric Railway Bill. The company has a Bill now before Parliament to make further provision respecting the capital and undertaking of the Metropolitan District Railway Co. to confer further powers on the London and South-Western Railway Co. in respect of their Wimbledon and Fulham Railway, and on the Wimbledon and Sutton Railway Co. and for other purposes.

City & South London Railway Co.

The annual meeting was held on Tuesday at the Westminster Palace Hotel. The report submitted contained the following results for the year ended December, 1914:—

		1914.		Inc. or Dec. compared with 1913.
Gross receipts of railway, etc. ...		£136,844	–	£9,759
Expenditure		93,967	+	3,054
		£42,877	–	£12,813
Miscellaneous receipts (net) from rents, etc.		9,073	+	698
Total net income		£51,950	–	£12,115
Add balance from last account ...		738	–	1,850
		£52,688	–	£13,965
Deduct interest, rentals and other fixed charges		28,321	–	630
		£24,367	–	£13,335
Dividends on preference stocks	£30,000			
Less chargeable to capital under provisions of Act of 1913	5,633			
		24,367	–	10,747
Balance available for dividend on consolidated ordinary stock		—	–	£2,588

The interim dividends, which in July, 1914, were declared upon all four of the company's preference stocks, absorbed £21,250. The balance estimated as available for dividend for the six months to June 30th, 1914, not having in fact provided that sum, it was to the extent of £5,633 provided out of capital. In view of the necessary uncertainty of the duration of the war, the directors think it undesirable that any further appropriation of capital under that enactment should for the present be made. The balance available for dividend for the second half of 1914 amounts to £8,750, which it is proposed to apply in payment of a half-year's dividend on the preference stocks of 1891 and 1896. The capital expenditure during the year was £24,767. Under the terms of an agreement dated April 28th, 1914, £412,000 four per cent. debenture stock was allotted and issued to the Underground Co. It was proposed to utilise the proceeds from the sale of this stock towards the various improvements on the railway; but in consequence of the outbreak of war, the directors, notwithstanding the fact that their financial and other preparations for beginning the enlargement of the tunnels and the other great improvements contemplated by the company's Act of 1913 had been completed, and the necessary arrangements made with the contractors, did not feel justified in proceeding with the works.

Mr. C. B. Stuart Wortley, K.C., M.P., presided at the meeting on Tuesday. He said that but for the war they would now have been well forward with the reconstruction of the railway. They would have been within twelve months of finding themselves the owners of an improved railway and new and larger rolling stock. When the war came they had actually passed their plans and drawings, made arrangements with contractors, and raised a portion of the money. Perhaps it was as well that at that moment no contractors' men had as yet been set at work, for in that case they would now have been committed to going continuously forward with difficult underground works in spite of greatly enhanced rates for labour and materials. The war had also had its effect on their traffics and accounts. During the mobilisation in August they carried soldiers and sailors free, and ever since the beginning of the war all pleasure traffic, and most of the evening traffic, had greatly fallen off. At the same time the adverse influences continued which had already told so heavily upon their earnings in previous years, and which were accepted by Parliament in 1913 as sufficient ground for permitting the fundamental changes by which it was hoped to counteract them. The result on the receipts side was that the gross railway earnings were down by £9,760. There were, however, some grounds for hoping that this decrease would not continue to be progressive, for of late there had been a distinct revival in the weekly traffics. Since the beginning of the year traffic increases set in which, up to the last completed week of 1915, showed an improvement, as against the corresponding weeks of 1913 and 1914, of £350 per week on an average. It remained to be seen whether this improvement was due to temporary causes, such as the removal of 'buses from the streets for service in the war. Should it, however, continue for any great part of the new year, it would work a most welcome improvement on their accounts for 1915. On the expenditure side there was an increase of £3,054. This time the increase could not be attributed to higher prices of coal, which, indeed, were slightly lower; but there were substantial increases for men's wages, amounting to no less than £4,000. The number of City and South London Railway men on the pay roll who had rejoined the colours or had volunteered for service was not easily separable from the total number of men who belonged to the staffs of the whole of their group of railways and were serving in the war. That total, however, was no less than 1,300 men, or 20 per cent. of the whole. The Chairman proceeded to refer to the arrangements made for, and allowances to, men with the colours.

Admiral Sir Cyprian Bridge seconded the motion, which was adopted.

London Electric Railway Co.

At the annual meeting held yesterday the following results for the year ended December, 1914, were submitted:—

			Inc. or Dec.
Gross receipts of railways, etc. ...	£712,573	–	£2,746
Expenditure	345,001	+	12,145
	£367,572	–	£14,891
Miscellaneous receipts (net) from rents, interest, etc.	69,372	+	10,371
Total net income	£436,944	–	£4,520
Add balance from last year's account	1,086	–	2,021
	£438,030	–	£6,541
Deduct interest, rentals and other fixed charges	233,236	+	17,977
	£204,794	–	£24,518
Deduct appropriation to reserve ...	8,000		—
	£196,794	–	£24,518
Deduct dividend on preference stock	126,947		—
Balance available for dividend on ordinary shares ...	£69,847	–	£24,518

After paying the dividends mentioned in our last issue, £8,000 is carried to reserve and £11,547 carried forward. £867,971 of 4 per cent. debenture stock has been issued during the year and the capital expenditure was £399,997. Passenger traffic was adversely affected by the conditions which prevailed during the last five months of the year and prevented any expansion in receipts for the year which should have resulted from the various extensions and improvements. The extension of the company's line at Charing Cross was completed and brought into operation in April last. The arrangements for the interchange of passengers between this company's stations and the station of the Metropolitan District Railway Co. at this point, where escalators have been installed, have been working very satisfactorily and are much appreciated by the travelling public. The escalators constructed at Oxford Circus station were placed in service in May last, and the opening of the new concourse booking hall at the basement level has very satisfactorily met the traffic requirements at this busy station. Escalators have also been constructed at Baker Street station, making a convenient means of interchange of passengers with the Metropolitan Railway, and were placed in service in October last. Rapid progress was made with the extension from Paddington to Queen's Park and a portion was opened for public traffic on January 31st, 1915. The company has a Bill before Parliament, as mentioned in the Central London report above.

Metropolitan District Railway Co.

At the annual meeting held yesterday the directors reported that the normal course of the business of the company was necessarily disturbed by the outbreak of the European war. The control of the railway was taken over by the Government. The following is a summary of the receipts and expenditure on revenue account:—Receipts of railway, etc., £817,456, expenditure £413,970, miscellaneous receipts (net) from rents, interest, etc., £115,735; total net income £519,221, plus £12,659 brought forward. Deduct interest, rentals and other fixed charges £343,662, appropriation to reserve £20,000, dividends on guaranteed and first preference stocks £124,930, and there is a balance available for dividend on second preference stock amounting to £43,288. After providing for the dividends mentioned in our last issue, £13,888 is to be carried forward. The capital expenditure during the year amounted to £117,400. The extension of the London Electric Railway Co.'s line at Charing Cross was completed and brought into operation in April, 1914. The arrangements for the interchange of passengers between this company's station and the stations on the London Electric Railway at this point, have been working very satisfactorily and are much appreciated by the travelling public. The re-arrangement of the tracks at the Whitechapel station was completed and brought into use in October last.

London Electric Supply Corporation, Ltd.

The profit for the year ended December, 1914, is £93,234, against £71,753 last year. Adding £5,098 brought forward, less interest on temporary loan, £738, the total is £97,594. Deducting interest on debenture stock to December 31st, 1914, £19,494, and sinking fund for redemption of debenture stock in 1931, £12,000, there remains £66,100. The dividend on the 6 per cent. preference shares absorbs £26,952; a dividend of 4 per cent. on the ordinary shares requires £13,320; there is placed to contingencies account (making £11,000) £7,000, and to reserve account (making £87,500) £10,000, leaving £8,828 to carry forward. The sinking fund of £12,000 a year, cumulative, for the redemption of debenture stock in 1931, now amounts to £37,490, in addition to the fund, £23,118, invested to repay capital expenditure in Westminster and St. James' Companies districts, making a total of £60,608.

"The supply has been efficiently maintained during the year. The number of units sold amounted to 46,343,065, as against 35,336,223 last year; the total costs per unit were .50d., as against .62d. last year. The power supplied for traction and tramway purposes shows 43 per cent. increase, while the power supplied for industrial purposes shows 23 per cent. increase, over last year. The average receipt per unit sold (lighting and power) was .94d., as compared with 1.04d. last year. Attention is directed to these figures in view of the repeated statements that London is suffering from the want of a cheap supply of electric power."

The plant and machinery have been maintained out of revenue and are in efficient condition. The directors have joined with the other electric supply companies in London in depositing a Bill, entitled "The London Electric Supply (No. 2) Bill," in the present session of Parliament.

Annual meeting: February 25th.

Tyneside Tramways and Tramroads Co.

For the December half of 1914 the surplus of receipts over expenses is £6,185, plus £1,060 brought forward. After deducting interest on debentures, loans, etc. (£1,004), there remains an available balance of £6,241. Dividend on the preference shares (5 per cent. per annum) absorbs £601; a dividend on the ordinary shares at the rate of 3 per cent. per annum requires £2,008; there is placed to reserve for renewals, depreciation and other contingencies (plus £237 interest on investments, and making the fund £19,163) £1,400; to a special reserve account to meet contingencies £1,500, carrying forward £732. The ordinary share dividend for the whole year is an increase of ½ per cent. over 1913. Traffic receipts show an increase of £2,263 as compared with the corresponding half-year of 1913, but for the whole year there is an increase of £3,249.

	1912.	1913.	1914.
Car miles	717,567 ...	720,286 ...	724,097
Passengers carried	5,619,201 ...	5,959,691 ...	6,749,161
Total traffic receipts ..	£26,888 ..	£28,570 ...	£31,819
Gross profit	£9,456 ...	£9,796 ..	£12,009

Mr. J. T. Merz, who presided at the meeting on the 9th instant, said that of the increased traffic £2,488 was for ordinary, £537 for holiday, and £224 for workmen's traffic. The receipts per car mile averaged 10.54d. as against 9.52d. in 1913, and the cost per car mile 6.72d. as against 6.39d. That showed that the cars were carrying more passengers, and the cost was one of the lowest among the tramways of the country. The average for 77 tramways was 7.25d., while their's was only 6.72d.; that figure was even more reasonable when it was remembered that most of the other tramways produced their own current and they did not. The reserve fund now stood at £19,163. Their aim was always to keep £20,000 to meet repairs to rolling stock and permanent way. Of their reserve, only £14,000 was at once available, as the other £5,000 had been spent on the line as capital. Their profit was 1⅜ per cent. more than in the previous year, but it was not proposed to increase the dividend beyond ½ per cent. They proposed to put £1,500 to a special reserve. They had had some exceptional demands in consequence of the war, and proposed to vote a sum not exceeding £200 for charitable purposes connected with the war during the next half-year. During the past half-year they had spent £85 for similar purposes. Much of this had gone towards the maintenance of the families and dependents of those of their men who had gone to the war. As to the future, he could say nothing except that they had been very busy as the result of the activity in the engineering and shipbuilding yards.

A shareholder asked whether the trams had been overloaded; and, further, whether, in view of the rise in the price of commodities, they would be likely to be called upon to increase the wages of the tramwaymen.

The Secretary (Mr. J. C. Little) said the cars were only overloaded for one journey during the "rush."

The Chairman said they had a demand—he thought a reasonable one—in regard to wages, and the directors had authorised, or were going to authorise, the staff to arrange the matter. The workmen and staff had worked harder than usual, and had done it cheerfully and well. As to the increase in the cost of living to the workmen, that was a special matter, and the staff was to be authorised to arrange with the workmen as to a reasonable advance.

The report was adopted.

Mersey Railway Co.

The train mileage run during the year ended December, 1914, was 543,697 miles as compared with 547,784 for the previous twelve months. As the control of the system in common with other railways has been taken over by the Government, the accounts for the year take a special form.

Under the scheme of arrangement scheduled to the Mersey Railway Act, 1900, as extended by the Mersey Railway Acts, 1906 and 1910, the payment of interest on the following debentures stocks, viz.: 1866, 1871, 1882/3/5 and B, is contingent on the revenue of the company available therefor in each separate year. The auditors have certified that the revenue available for this purpose for the year amounts to £21,279, as compared with £20,202, and this amount is accordingly being distributed to the debenture holders as follows:—Interest at 4 per cent. on the 1866 debenture stock £4,661, at 3 per cent. on the 1871 debenture stock £3,000, at 3 per cent. on the 1882/3/5 debenture stock £10,800, and 1 per cent. on the "B" debenture stock £2,814; balance carried forward £1.

Annual meeting February 19th.

City of Buenos Ayres Tramways Co. (1904), Ltd.

The annual meeting was held on Monday at Winchester House, E.C., under the presidency of Mr. John Heaton. In proposing the adoption of the report (Elec. Rev., p. 225), the Chairman said he had to inform them that the annuity from the Anglo-Argentine Tramways Co., Ltd., had been duly received. Three quarterly interim dividends had been paid, and they would declare the final dividend that day of 1s. 3d., making the 5s. per annum. In addition, they proposed to add [illegible] to the general amortization fund, raising that fund to £37,146. With regard to the amortization funds, the auditors reported: "In our opinion, the position of both funds is quite satisfactory, and the purpose for which they were instituted has, up to the present, been more than fulfilled." It was a source of satisfaction to the board to receive such favourable reports in that connection from year to year. The [illegible] in Europe and the climatic conditions existing in the Argentine Republic had been adverse to both railway and general business, but he was glad to say it had not affected them in any way. The board were glad to be able to present such a satisfactory report and they hoped and anticipated the same good fortune for the future.

Mr. E. H. Woods seconded the motion, and the report was adopted.

Cambridge Electric Supply Co., Ltd.

During the year 1914 there were 183 additional consumers connected, and the number of units supplied was 1,011,835, an increase of 81,281 units. There was a total profit for the year of £11,585, plus £1,199 brought forward. After deducting debenture and other interest £1,816, and placing £3,000 to depreciation fund account, there remains £7,968. An interim dividend of 2½ per cent., absorbing £2,209, has been paid, and the directors recommend the payment of a further dividend of 3½ per cent., making 6 per cent. for the year, absorbing £3,112, leaving to carry forward £2,647. The directors have thought it wise to increase considerably the carry forward, in view of possible emergencies due to the war.

Annual meeting, February 24th.

Northampton Electric Light & Power Co., Ltd.

The development of the business during 1914 was in all respects satisfactory. Lamps and motors added (32 Watt lamp basis) were 32,883, making a total equal to 191,781 lamps. The increase in h.p. of motors is 894, making 3,935 h.p. The output has been 3,958,700 units, compared with 3,568,981. The maximum winter load was 2,433 kw., an increase of 15¾ per cent. The generating plant has been increased, and new buildings for additional offices have been erected. The general depreciation account has been increased by £6,000 (out of which certain specific items have been written down), £425 has been written off motors, and £1,750 added to reserve. £787 will be required for the dividend on the 5 per cent. preference shares, and 8 per cent. per annum is to be plaid on the ordinary shares for the half-year (making 6½ per cent. for the year) £3,140, leaving £3,041 to be carried forward.

Annual meeting, February 25th.

Bristol Tramways and Carriage Co., Ltd.

The gross receipts for 1914 were £454,774, and the working and general expenses and renewals £372,185, leaving a net revenue of £82,589. After paying debenture interest, 4 per cent. preference interest, and interim dividend of 4 per cent. on the ordinary, it is proposed to pay a final dividend for the half-year at the rate of 5 per cent. per annum (subject to income tax), making 4½ per cent. for the year, adding to reserve fund for contingencies and renewals £8,301.

The interest on investments has been carried direct to the credit of the reserve fund. With the addition of £8,301 now proposed, the reserve fund will amount to £260,010. The receipts from the tramway department show a decrease of £4,035, or 1.65 per cent., whilst those of the carriage department have increased by £34,811, or 19.92 per cent. Passengers carried on the cars and motor omnibuses were 58,301,585, as compared with 56,790,309 in 1913, an increase of 1,511,276.

The operation of motor omnibuses in Bristol has been further developed. Three of the existing routes have been extended, and on three additional routes new services have been inaugurated. New services have also been commenced between Gloucester and Tewkesbury and between Weston-super-Mare and Worle. The opening of further routes in Bristol and elsewhere in the near future is contemplated. In order to cope with the continued expansion of the business of the carriage department, additional rolling stock has been put into service, and in addition to other extensions and alterations of premises, the Bath and Cheltenham garages have been considerably enlarged, and a commodious depôt and garage is in course of erection at Avonmouth so as to provide for the rapidly growing requirements in that locality for motor omnibuses, cabs and commercial vehicles. The Motor Constructional Works at Brislington, since the outbreak of war, have been chiefly devoted to the execution of work for the Government. Seven hundred and eighteen men in the company's employment have joined His Majesty's forces.

The Bill promoted by the Corporation last session was amended, and if the Corporation now elect to purchase they must acquire the whole of the company's tramways and light railway undertakings both within and outside the city. Under the terms imposed by Parliament, the portions on which the Corporation have no immediate option (about one-sixth of the company's system) must be purchased with due allowance for computed profits over various periods, the period for the larger portion being 32 years from the present time. It is proposed to extend the Memorandum of Association to include the execution of Government and other contracts and the addition of new departments embracing the manufacture of aircraft, war material, the supply of electricity, and other matters.

Annual meeting, February 22nd.

Liverpool Overhead Railway Co.

For the year 1914, the gross revenue receipts (including estimated amount receivable under agreement with the Government) were £91,668, and the working expenses, including appropriation to reserve funds, £61,245, leaving £30,424.

Passengers carried—	1913.	1914.
First class	1,456,694	1,527,636
Third class (including tramways)	7,517,715	7,745,356
Workmen (special return tickets)	4,208,912	4,088,952
Total	13,183,321	13,361,944

After referring to the assumption of control by the Government in August, the directors state that, deducting from the above figure £30,425, the amount of debenture interest, £6,755, and adding £6,275 brought forward, there is available for dividend £29,944, out of which interim dividends have been paid for the half-year ending 30th June last, at the rate of 5 per cent. per annum on the preference shares, absorbing £3,000, 5 per cent. per annum on the 1906 shares, £965, and 2½ on the ordinary shares, £6,250, leaving available for final dividend £19,728. The directors recommend the declaration of dividends for the December half-year at the rates of 5 per cent. per annum on the preference shares, and 3½ per cent. per annum (making 3 per cent. for the year) on the ordinary shares, payable on and after 26th February next, leaving £7,013 to be carried forward.

Annual meeting, February 23rd.

National Electric Supply Co., Ltd.

The annual meeting was held at Preston on February 11th, Mr. John Booth presiding. The Chairman said that until the outbreak of war there seemed every probability that the company would enjoy another record year, with an increased dividend. As it was, they had reason to be thankful that after five months of war they had held their ground, and were in a position to recommend the same dividends as twelve months ago.

A year ago they adopted a profit-sharing scheme with the employés, and from his own experience of similar schemes in other businesses he felt sure that they had done the right thing in making the men feel they were partners in the concern. In the revenue account, by the new larger battery of accumulators they had made a saving of £577 in fuel, but they had to spend about £90 per annum more in the upkeep of the battery. There was a rapidly growing demand for electric heating and cooking appliances, and they found that a satisfied customer was their best advertising agent.

During the year they had added a larger number of new consumers than ever before in one year. Against this they had a decreased consumption from shops through closing earlier, and a considerable falling off in the demand from power-users. The total sales showed a falling off of £226. That would have been much larger but for the revenue from new consumers. They were proposing to again put £5,000 to reserve for depreciation and to write £500 odd off old meters, bringing the total reserve for depreciation to £50,669. The stores and stock of meters were now in such a healthy condition that he was hoping they would not require any more special amounts for some time. Dividends at 4 per cent. for the year, making with the interim dividend 8s. for the year, also £2 14s. 3d. per share on the founders' shares, were declared.

Smithfield Markets Electric Supply Co., Ltd.

Sir H. S. Leon, Bart. (Chairman), presided on Friday, at the offices, 57, Charterhouse Street, E.C., over the annual meeting of the company. In moving the adoption of the report (Elec. Rev., p. 225), he said that the total capital expenditure during the year was only £100. The Diesel plant installed two years ago had not been paid for, nor would it be until their dispute with the company was definitely settled. The engines were of bad design, and consequently gave a great deal of trouble and were a source of continual expense. Dearer fuel and the cost of keeping the oil plant in working order accounted for the increase in the revenue account. The cost of maintaining the plant was much greater than it ought to be, and was likely to be heavier still. The price of oil fuel was on the increase, but so far they had been fortunate in having a contract, which, however, they could not hope to renew on the same terms. The increase in lamp renewals of £270 was the result of the concession to the consumers which was arranged before the metallic lamp came into use, and it was made to meet the gas competition. The result was that they had retained practically the whole of their customers, whilst new ones had been obtained. On the other side of the revenue account, sales of current showed a decrease of £571, part of which, however, was an item payable to the Corporation on the basis of the percentage of gross receipts under the terms of the company's contract with them. They had suffered, perhaps, less than most lighting companies from the war, but it was impossible to say what the future might have in store. The number of units sold was greater than last year, but the average price obtained was lower. The lamps connected showed a satisfactory increase. In view of the conditions prevailing and the prospect of increased expenditure, the Board had decided that they would not be justified in paying more than 2 per cent., and the balance of £1,330 would be carried forward, against £791 last year. The balance sheet showed that they were in a healthy position financially. They had £10,000 on deposit and nearly £4,000 besides due at the end of the year, most of which had already come in.

Mr. J. Browne Martin seconded the motion, and the report was adopted.

Westminster Electric Supply Corporation, Ltd.

The directors report that during 1914 the total power of lamps, motors and apparatus connected advanced from 39,646 kw. to 41,201 k.w.

Continuous current mains have now been laid in more than 97 miles of roadway, making 395 miles of ways, into which upwards of 285 miles of copper (strip and cable) have been drawn. In addition six miles of trunk mains (35 miles of ways) are laid in the company's area to connect the stations with the Central Electric Supply Co.'s station at St. John's Wood.

After paying the interim dividend on the ordinary shares and the full year's dividend on the 4½ per cent. preference shares the balance is £26,198. Out of this a dividend at the rate of 8 per cent. per annum, less income tax, for the past half-year, is to be paid on the ordinary shares, making 9 per cent. for the year, carrying forward £5,802.

Mr. C. S. Gilman has been elected to a seat on the board, to fill the vacancy caused by the death of Lord Suffield, who was the first chairman of the company, and had served as a director for 25 years.

Quantity utilised :—	Units.
Sold to consumers (including A.C supply of 1,404,493)	22,200,874
Used on works	353,360
Total	22,554,234
KW. on circuit	41,201

Annual meeting February 24th.

Notting Hill Electric Lighting Co., Ltd.

During 1914 £4,129 has been expended on capital account, making the total £252,121. The expenditure exceeds the receipts by £42,769. The cost of the joint station at Wood Lane to date has amounted to £218,187, and joint debenture stock amounting to £231,500 has been issued. The redemption of this stock is secured by cumulative sinking funds, which now amount to £66,045, invested in trustee securities.

Progress Table :

1912.	Equivalent of 8 C.P. lamps connected,	211,338.	Profit,	£24,436.
1913.	do. do.	222,350.	do.	24,465.
1914.	do. do.	234,608.	do.	24,221.

The consumers now number 4,293 and, with the exception of 23, are supplied at 200 volts.

Revenue from the sale of current amounted to £42,087, showing a decrease of £759. The loss of net revenue attributable to the Government war regulations, restricting the lighting in London, amounted to nearly £2,000. From the available net profit of £26,663 the following sums are deducted :—Depreciation, renewal and reserve fund £3,000, debenture interest £2,405, Kensington and Notting Hill joint debenture stock—(debenture interest £2,668, interest on loans £324, sinking funds £1,643), income tax £1,499, distributed to staff under co-partnership scheme £253, leaving £14,871 available for dividend.

After paying the 6 per cent. preferred dividend, one of 5s. per share less tax is recommended on the ordinary shares, absorbing £6,241, carrying forward £656.

The scheme of co-partnership with the company's staff, brought into operation during 1912, is still working satisfactorily. Under this scheme there will be distributed among the staff an addition to their wages of 8 per cent.

During the past year communications have passed between a group of London electric lighting companies, of which ours is one, and the L.C.C., in connecton with a Bill entitled the London and District Electric Supply Bill, but the necessary majority did not vote in favour of the Bill at the County Council meeting. Meanwhile, with a view to facilitating combination, the companies are associated in promoting the London Electric Supply (No. 2) Bill, intituled a Bill to constitute a company with powers to supply electrical energy in an area comprising the Administrative County of London and adjacent areas; to transfer to such company certain existing undertakings and to make provision for improving the supply of electrical energy; to make provisions for transferring the undertaking of the company to the L.C.C. or other public body; for authorising agreements or arrangements between the company and the L.C.C. or other public body; and for other purposes.

The directors refer with regret to the death of their esteemed colleague, Sir Joseph Wilson Swan, F.R.S. They have elected Mr. Lionel Jacob, of 32, Fenchurch Street, E.C., to the seat on the board.

Units generated and purchased	3,509,440
Units sold—Public lamps	63,589
Private consumers by meter . .	2,475,823
Total sold	2,539,412
Units sold on works	14,600
Total accounted for	2,554,012
Units expended in distribution, transformers and accumulators	955,428
Number of public lamps .. .	53
Total maximum supply demanded in kilowatts	1,669

Annual meeting, February 23rd.

Paisley District Tramways Co.

The revenue for the year ended December, 1914, was £61,999, and the expenses were £42,025, leaving £19,974; less general interest £938, debenture interest £3,200, debenture sinking fund £1,500, leaving £14,335, plus £2,865 brought forward. Out of the balance of £17,200, £4,500 has been placed to general reserve, £7,500 is absorbed by the dividend on the 5 per cent. cumulative preference shares, £2,000 is placed to preference share sinking fund, and £3,200 is to be carried forward.

The traffic receipts show a decrease of £845. For the first six months of the year there was an increase of £777, but for the second six months there was a decrease of £1,662 due to the war. Considering the circumstances the traffic receipts are satisfactory. The amount spent on the maintenance of the track and roadway is again very heavy, and larger than in the previous year, but the condition of the track is much improved. The directors regret that the profits will not allow of any dividend being paid on the ordinary shares. Mr. Fred Coutts, the company's general manager, held a commission as Captain of the 5th Black Watch (Territorials), and was called out at the commencement of the war, and is now serving. In addition 79 members of the staff and men have joined the colours. The difficulties in carrying on the service in the abnormal circumstances have been largely overcome by the exertion and loyalty of the remaining members of the staff and men, who have done their part and kept things going.

Resolutions are to be submitted to the meeting modifying the trust agreement with reference to the special preference shareholders' sinking fund.

Year.	Miles open.	Passengers.	Traffic Receipts.	Average Fare.	Car Mileage.	Cars.
1912	17.98	13,459,662	£58,329	1.04	1,264,323	60
1913	18.25	14,403,489	62,459	1.04	1,349,462	60
1914	18.25	13,755,904	61,614	1,07	1,378,120	60

Annual meeting February 22nd.

Electrical Distribution of Yorkshire, Ltd.

The accounts for the year ending December, 1914, again show steady progress. The net profit for the three years ending 31st December is as follows:—1912, £1,903; 1913, £2,569; 1914, £2,964. Including £573 brought forward there is a disposable balance of £3,537.

The directors recommend a dividend (free of income tax) for the year 1914 at the rate of 6 per cent. per annum on the ordinary shares requiring £1,809, increasing the reserve fund to £3,000 by adding £1,000, and carrying forward, subject to directors' remuneration, £727.

In February last 12,500 further shares of £1 each were conditionally allotted at par to the shareholders in proportion to their respective holdings, applications being at the same time invited for any shares not taken up. The shares were over-applied for.

The company now hold electric lighting provisional orders for the following 16 districts in the West Riding of the county :—Ardsley, Birstall, Calverley, Castleford, Darton and District, Farsley, Gomersal, Goole and District, Greetland, Hipperholme, Horsforth, Liversedge, Ossett, Rothwell and District, Sowerby Bridge, Wombwell and Worsborough.

During the year, supply was commenced in Birstall, Goole and district, Rothwell and district, and Wombwell and Worsborough. With two exceptions, a supply of energy was being given at the close of the year under all the above orders. The necessary works are being proceeded with, and supply will be available within the next few weeks, in respect of the whole of the orders held by the company. Applications are being made for E.L. orders for other districts in the West Riding.

Annual meeting February 23rd.

Electrical & Industrial Investment Co., Ltd.

The annual meeting was held on February 11th at Electrical Federation Offices, Kingsway, Mr. E. Garcke presiding.

The Chairman, in proposing the adoption of the report (Elec. Rev., p. 189), said that in order to adequately understand the operations of the company during the past year, one ought to divide the revenue account into two parts—the first half of the year which was more or less normal, and the second half, when things were altogether abnormal owing to the war. The first half-year yielded fairly satisfactory results, while the second half had brought them some losses and many disappointments. The dividends and interest received and sundry other profits amounted for the year to £34,295, compared with £28,330 for the preceding year, and the net profit, after deducting management and general expenses, income tax, etc., was £23,444, as against £20,751 in 1913. Last year, however, they had to deduct £3,091 from the net profits as expenses on the issue of debentures, so that, in fact, the net result for 1914 was £5,784 better than was obtained in 1913. On the whole, the net results compared favourably with those of the previous year, but they were not so good as they would have been if the war had not caused some dividends and interest to be kept back. This year he was afraid owing to the war conditions a larger number of dividends would be suspended, and for that reason the directors had deemed it advisable to pay only 6 per cent on the 7 per cent. preferred ordinary shares which were created last March. Proceeding to deal with the company's investments, the Chairman said that the majority of the securities were in electrical undertakings of which they had knowledge, but they by no means confined their operations to that class of investment. They had strictly adhered to the principle which they decided to adopt at the formation of the company—to keep the capital account distinct from the revenue account; to enter all investments at their actual cost; and place any surplus obtained by the realisation of investments to reserve in order to meet any deficiency on the realisation of other investments. That reserve now stood at £28,298 as against £21,223 at the end of 1913. The aggregate book value of the investments and loans after deducting that reserve was £648,629. At the last meeting he stated that a valuation made at the date of the last annual report showed a surplus of £8,000 in excess of the whole of the capital and liabilities of the company. Considering the very heavy depreciation which had taken place owing to the Balkan war and the general political unrest at the time, that was quite a satisfactory position. Unfortunately, however, the present war had altered everything and necessitated a re-valuation of their profits as well as of their ideas. If an estimate were now made of the realisable value of their securities a heavy depreciation would be shown. There was, however, no legal or other necessity for dealing with that depreciation at present, for the company having adopted the principle of keeping capital account and revenue account distinct, there was no valid objection to their distributing the profits which they made, although the market value of the investments was less for the time being than the cost price at which they stood in the books. It was evident, however, that it would be better if they could have a balance sheet which showed the whole of their capital to be intact. At the present time, especially, such a balance sheet would place the company in a strong position for dealing with the situation created by the war, and for earning increased profits. They had, therefore, conferred with the larger holders of the deferred ordinary shares as to what should be the policy of the company on that question. They were in an exceptionally favourable position to adjust their capital account to the revised value of their investments, because the deferred ordinary shares, of which there were 90,000 of £1 each fully paid, were entitled to all the surplus profits after the preferred orinary shares had received 7 per cent. in any one year, and they were also entitled in the distribution of assets to any surplus remaining after the debentures had been paid off. It was practically a matter of indifference to the holders of the deferred ordinary shares whether their shares had a denomination of £1 fully paid or of 1s. full paid or any other denomination, as they received the entire surplus both of assets and of profits irrespective of par value of their shares. As a matter of fact, it was better for the holders that the nominal value of the shares should be 1s., which would give them a higher market value, than that they should remain at the nominal value of £1 and have a smaller market value. The larger holders of those shares agreed with the directors that it would be wise to reduce the company's capital by writing down the deferred ordinary shares to 1s. each. The effect of that policy would be to place the company in a strong position and to improve its facilities for exchanging some of its present depreciated securities for others which promised to prove of a more profitable character. The proposal would not directly affect the holders of the debentures, the preference, and the preferred ordinary shares, but those holders would all benefit in due course by the improvement in the position of the company, which it was anticipated would follow from the adoption of that policy. The directors proposed at an early date to convene an extraordinary meeting, and also a class meeting of the deferred holders, in order to consider this proposal.

Mr. C. H. Dade seconded the motion, and the report was adopted.

St. James' and Pall Mall Electric Light Co., Ltd.

The annual meeting was held on Tuesday at Carnaby Street Station, Golden Square. Mr. Walter Leaf, who presided, said that the year began with most favourable prospects, and for the first six months the revenue was growing steadily, and when they declared the usual interim dividend in July they had every reasonable confidence that at the end of the year they would be able to sustain the dividend at 12 per cent. without the least difficulty. The effect of the war upon their revenue was instantaneous. He was not going to complain of the police regulations with regard to lighting, but they supplied a larger number of well-to-do shops than any other lighting company, and it was upon those establishments that the restrictions had fallen most severely. The result was that their sales had fallen from 11,605,000 units to 11,171,000, a decrease of 3.7 per cent., and their revenue showed a drop of 4.1 per cent. That might seem a small decrease in itself, but it became serious when they considered that it was entirely due to the second half of the year, and that the first half showed a marked improvement on the first six months of 1913. The net revenue had amounted to £34,347, against £35,942, and it would seem at first sight as if the smallness of that drop was very satisfactory under the present circumstances. There again, however, they had to remember that the special appropriations which they had been for some time making out of revenue for the replacement of obsolete plant came to an end in 1913, so that this year they had been able to bring into revenue more than £3,000 which last year they set aside. That was shown in the reduction of the amount received for depreciation from £16,209 to £13,069. But for that they would show a loss of profit of over £5,000 all in the last half of the year. That, however, did not measure all that the war had cost them. The actual profit available for dividends made during the year was £27,133. Of this £17,500 was made in the first six months. They had every reason to expect that, but for the war, the second half would have been at least as good as the first, and that they would have shown not less than £35,000 as the result of the whole year's working. They were quite prepared to face a continuance of the war. Supposing that present conditions continued to the end of the year, they had come to the conclusion that that would mean an additional loss of £9,000, and in all they would lose £17,000 in 1915 compared to their profits in 1913. That was what they had before them in recommending the dividend. On the other hand, they had to remember that this loss of profit was purely temporary. The earning power of the company was in no way affected, and they had every reason to suppose that the moment the war came to an end their sales would return to something like their old level. On those facts he felt confident that they would agree that it would not be prudent to maintain the 12 per cent. dividend paid last year. Even if they were to pay it for 1914, they could not expect to maintain it for the present year. They therefore proposed to revert to the old figure of 10 per cent., which they had paid for many years up to 1913, and to put the handsome sum of £4,000 to the contingency fund, which, if the worst came to the worst, would enable them next year to maintain the dividend at 10 per cent. He was glad to say that 42 of the staff, about 24 per cent. of their normal establishment, had joined the colours. While thanking and congratulating those who had been privileged to serve their country in this way, they must not forget the claims of those who had also served their country by staying at work. In some ways their task had been the hardest. The work of that and other lighting companies was essentially public work, and its maintenance was a matter of very serious responsibility; much of it could only be entrusted to men possessing skill and experience which could not be manufactured to order in a few months. It was impossible for them to give leave to such men, and it should be fully recognised that the post of duty for them was not with the colours but here at home. Turning to the question of bulk supply of electricity for London, he said that the whole matter had been the subject of acute discussion, and had been taken up by the L.C.C. in a way which very materially affected every individual undertaker whether company or municipality. The L.C.C. embodied their scheme in a Bill, of which the salient feature was to be the establishment of a single large company to supply the whole of London—a company formed outside the County Council, but operating under its control. A large majority of the companies had been constantly in conference, and had come to the conclusion that it would be well to enter into negotiations with the L.C.C. and endeavour, if possible, to work in harmony towards the establishment of such a scheme—always, of course, with full regard to the interests of their shareholders. The result of those conferences was that a Bill was deposited in Parliament which provided, among other things, for the establishment of such an operating company as the L.C.C. contemplated. Since the Bills were deposited, however, the whole situation had been changed. The L.C.C. had failed to obtain the necessary majority for the further prosecution of their Bill, and since then the Prime Minister's statement in the House that no contentious business would be taken made it highly probable that the company's Bill also would be hung up. Under their scheme it was proposed to constitute a company with powers to supply electricity in the county of London and adjacent areas; to transfer to the company ten of the existing undertakings; to provide for transferring the undertaking of the company to the L.C.C. or other public body; for authorising agreements between the company and the L.C.C. or other public body; and for other purposes. As to the principles upon which they were proceeding, they had no doubt that by centralisation of administration, and though to a less extent of generation, economies might be effected in the supply of energy to the London district. In the effecting of those economies they were ready, and indeed, anxious, to co-operate both with other companies and with the L.C.C. They were prepared to advise the shareholders to sell their property either to the L.C.C. or to an amalgamation at a price and on conditions. But the price and the conditions must be fair. By a fair price, he meant two things. In the first place, proper regard must be had to the position of security which that company had attained by prudent attention to reserves and depreciation in the past. Prudence must have its full reward. In this respect they held an exceptionally strong position which they could not allow to be disregarded. In the second place, the price must be paid in solid value—if not in cash, then in some form which might be regarded as equivalent to cash, at least for a very substantial part of their holding. Another important principle on which all the parties to the conference were in agreement was that all centralisation of supply must proceed by development of existing resources, and not by scrapping at a blow what had been already effected. He did not admit that London, even under existing conditions which were forced upon them by Parliament years ago, had any reason to be ashamed of the cost of its supply; on the contrary they asserted that the supply was at least as cheap as that of any great city in the world. There was another consideration which must have forced itself upon them during the present crisis. An essential part of the more ambitious schemes which had been put forward for the cheapening of supply was a huge central generating station for all London on the river side below the city. Did they think that such a concentration of one of London's most vital supplies at that point would conduce just now to the sense of public security? Was not the fact that generation was scattered over various parts of London an element of safety, and even if such a concentration resulted in a fractional reduction in the price of the unit, would the gain be worth it? They had higher interests just now to consider than decimals of a penny. The situation was in all respects most interesting, and he was confident that, even though immediate action was likely to be suspended by the war, they would be using their time well in negotiation, whether with the L.C.C. or among themselves.

Mr. Marlborough R. Pryor seconded the motion.

Replying to a shareholder, the Chairman said that the company was paying half salaries to all the members of the staff who had enlisted and was keeping their places open.

The report was adopted.

Neuhausen Aluminium Industry Co.—The directors of the Aluminium Industrial A.G., of Neuhausen, have resolved to recommend the payment for 1914 of a dividend of 20 per cent. on the old share capital, which is paid to the extent of 60 per cent. of the nominal capital, as compared with 20 per cent. on shares, which were 50 per cent. paid up in 1913, and a dividend of 10 per cent. on the new capital of £360,000, which was issued last year, and which is also 60 per cent paid. The sum of £64,500 has been placed to the fund created for the purpose of gradually paying up the shares in full out of the profits, so that the fund now amounts to £69,500, or 5 per cent. of the total share capital of £1,400,000. A year ago there was allocated to this fund, from which free payments in 10 per cent. instalments are made on the shares which are not fully paid, the amount of £84,000, thus increasing the total to £109,000. Of this the sum of £104,000 was applied to raising the payments on the old capital from 50 to 60 per cent., leaving a balance of £5,000, which again rises to £69,500 by the appropriation now made from the profits earned in 1914. A further amount of £12,000 was apportioned to the disposition fund in 1913, but for the past year the directors have set aside £40,000 for war taxes and risks, and £6,000 for relieving distress in Switzerland. The balance then remaining is about the same as in 1913 (£13,000), so that it is assumed the net profits for 1914 must have exceeded those realised in the previous year by £20,000.

Crossley Brothers, Ltd.—The directors report that for the year ending December, 1914, the amount to the credit of revenue account is £53,847, out of which a dividend has been paid on the preference shares at the rate of 5 per cent. per annum for the first half of the year, amounting to £10,085. It is proposed to pay a further dividend for the second half of the year at the rate of 5 per cent. per annum on the preference shares amounting to £10,085, carrying forward £33,678. Mr. D. Hastings Irwin has resigned his seat on the board after more than 42 years' association with the company. Annual meeting, February 24th.

Buenos Aires Electricity Co.—The report of the Compania de Electricidad de la Provincia de Buenos Aires, Ltd., states that the gross profit for the year to July, 1914, amounted to £86,794, an increase of £6,454. The administration and general charges in Buenos Aires were £12,497, as against £20,037, a decrease of 25·12 per cent. The average ratio of the working expenses was 54·72 per cent., which is not as low a figure as the board had hoped for. £9,000 has been appropriated to depreciation, and after payment of debenture interest, &c., £10,656 is carried to the balance-sheet.

Bruce Peebles & Co., Ltd.—During 1914 the works were fairly well employed with results which show satisfactory and steady progress. After deducting administration expenses, interest on mortgage debentures and unsecured debentures, the net profit is £3,893. Buildings, machinery and plant have been maintained out of revenue at a cost of £4,449. Owing to other engagements, Mr. Lee Murray retired from the board early in 1914, and another director, Mr. A. Bruce Anderson, perished in the wreck of the *Empress of Ireland*. Annual meeting, February 26th.

Rushden and District Electric Supply Co., Ltd.—The directors report great progress during the past 12 months, which is largely attributable to the growth of the power load. The number of consumers increased from 56 to 79. The lamps connected (including motive power) numbered 5,561 at the end of the year 1914, as compared with 2,480 at the end of 1913; the units sold have been 56,993. There is every prospect of a steady and increasing output in the near future.

Metropolitan Railway Co.—The directors recommend a dividend at the rate of 1 per cent. per annum for the second half of 1914, making 1½ per cent. for the year, transferring £12,500 to general renewals, and carrying £11,500 forward.

Bastian Meter Co., Ltd.—The directors recommend the payment of the 6 per cent. dividend on the cum. preference shares, also one of 2 per cent. on the ordinary share capital for the year ended December 31st, 1914.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer books are closed from February 16th to March 1st, for the preparation of warrants for dividends on 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended December 25th, 1914, amounted to 914,335, compared with 952,773 in the corresponding four weeks of 1913. The decrease is owing to consumers taking less current on account of the war.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—The directors recommend a dividend at the rate of 10 per cent. per annum for the half-year ended December 31st last, this making, with the interim dividend, 9 per cent. for the year. The total for 1913 was at the same rate.

Oxford Electric Co., Ltd.—The directors recommend a dividend at the rate of 4 per cent., less income-tax, on the ordinary share capital, for the December half-year, being a distribution for the year at the rate of 6½ per cent. The rate for 1913 was 7 per cent.

Mather & Platt, Ltd.—The *Financier* states that the directors recommend a dividend on the ordinary shares for the year to December 31st at the rate of 10 per cent. per annum, with a bonus of 2½ per cent., both free of income-tax, less the interim dividend of 5 per cent., already paid.

Ottawa Electric Railway Co.—Fifteen per cent. was paid in dividends according to the report presented at the annual meeting of the Ottawa Traction Co. held on February 3rd. This involved a total cash payment of $281,535. Of this amount $204,813 was transferred. The gross earnings were $1,096,459, and operating expenses $665,226. The net earnings were $431,232, as against $414,100 in 1913.

Telegraph Construction and Maintenance Co., Ltd.—It is proposed to distribute, in addition to the interim dividend of 5 per cent. paid in July last, a further dividend of 10 per cent., together with a bonus of 12s. per share.

Newcastle-on-Tyne Electric Supply Co.—The *Times* states that the directors announce a final dividend of 3 per cent. on the ordinary shares, making 5½ per cent. for the year, the same as for 1913.

STOCKS AND SHARES.

Tuesday Evening.

Business in the Stock Exchange moves as quietly as the progress of the war on land. A good many members of the House find that the number of orders at the present time is considerably less than it was a month ago, although that certain sections are busy is shown by the daily number of transactions marked in the Stock Exchange Official List. The tedious, and sometimes exasperating, delays caused by the Treasury regulations have become part and parcel of Stock Exchange life; so that it is clients, more than their brokers, who resent the difficulties thrown across their path. The tale of Home Railway dividends is practically complete, and will be finished before the end of the week. On the whole, the results are disappointing.

The railway companies are holding their meetings and issuing reports, but the absence of any details as regards figures is against public interest arising in this department. The steam stocks can be bought to pay 5¼ to 6 per cent. on the money, and something between this will probably come to be regarded as the rate which investors require from money put into such securities. In a dull market, the firmness of Underground Electric Income bonds stands out conspicuously; on the week, the price is ¾ higher at 83¼, this including the dividend of £3, payable net on the 1st of next month. Allowing for the inclusion of the dividend, the yield works out to 7½ per cent. The Company's shares are unchanged. Districts have hardened a shade, but Metropolitans further went back to 30, the dividend being considered very meagre. At the same time, the pre-Ordinary securities are very firm. Metropolitan new Preference is 99¾, South-Western new 104½, and other Preference stocks are difficult to get at anything like reasonable prices.

Brazilian exchange has been upsetting the market for most things connected with that country. It fell last week to 12½d., recovered ⅛d., and is a little easier at the time of writing. On this, Brazil Tractions have fallen 2½ to 52; and most Brazilian securities have also given way. The Argentine group, on the other hand, displays more resistance to the few sellers which have lately troubled the market. Prices are all firm; indeed, Argentine descriptions have begun to re-establish a place for themselves in popular favour—a point that will be noted with pleasure by the many British holders of stocks and shares of industrial companies operating in the Republic. Mexico, on the other hand, merely goes from bad to worse, if that be possible. Mexico Tramway shares have halved the price at which they stood at the end of July, upon the outbreak of war; and the Company's bonds are extremely nominal at the quoted values.

The following price lists show the rises and falls since last week:—

Home Electricity Companies.

	Mean price. July 27.	Feb. 16, 1915.	Rise or fall this week.
Brompton Ordinary	9½	8¾	—
do. 7 per cent. Pref.	8⅜	8½	—
Charing Cross Ordinary	5¼	4¾	— ¼
do. do. do. 4½ Pref. . ..	4¼	4½	— ¼
do. do. City Pref.	4½	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅛	4¼	—
do. 4½ Deb.	95½	92	—
City of London	16	14½	—
do. do. 6 per cent. Pref... ..	13½	12¾	—
do. do. 5 Deb.	116½	112	— 2
do. do. 4½ Deb. .. .	100½	98	—
County of London	12	11	— ¼
do. do. 6 per cent. Pref. ..	12	11⅛	— ⅛
do. do. 1st Deb... .. .	102½	99	—
do. do. 2nd Deb. ..	100½	97	—
Kensington Ordinary	7½	7¼	—
London Electric	1⅜	1½	—
do. do. 6 per cent. Pref. . ..	5⅛	5⅛	+ ⅛
do. do. 4 Deb. . .	92½	87	—
Metropolitan	3½	3⅛	—
do. 4½ per cent. Pref. .. .	4⅛	4	—
do. 4½ Deb...	97½	96	—
do. 3½ Deb .. .	83	78	—
St. James' and Pall Mall	9⅝	9	—
do. do. do. 7 per cent. Pref.	7	6⅞	—
do. do. do. 3½ Deb.	84½	80	—2
South London	8⅛	8	—
South Metropolitan Pref.	1½	1⅛	—
Westminster Ordinary	8⅜	8⅜	—
do. 4½ Pref...	6⅜	6⅜	—

Home Rails.	Mean price. July 27.	Feb. 16, 1915.	Rise or fall this week.
Central London, Ord. Assented	83	77	—
Metropolitan	37½	30	— ½
do. District	21¾	18	+ ¼
Underground Electric Ordinary	2½	1⅞	—
do. "A"	7/6	6/-	—
do. Income	88	83¼	+ ¼
Telegraphs and Telephones.			
Anglo-Am. Tel. Pf.	108¼	105 xd	—
do. Def.	23	21⅞ xd	—
Chile Telephone	7⅜	7⅛	—
Constantinople Tel.	4¼	3½	—
Cuba Sub. Ord.	8⅜	8⅛	—
do. Pf.	16¼	15¼	—
Eastern Extension	12¾	12¾	—
do. 4 Deb.	97½	92 xd	—
Eastern Tel. Ord.	130½	128	—
do. 3½ Pf.	77½	72	+1
do. 4 Deb.	96½	94	—
Globe Tel. and T. Ord.	11½	10½	+ ¼
do. Pf.	12⅝	11¾	—
Gt. Northern Tel.	32½	27	—
Indo-European	59	55	—
Marconi	1$\frac{15}{16}$	1¾	—
New York Tel. 4½	101	97	—
Oriental Telephone Ord.	2$\frac{5}{32}$	2	—
do. Pf.	1$\frac{1}{32}$	1$\frac{1}{16}$	—
Tel. Egypt Deb.	98	88½	—
United R. Plate Tel.	6⅜	6	—
do. Pf.	5½	5	—
West India and Pan.	1¼	1$\frac{5}{16}$	+ $\frac{1}{16}$
Western Telegraph	13⅝	13	—
do. 4 Deb.	96½	95½	—
Foreign Trams, &c.			
Anglo-Arg. Trams, First Pf.	4¾	4½	—
do. 2nd Pf.	4¼	4	—
do. 4 Deb.	91	84	—
do. 4½ Deb.	98½	93	—
do. 5 Deb.	96	88	—
Brazil Tractions	66	52	—2½
Bombay Electric Pf.	11⅝	10½	—
do. 4½ Deb.	96	91	—
Mexico Trams	70	35	—5
do. 5 per cent. Bonds	84	60	—
do. 6 per cent. Bonds	76	50	—
Adelaide Sup. 6 per cent. Pf.	5¼	5⅛	—
do. 5 Deb.	104	101½	—
Manufacturing Companies.			
British Westinghouse Pref.	1¾	1⅞	—
do. 4 Deb.	74½	70	—
do. 6 p. lien	102⅛	98½	—
Callenders	11⅞	11⅞	—
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2½	8¼	—
Edison & Swan, £3 pd.	$\frac{3}{32}$	11/6	—
do. do. fully paid	1¼	[illegible]	—
do. do. 4 Deb.	59	60	—
do. do. 3 Deb.	63½	60	—
Electric Construction	$\frac{17}{32}$	13/6	—6d.
do. do. Pf.	$\frac{1}{16}$	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	13½	—
do. 4½ Pref.	5	5	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	8½	—
Telegraph Con.	38½	36½	—

It is a little instructive to stand in the Stock Exchange by the side of a jobber dealing in purely investment issues, and to hear his replies to one man and another as they ply him with questions. In the Telegraph market, for example, one may see a broker walk up to a jobber and ask him the price of Eastern Extension shares, to which the reply is pretty sure to be that the latter can place them at a good price, but is not so sure of being able to get the offer of any. The next will perhaps ask the price of Henleys, and "about 13½" will probably be the reply, "but we have only cheap buyers." So the wheel goes round; and if anyone took the trouble to run through the list and ask what stocks were on offer, he would probably be surprised at the comparatively few open for his selection. We refer, of course, to purely investment securities: of rubbish there remains an extremely bountiful supply.

County of London Ordinary and Preference are both a little easier. Small falls have occurred in Charing Cross Ordinary and Preference, and in St. James' Debenture stock. London Preference are ⅛ higher. Another batch of dividends should be out this week; and if it is of any interest for the curious to compare results with prophecies, we may mention that Stock Exchange estimates look for a reduction of 1 per cent. in the City of London dividend, maintenance of the last County dividend and reductions of ½ to 1 per cent. in several other cases. The situation as regards coal, and the continued turning down of London's lights are two of the principal factors making for public disinclination to touch electric lighting shares at the present time. That the second reading of the London Electricity No. 2 Bill should have been postponed will perhaps afford no great astonishment to those who follow this review.

The Manufacturing group is very quiet, with buyers of Henleys, as noted above, and of various other highest-class telegraph manufacturing shares. Electric Constructions are a shade easier at 13s. 6d. Armament shares, after being dull, show a tendency to harden. On Friday this week will be held the meeting of the Projectile Company, which should prove a particularly interesting function. The Rubber market pursues the even tenour of its way, without disturbance in one direction or the other. In many of the leading shares there is a tolerable amount of business going on; for the rest, the public appear to be more ready to buy than they are to sell.

The yields on some of the electricity supply preference shares begin to look tempting. Taking a few of the leading undertakings, the Preference shares of the Westminster Company pay 4⅝ per cent.; City of London, 4¾ per cent.; London Electric, 5⅞ per cent.; County and St. James's, 5⅜ per cent. each; Charing Cross, 5½ per cent.; and Metropolitan 5⅝ per cent. These figures are worked out on the existing prices, without taking into account accrued dividends, so that in nearly every instance the actual yield is rather higher than given. The difficulty, as indicated above, in the case of telegraph stocks, is to get the offer of first-class shares at current prices, but probably most of the Preference issues mentioned could be obtained at, or quite close to, the prices given in our lists.

MARKET QUOTATIONS.

Owing to the war, the prices given below are, of course, more or less nominal.

Wednesday, February 17th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a „ Nitric	„	19/-	..
a „ Oxalic	per lb.	8d.	..
a „ Sulphuric	per cwt.	5/-	..
a Ammoniac Sal	„	£49	..
a Ammonia, Muriate (large crystal)	per ton	£49	..
a Bleaching powder	„	£8 10	..
a Bisulphide of Carbon	„	..	..
a Borax	„	£18 10	..
a Copper Sulphate	„	£26	..
a Lead, Nitrate	„	£35	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	6d.	..
a Potash, Caustic (88/90 %)	per ton	..	..
a „ Chlorate	per lb.	1/4	..
a „ Perchlorate	„	1/-	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£5 10	..
a Sulphur, Sublimed Flowers	„	£11 10	..
a „ Recovered	„	£8	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %)	„	£10 2 6	..
a „ Chlorate	per lb.	8½d.	..
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	8½d.	..
METALS, &c.			
Aluminium Ingots, in ton lots	per ton	£55	..
„ Wire, in ton lots (1 to 14 S.W.G.)	„	£112	..
b „ Sheet, in ton lots	„	£112	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8¾d.	..
c „ Tube (brazed)	„	10d.	..
c „ „ (solid drawn)	„	9¾d.	..
c „ Wire, basis	„	9d.	..
c Copper Tubes (brazed)	„	11¼d.	..
c „ „ (solid drawn)	„	11⅓d.	..
g „ Bars (best selected)	per ton	£84	..
g „ Sheet	„	£84	..
g „ Rod	„	£84	..
d „ (Electrolytic) Bars	„	£68 15	..
d „ „ Sheets	„	£86 15	..
d „ „ Rods	„	£74 15	..
d „ „ H.C. Wire	per lb.	9$\frac{3}{16}$d.	..
f Ebonite Rod	„	3/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1,8	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/6	..
j Iron Pig (Cleveland warrants)	per ton	56/2	4d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£16	..
g Lead, English Pig	„	£19 10	..
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£12 5	..
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e „ „ „ medium	„	3/- to 5/-	..
e „ „ „ large	„	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/8½	..
p „ „ rolled bars & rods	„	1/1½ to 1/3	..
p „ „ rolled strip & sheet	„	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£70	..
g Tin, Block (English)	„	£170 to £180	..
n „ Wire, Nos. 1 to 16	per lb.	2/4	..
p White Anti-friction Metals	per ton	£50 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

- a G. Boor & Co.
- b The British Aluminium Co., Ltd.
- c Thos. Bolton & Sons, Ltd.
- d Frederick Smith & Co.
- e F. Wiggins & Sons.
- f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
- g James & Shakspeare.
- h Edward Till & Co.
- j Bolling & Lowe.
- k Morris Ashby, Ltd.
- l Richard Johnson & Nephew, Ltd.
- m W. T. Glover & Co., Ltd.
- n P. Ormiston & Sons.
- o Johnson, Matthey & Co., Ltd.
- p
- r W. F. Dennis & Co.

Torquay Tramways Co., Ltd.—The accounts for 1914 show a profit, after providing for debenture interest, &c., and including £882 brought forward, of £7,625. It is proposed to transfer £2,500 to reserve and renewals account, and a dividend of 3¼ per cent. is recommended, as compared with 5 per cent. for 1913. £897 is to be carried forward.—*Financier.*

LOG BOOKS AND SHEETS FOR ELECTRICITY WORKS.

By "INTERESTED."

In order to secure economical working and obtain the best possible results from the plant installed, central-station engineers, like others, keep constant records of the various results obtained from all machinery and plant under their control. It is imperative that figures be recorded which constantly show the actual work accomplished by every detail in the composition of the undertaking. There are so many little matters calling for careful attention which, if allowed to become neglected, very soon commence to push up the works costs, and the Chief sees this working reflected as in a mirror on the various log-sheets. A few minutes spent day by day in looking over the results of the previous day's working convey to his mind a general impression of the efficiency of the previous day's run. Units, coal, oil, steam pressure, vacuum, and the dozen or so other items which are given on the sheets or in the log-book, prompt questions in his mind which are in turn put to those in charge; for it is only by careful and unremitting attention to details that it is possible to obtain from the works the most profitable results.

TOTAL UNITS FROM BEGINNING OF YEAR.

	Brought forward.	Week's advance.	Total.
Metered			
Calculated... ...			
Private			
Public			
Works			
Mains			

UNITS.

Private.	Public.	Total calculated.	Units metered.

MACHINE METERS.

Meters.	Readings.		
	This week.	Last week.	Advance.

PUBLIC LIGHTING.

Meters.	Readings.		
	This week.	Last week.	Advance.

WORKS UNITS.

Meters.	Readings		
	This week.	Last week.	Advance.

WATER METERS.

Meters.	This week.	Last week.	Advance.
Main			
By pass ...			

Grand total ....

BOILERS.—HOURS UNDER STEAM.

No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8	No. 9.	No. 10.

ENGINES.—RUNNING HOURS.

No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	No. 11.

Power factor.	Max. load.	Time.	Day.

The matter resolves itself into one of pounds, shillings and pence. For example, low vacuum means more steam used for a given output, and more steam requires extra coal, and coal costs money.

I do not propose here to continue expounding examples. There are very few engineers who do not recognise the necessity and importance of this form of record, but for the many scores of readers who must be interested in this subject, I give herewith a number of patterns taken from several log sheets and books at present in use in some London stations. Not all the rulings may prove new or novel, but, on the other hand, some very useful tips can often be obtained by studying the work of others. One way in which they might prove useful is that the cost of printing might be reduced by a saving in the work of

HEATERS.				BOILERS.											ECONOMISER TEMPERATURES.										CONDENSERS.				
No. 1.		No. 2.		Numbers.											No. 1.		No. 2.		No. 3.		No. 4.		No. 5.		Vacuum.				Barometer
Inlet	Outlet	Inlet	Outlet	2	3	4	5	6	7	8	9	10	11	12	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	No. 2	No. 3	No. 4	No. 5	

Power Factor Meters		EXCITERS.						BATTERY.				ALTERNATOR FIELDS.							
		Steam.		No. 1 Motor.		No. 2 Motor.		Amperes.		Volts.		Amperes.							
1 phase	2 phase	Volts	Amps.	Volts	Amps.	Volts	Amps.	Charge	Discharge	Battery	Booster	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12

VOLTS.							ALTERNATORS.											
Primary.			Pilot				No. 5	No. 6.	No. 7.	No. 8	No. 8	No. 9	No. 10	No. 10	No. 11	No. 11	No. 12	No. 12
Red phase	Blue phase	Brown phase	No. 1	No. 2	No. 3	No. 4	Amps	Amps.	Amps.	Red Amps.	Blue Amps.	Amps	Red Amps	Blue Amps	Red Amps	Blue Amps.	Red Amps.	Blue Amps.

MAIN CIRCUIT METERS.

Meters.	Readings.		
	To day.	Yesterday.	Advance.
No. 5			
No. 6			
No. 7			
No. 8 red phase ...			
No. 8 blue phase ...			
No. 9			
No. 10 red phase ...			
No. 10 blue phase ...			
No. 11 red phase ...			
No. 11 blue phase ...			
No. 12 red phase ...			
No. 12 blue phase ...			

Total red .... Total blue .... Total ....

WORKS UNITS.

Meters.	Readings.		
	To-day.	Yesterday.	Advance.
No. 1 pump red ...			
No. 1 pump blue ...			
No. 2 pump			
Nos. 3 and 4 pumps ...			
Station motors ...			
Station lights			
Exciter No. 1			
Exciter No. 2			

Total ....

COAL.

Description.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Total.	Remarks.
Steaming ...							
Banking ...							

Grand total ....

TURBINE LOG.

day, the day of 191

Time.	Amps.	Armature.		Steam.		Vacuum.	Air pump discharge.	Circ. Water.	
		Inlet.	Outlet.	Temp.	Press.			Inlet.	Outlet.

Lb. of coal per unit generated ....

Lb. of coal per unit metered ....

Lb. of coal per unit to mains..................................

BATTERY.

Units charging.	Units discharging.	Efficiency.

AMPERE-HOUR METERS.

	This week.	Last week.	Advance.
Charge			
Discharge ...			

Dis. = ... % of charge. Difference ....

Maximum load one-phase .... Amps. at ....

Maximum load two-phase .... Amps. at ....

Maximum load ...... Total .... Amps. at ....

Minimum load ...... Total .... Amps. at ....

Total units to mains ....

Arc lamps on at .... p.m.

Arc lamps off at .... a.m.

Lighting hours .... hours .... min.

Weather ....

EXCITERS.

RUNNING HOURS.

Steam exciter ... ...

Motor exciter No. 1 ... ...

Motor exciter No. 2 ... ...

Motor exciter No. 3 ... ...

printing where better arranged headings are devised, and sheets provided which save repetition of figures.

These illustrations are taken from books and sheets, some weekly and some daily forms, and I think no further explanation is required than the forms themselves.

MODERN WIRING WORK, PARTICULARLY IN BAD SITUATIONS.

By H. C. TOFIELD.

(Concluded from page 205.)

Tumbler switch, 5 amps. (White's patent).—This is made in porcelain, and also in galvanised iron for positions where it would be subject to mechanical damage. It will be seen (fig. 6) that the switch is contained in a chamber separate from that which contains the connection terminals for the wires. This enables the wireman to connect up and deal with the ends of the wires without interfering with the mechanism of the switch. The seal-

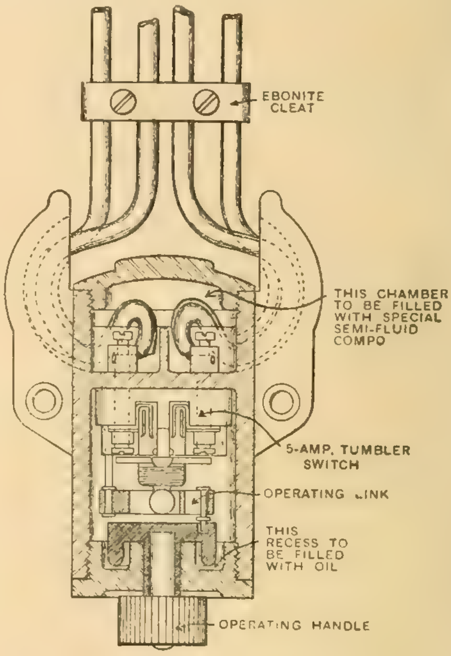
EBONITE CLEAT
THIS CHAMBER TO BE FILLED WITH SPECIAL SEMI-FLUID COMPO
5-AMP. TUMBLER SWITCH
OPERATING LINK
THIS RECESS TO BE FILLED WITH OIL
OPERATING HANDLE

Fig. 6.—Section of Switch.

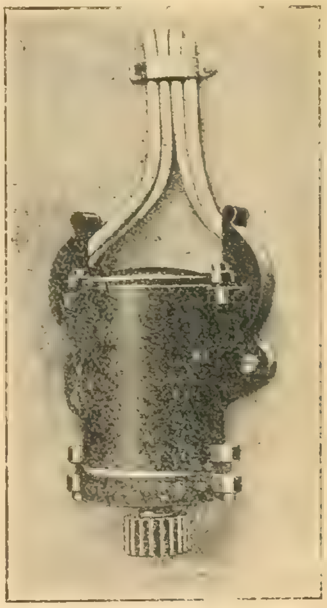

Fig. 7.—Switch in Position.

ing of the ends and terminals is effected by filling up the top chamber with the special semi-fluid compound, which is forced up the "leading-in-tubes" to a higher level when the top cap is screwed on, thus giving a longer sealing path. The operating of the switch is effected by a special link motion, while gases are effectively prevented from entering along the operating handle by means of the oil seal. This method does away with the necessity of a packing gland, with its attendant troubles.

Lampholder (White's patent).—This holder, fig. 8, was specially designed to prevent corrosion of the terminals and the lamp cap and to supersede the so-called acid-proof fitting with its many failings, the chief being, that condensation takes place inside the well glass which in time accumulates in such quantities that chemical action is set up inside the fitting, thus defeating its own object and also greatly reducing the light owing to fogging of the globe.

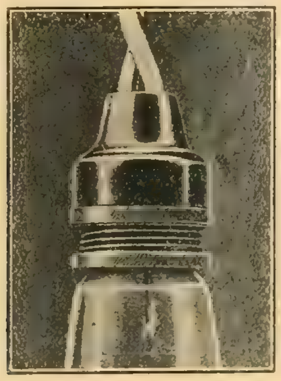

Fig. 8.—Corrosion-proof Lampholder.

The corrosion-proof lamp holder is not liable to the above trouble, as no outer globe is required.

Among the advantages claimed are the following:—

1. The contacts, terminals, &c., and the lamp cap are protected from corrosive agents.
2. It is watertight and may be used under water.
3. The lamp is automatically locked and cannot be taken out by anyone not fully acquainted with its construction.

Wall plug (Reyrolle's patent).—The wall plug shown in fig. 9 has been specially designed for positions where it is essential for the apparatus to be completely watertight.

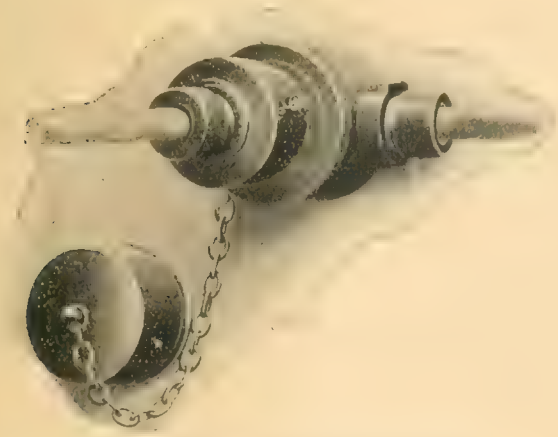

Fig. 9.—Reyrolle Plug and Socket.

It complies with the Home Office regulation which calls for the use of a separate earth conductor in the flexible cable. When the socket is fixed to the wall its allows the plug to be withdrawn either vertically or horizontally. In use the plug is secured to the socket by means of the clamping ring, and a brass cap is provided to take the place of same when not required, thus protecting the plug connections from moisture and fumes under all circumstances. Rubber ring-grip packing glands are supplied in both the plug and socket portions for taking the incoming and outgoing C.T.S. cables.

Entrance glands.—These glands are made of ebonite, and are used in conjunction with distribution boards, main switches, fuses, and wall plugs having iron cases; they are also useful as a means of connecting up to any special apparatus and provide a convenient and reliable method of bringing the wires and cables into any of the above accessories; at the same time they form an air-tight joint and prevent fumes entering the cases and attacking the ends of the wires.

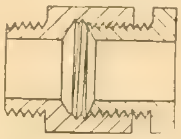

Fig. 10.—Ebonite Stuffing Box.

The entrance holes of the glands are an easy fit for the wires, but when the caps are screwed down, the rubber ring is compressed, thus forming an airtight joint. Under exceptional circumstances a small quantity of Chatterton or similar compound is run round the wires at the glands as an extra safeguard.

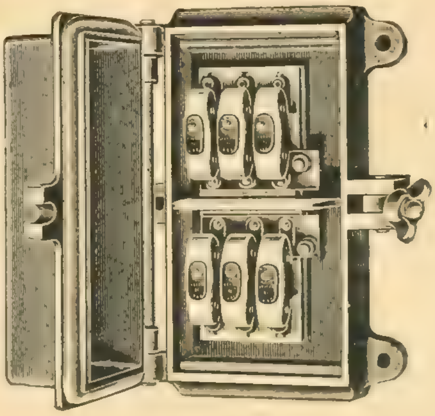

Fig. 11.—Watertight Distribution Board.

Special rubber washers can be obtained for fitting between the glands and case into which they are screwed.

Distribution boards.—These may be of the ordinary watertight iron-clad pattern (fig. 11), having heavy cast iron cases with hinged solid fronts. The type of porcelain or slate bases and fuse carriers used is a matter for discretion, but all metal work should be substantial.

It is most important that a first class heavy case be used, and that the door be an airtight fit: if rubber jointing is supplied it should be removed and greasy asbestos packing substituted, or a strip of the outer sheathing cut from the C.T.S. wires will provide a reliable packing. The cases should be galvanized and finally coated with bitumastic paint when fixed in corrosive situations. All holes should be tapped to receive the glands, the usual dimensions being ⅝ in. and ¾ in. conduit threads for circuit wires, and larger according to requirements for the main cables.

Main switches and fuses.—The iron cases should conform with the requirements enumerated for distribution boards. The handle, whether at the side or in the lid should operate through a gland. A switch and fuses combined in one case as shown in fig. 12 form the best arrangement.

Fixings.—Lead, porcelain and ebonite saddles and cleats should be used for fixing the wires and cables. The last two are the least affected by corrosive conditions.

Erecting the wires.—The erection of the wires and cables hardly calls for any description, as they are fixed in a similar manner to ordinary lead covered wires saddled direct to walls and ceilings; they are, however, very much easier to handle and they can be bent to any desired shape without injury. Under exceptional circumstances it is advisable to use ebonite or porcelain cleats for securing the wires, with the object of keeping them off walls, and to allow the free passage of air behind them, fig. 13.

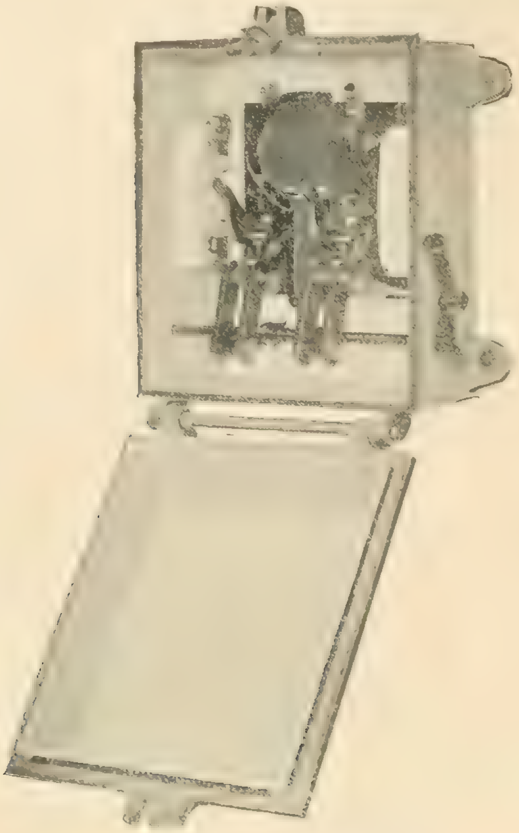

Fig. 12.—Ironclad Switch-fuse.

Where switch wires are to be sunk in walls it is sometimes an advantage to enclose them in a tube to allow for an extra switch wire being drawn in at a later date, if required.

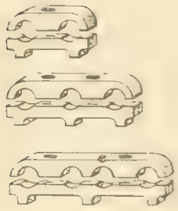

Fig. 13.—Ebonite Cleats for Wiring.

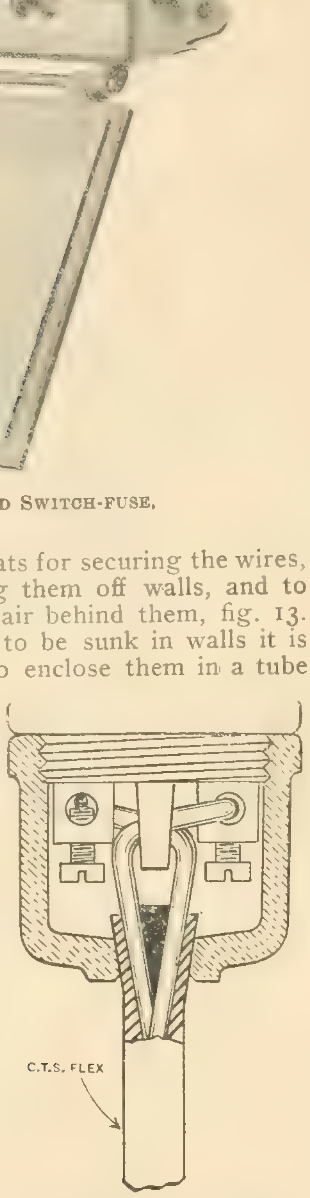

Fig. 14.—Showing Wedge to take Steam off Flexible.

Motor wiring.—It may be of interest to mention that the C.T.S. system forms an ideal method of wiring for motors, &c., in severe situations. For three-phase current it is made up in three-core circular cable to any desired size, and also four-core cable can be supplied, one conductor forming the earth wire.

In carrying out wiring for motors with three and four-core cables, these need not be treated in the same careful and expensive way as most types of cables, where the ends have to terminate in trifurcating boxes. This is because each core (of the St. Helen's make, at least) usually has a layer of C.T. sheathing over the insulation, which is designed to resist corrosive moisture from attacking the tail ends, as it does in the case of other cable ends. This saves not only the cost of boxes, but that of jointers.

Portable apparatus.—The use of C.T.S. flexible cable for portable apparatus calls for special reference, as it possesses distinctive features which render it invaluable for many purposes.

It is particularly adapted for use with domestic utensils such as electric irons, kettles, and cooking and heating apparatus on account of its smooth surface, small overall diameter, and waterproof nature.

Trouble is frequently experienced with ordinary flexible cords attached to laundry irons owing to the constant breakage of the wires at the connectors, this defect being usually caused by kinking and rough handling. It will be found that C.T.S. flexible cannot be kinked, and its life may be safely taken at six times that of the ordinary kind when used under the most severe conditions, providing a proper connector is used that will keep the insulation from contact with the iron.

Workshop flexible cord attached to portable hand lamps, especially where used in garages and similar places, is usually troublesome, as the conductors are constantly breaking, while the braided cotton covering soaks up water and oil with disastrous results.

The writer has used the C.T.S. type of flexible cable for almost every kind of portable apparatus, and it has been frequently acknowledged by clients that its life has many times exceeded that of all other kinds formerly used.

It may be mentioned that C.T.S. flexible cable is supplied in twin circular or three core with earth wire, the standard sizes being 6/30 and 11/30. To increase the tensile strength of both these conductors, one strand is of steel wire.

This type of flexible is made up to almost any size for use in conjunction with coal cutters, cargo clusters, electric drills, lifting magnets, and heavy portable workshop tools, and for numerous other purposes, a description of which is beyond the scope of this article.

A novel method of taking the strain off the wires in connection with C.T.S. cables may be mentioned. It is to insert a short wooden match down the end of the sheathing where it passes through the hole in the ceiling rose, or in the portable lamp handle. This acts as an internal wedge, which enlarges and effectually jams the cab tire sheathing in the hole. Sometimes two matches are necessary and are as effectual. Fig. 14 shows the original method as devised and patented, but it is found in practice that matches are handier, and, of course, less expensive, than the shape of wedge shown. Other types of protected cable do not seem so easily adaptable to such a simple improvisation.

MODERN METHODS OF ELECTRICAL WIRING.

On January 16th, Mr. D. S. Munro, M.I.E.E., read a paper on this subject before the Scientific Society of the Royal Technical College, Glasgow. The author described and criticised the methods ordinarily used, giving many practical hints, and showed a disposition to favour wood-casing in preference to steel conduit for the protection of the wires. The subject of surface wiring was also dealt with, and Mr. Munro described a new type of C.T.S. wiring which he had devised. The following is an extract from his paper:—

A notable addition to the wiring resources of the electrician is the introduction of cab-tire sheathing. This material, although a rubber mixture, has not highly insulating qualities, so it is not generally used as an insulator but as a mechanical and chemical protection. This sheathing has surprisingly good qualities of resistance to mechanical injury, and is impervious to all the usual chemical sources of deterioration.

It can be used in such places as stables, breweries, dyehouses, laundries, etc., when almost every other kind of protective cover fails, and, unlike lead, it will stand unlimited vibration and temperature changes without cracking.

Two or more wires insulated in the usual manner are commonly laid up together within this cab-tire cover. For indoor surface work in good buildings it is not always easy to make it pleasing to the eye, because of its considerable diameter and its reluctance to retain the desired straight or curved positions whether constructed in circular or oval section. It is also subject to dust troubles. If, notwithstanding its resilient strength and durability, it is pierced as by a sharp nail, a partial and therefore more dangerous short circuit may be established.

To reduce these minor disadvantages and make the system more widely suitable for surface or covered work, the author has recently protected a modified construction—the C.T.S. concentric system.

The core consists of one or two tinned copper cables, rubber insulated to the C.M.A. specification, and taped. Lapped closely around this is a ribbon of tinned copper wires; these are so laid that side by side contact is fully maintained. The whole is then taped and finally covered with a tough layer of cab-tire sheathing.

The inner conductor is thus highly insulated and is doubly protected against injury, first by the copper windings of the exterior conductor, and then by the resilient consistency of the outer sheath.

Although the cable is made in concentric form, it is not intended that its use should be confined to installations planned on what is currently understood to be the concentric method. This method assumes that one pole is deliberately connected to "earth" at a point, where the concentric system begins, usually at the main switch; also that single pole switches and fuses on the live wire only are used. When, however, it is decided to carry out the work in this purely concentric system manner, then the new form of cable possesses very distinct advantages over the metal-covered concentric cables hitherto employed.

The chief troubles on concentric systems have been due to electrolysis. Electrolytic action will start where there is moisture and a potential difference of about 1.25 volts. The outer metallic covering, even if purposely and laboriously "earthed" at many points, will have sections of slightly differing potential, hence trouble in the average building. The Institution rules permit a drop of seven volts on the external conductor between the "earthed" points and the farthest lamp. This provides an ample margin for trouble. When the exterior is protected with cab-tire rubber, however, the few volts difference and the dampness here and there do not matter.

This system is primarily designed, however, for use on ordinary two-wire installations up to 250 volts pressure. The rubber coverings of the inner conductor are chiefly relied upon for insulation. The external or neutral conductor is normally at approximately "earth" potential, and does not require so high an insulation between it and "earth."

On a conductor having a core of 3/22 S.W.G. and an external conductor of 36/30 S.W.G., the insulation resistance between the two wires was 1,700 megohms per mile. This latter was the insulation given by the impregnated tape plus the cab-tire sheathing.

It may be interesting to mention that the combined effect in the external conductor of the greater copper area, longer length due to spiral winding, and of the side contact between turns of wires is that the ohmic resistance of the external conductor is approximately half that of the inner. This apparent extravagance in copper is partly to provide armouring for mechanical protection. It has some advantage in reducing temperature rise and fall of potential. In most circuits the return wire has most current to carry as it serves more lamps than the individual switch wires. The cost of the extra copper is negligible as there are no expensive Para rubber coverings to go over it.

I have not yet obtained figures of the actual temperature rise nor of the self-inductive effects due to the coiled form of outer conductor, but as the 36 strands of the latter are laid side by side to form a ribbon the turns have a long "lay."

The author is reluctant to run the cable through a bath of tin before adding the outer covering, lest the heat should injure the internal rubber. All the strands are, of course, tinned, and the free individual form is far more convenient for use at terminals and joints. The whole construction, indeed, lends itself to quick and easy manipulation with standard accessories.

In many cases it is easier to carry both conductors through the switch box. If this is done the switch boxes are lined with, or constructed of, insulating material. It is easy to fill up the junction boxes and seal the terminal boxes with compound in places where it is better to have everything waterproof.

It is claimed for this system that it is neat enough for surface and safe enough for concealed wiring. There are no conduits to rust, and there can be no condensation to destroy the rubber. It is free from dust troubles. There is nothing that can suffer by ordinary chemical and corrosive action. The inner insulation is preserved by the outer sheathing, which itself shows no signs so far of deterioration by time. There is no risk of cutting the main insulation in removing the outer covering. There is a minimum of fibrous material to transmit moisture. Having a smooth surface it can readily be painted to suit surroundings. It takes almost any curve required, a feature specially advantageous in ship work. It will stand unlimited wear. In iron bulkheads it is almost self-plugging It is impossible to get a shock between an imperfect switch or fitting and the outer covering.

The chief excellence of the system, however, is that there is no external metallic surface to carry leakage and short circuit currents throughout a building to points of danger. Like wood casing, its outer protection is an insulator, but unlike wood casing, it is damp and acid proof. In extra hazardous risks, it may be covered with fireproof material, though it is difficult to set on fire.

CONDITIONS AFFECTING THE VARIATIONS IN STRENGTH OF WIRELESS SIGNALS.

By Professor E. W. Marchant, D.Sc., M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *February 11th,* 1915.)

The changes which take place in the strength of signals received from any transmitting station are well known to every wireless operator. Remarkable distances have been covered at night by using comparatively small-power plants; for example, the signals from a boat sailing from Gibraltar to Port Said with a standard 1.5 kw. set were received at Liverpool with great clearness on Sunday evening, 14th June, 1914, *i.e.*, at a distance of over 1,200 miles.

The complete explanation of freak signals such as this is a matter that requires further investigaiton.

Although many records have been taken, very few of these give actual measurements of signal strength, and it was with the view of securing such information that the following investigations were undertaken.

Their scope is confined to (1) observations of the effects of atmospheric conditions of all kinds on the strength of signals, and for this purpose a series of observations, lasting for a year, has been made; (2) variations noticeable at sunset in the strength of the signals; (3) observations on fluctuations in the strength of signals during the night.

The stations between which most measurements have been made are Liverpool and Paris, which lie mutually almost north-west and south-east. Some results are recorded in connection with the new station (recently destroyed) erected in Brussels by Mr. Goldschmidt. The bulk of the work, however, has been done in connection with the Eiffel Tower station.

H. Mosler, in August, 1913, found that the day strength appeared to be very nearly constant, *i.e.*, it was not affected by the altitude of the sun. The ratio between night strength and day strength varied considerably, being greatest in the spring and autumn and least during June, when the ratio was only 1.04. The maximum ratio was 3.15 on 13th November, the other maximum being 2.2 in April.

A. H. Taylor found that the best condition for signalling was when the intervening space was cloudy. Signals were not so strong on a clear day, or in bright sunshine. This result cannot be explained by the reduced ground absorption after heavy rainfall, but must be due to variations in the absorptive capacity of the intervening medium.

Lutze investigated the variation in signal strength on balloons, and found that the signal strength did not appear to change very much until an altitude of 1,000 to 1,500 metres was attained, but that at altitudes of 5,000 metres and over it fell to less than 10 per cent. of the value that was observed at the lower levels. The transition from strong to weak signals with changing altitude seems to be comparatively sudden and to take place at a height of between about 2,500 and 3,500 metres.

His results seem to provide clear evidence that there is, on a much lower level than has previously been suggested, a mass of ionized air which absorbs a considerable amount of the energy of the transmitted electro-magnetic waves.

Howe has shown that the current received by an antenna at a great distance from the transmitter, on the assumption of a perfectly conducting earth and on non-ionized atmosphere, is much smaller than that actually found by experiment, thus strongly supporting the theory of reflection or refraction due to ionization of the upper atmosphere.

The aerial employed in connection with the author's tests was of an L shape, having an horizontal length of over [illegible] and a vertical height above ground of 150ft. The earthing system consisted of a ring of water pipes connected with the water-pipe system of the building.

The arrangement of the circuit used in connection with the aerial is shown in fig. 1. The coupling between the aerial circuit and the receiving circuit for most of the records was 3.75 per cent. The coupling coefficient was accurately measured in all cases, and the current received in the aerial circuit could be determined from the readings of the [illegible] in series with the crystal detector on the closed circuit. The measurements of mutual induction, self induction and capacity were made by a Campbell mutual variable standard used in conjunction with a high-frequency (500 periods) alternator and vibration galvanometer. This arrangement has enabled measurements of inductances, of the order of 10 microhenries, to be made within 1 per cent. without serious difficulty. The crystal combination used in nearly all the tests was the one known as perikon, with crystals of zincite and chalcopyrites.

The secondary circuit was calibrated on the same wavelength as that of the received signal. This not only surmounts the difficulty that the sensitiveness of the crystal may depend upon the frequency of the currents passing through it, but enables the antenna current to be determined directly in terms of the current in the buzzer circuit by a constant multiplier. The current flowing in the crystal circuit connected to any oscillating system is proportional to the square of the oscillating current. This result appears to show that the action of these crystals is not a valve action, but one in which the magnitude of the current flowing in the circuit depends on a thermo-electromotive force induced by the heating effect of the oscillating current.

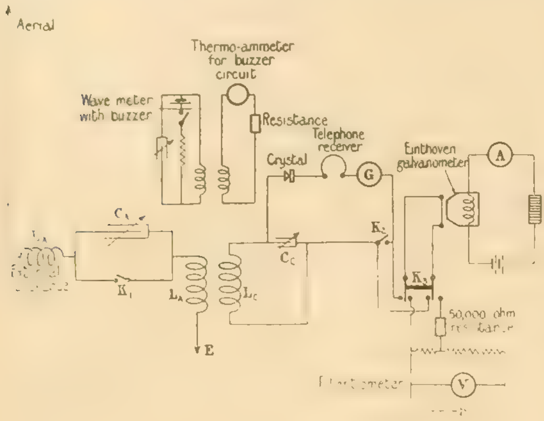

Fig. 1.—Receiver Circuit.

In series with the crystal was placed a high-resistance (8,000 ohms) telephone receiver, an ordinary Broca galvanometer with a period of about 9 seconds, and an Einthoven galvanometer with a silvered quartz fibre having a natural period of about 1/20 second when working at normal sensibility. In practice it was found that extraneous causes made it almost impossible to use the Broca galvanometer for purposes of measurement.

The number of stations in the vicinity of Liverpool prevented any accurate observation being made on the shorter wave-lengths, and for this reason the work has been confined almost entirely to the wave-lengths used by Brussels, Paris, and Clifden.

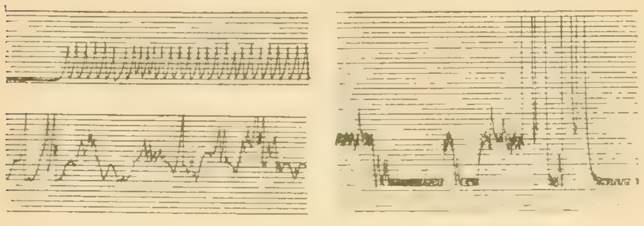

Fig. 2 —(*a*) Paris Signal—Low-Frequency Spark; (*b*) Clifden Signal—Bad Atmospherics; (*c*) Brussels Signals—Showing Atmospherics.

In connection with each test a calibration of the crystal sensibility was made by means of the buzzer shown in fig. 1. In each case the current flowing in this circuit was measured by a Duddell thermo-ammeter, and the corresponding current in the galvanometer circuit observed.

The accuracy of the measurements of signal strength is not closer than 5 per cent., and too much attention should not be given to small variations or irregularities in the curves.

Several observations have been made at the time of sunset. The increase in strength of the signal does not occur at the time of sunset, but some time afterwards, almost the same time as daylight ceases, *i.e.*, at the same time as the number of ions per cubic cm. in the atmosphere would rapidly diminish.

The curves show that the sunset effect varies with the weather conditions at the time of sunset.

The variations during a single night may be very large, and the difference in the ratio from day to day in any given month may also be large.

A possible explanation of the observed phenomena may be as follows: When the atmospheric conditions are bad and rain has fallen, the transmission is good, and the removal of sunlight, which is one of the chief causes of ionization in the atmosphere, produces little effect. Irregular reflections and refractions from masses of ionized air in the upper regions of the atmosphere, which cause irregular increases in the received antenna current, such as are observed in the all-night tests referred to later on, are prominent, because of the transparency of the lower atmosphere to the waves. On the other hand, when the day is clear the received antenna current is less strong during the day, and when darkness falls there is a considerable strengthening of the signals, owing to the atmosphere becoming more transparent to the waves as it becomes de-ionized after daylight has ceased. The reflections from masses of ionized air in the upper regions of the atmosphere are less prominent, because of the less transparent condition of the lower atmosphere after a fine day than after rain.

One point of great interest in connection with the tests is that the signals sent out on 26th July and 27th October from the Eiffel Tower were measured at Nancy by MM. E. Rothé and R. Clarté. These results have been plotted for comparison with those obtained at Liverpool on 26th July (see fig. 3*a*). They found that the increase in signal strength was very slight. Here, on the other hand, it was very considerable, the antenna current received after sunset being nearly 1.5 times that received just before sunset. The difference in the time of sunset at Liverpool and Paris on 26th July is just about 40 minutes, whereas on 27th October the difference is less than one minute.

On 27th October (see fig. 3*b*) there is some correspondence between the results obtained at Nancy and Liverpool, though there are considerably greater irregularities in the strength of signal measured at Nancy than are found here. It is difficult to see how these differences can be explained by the different orientation of Liverpool and Nancy in relation to Paris, and the consequent difference in the reflection and refraction at the shadow band. The theory of cloud reflection, however, may easily be applied to explain the difference in the effect observed at these two places.

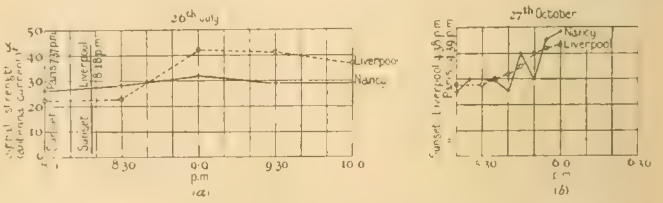

Fig. 3 —Variation of Signal Strength at Sunset at Nancy and Liverpool.

There is throughout the year very little difference between the morning and evening signals. Mosler's results may be taken as giving some evidence that the maximum night strength condition tends to occur either earlier or later in January than it does in November or April. In view, however, of the fact that the variation during the night is so great, it is very difficult to base theories on Mosler's results. One may suggest that besides the conducting outer envelope which Heaviside and Eccles have postulated, there exists in the upper atmosphere a cloud condition which affects the transmission of electric waves of much the same character as the cloud distribution with which everyone is familiar, and which affects the transmission of light waves. These clouds may consist of masses of ionized air which are transparent to light, but which absorb or reflect the long waves used in wireless telegraphy.

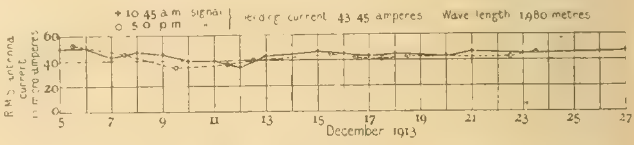

Fig. 4.—Curve Showing Variation in Antenna Current Received.

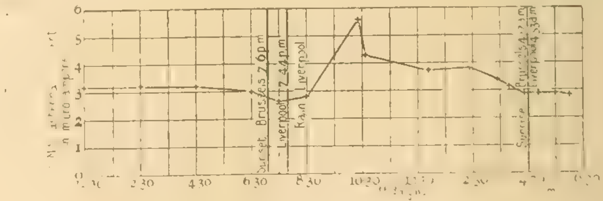

Fig. 5.—All-Night Brussels Test.

From the fact that the signals observed in the day are less variable than those received at night, it is evident that this "electromagnetic atmosphere" is prevented from producing much effect during the daytime; it cannot, in other words, produce much effect until the de-ionization of the lower atmosphere by the withdrawal of sunlight makes it sufficiently transparent to enable the waves to pass through it and reach the cloud masses which reflect them.

The earth-transmission theory of Sommerfeld indicates that it is possible that the real factor in very long distance transmissions is the influence of earth or surface waves. The fact that the night strength is so variable, however, and that the increase in signal strength on a fine evening occurs after some more or less definite interval from sunset, seems to show that the earth transmission theory cannot be a complete explanation of the facts. One must have recourse to changes in the "atmosphere" rather than in the surface over which the signals come.

It was noted in certain tests that there was a marked fall in signal strength when heavy rain fell in Paris, possibly due to defective insulation in the Paris aerial; but the constancy of the antenna current in Paris does not support this view. On several other days when it was raining in Paris the signal received was at full strength.

Speaking generally, the best conditions for wireless signalling are cloudy skies, except of course when there are strong atmospherical discharges in the clouds which make signal reading difficult. Records show that bright sunshine is not satisfactory for transmission, and this is borne out by the observations of operators, who have stated that during a spell of very sunny weather their range appears to be very much restricted (this may possibly be due to large earth resistance).

Looking now at the all-night record, fig. 5, it is remarkable that there appears to have been on the nights of 26th and 27th March and of 4th May a very considerable increase in strength after rain.

It would seem from this result that one of the causes of change in signal strength at night is rain. After the fall of rain the atmosphere becomes more transparent for the electric waves and allows the reflections already referred to, which cause an increase in the strength of signals, to become more marked; that this is possible is evident from the fact that a fall of rain must tend to de-ionize the air and carry down the charged nuclei on which rain-drops form, and which make the air conducting and therefore absorbent.

In the plates giving records of the signals taken during the all-night run from Paris there is a very considerable variation in the strength of the signal during a 10-seconds' dash. At first sight it might appear that the explanation of this is that the sparking was irregular, but if these records are compared with those obtained with similar dashes sent out during the daytime, it is noticeable that the variation in strength is much greater at night, *i.e.*, there will be during one second of the dash an increase in signal strength amounting to as much as 10 to 15 per cent. of the normal wave. The increase in strength may decrease or increase as the sparking continues.

These variations only emphasize the fact that changes in signal strength during the night are due to some rapidly fluctuating influence such as might be expected to arise from the variation in form or composition of a reflecting mass of vapour.

One may summarize the results of these observations as follows:—

1. That between two stations lying nearly north-west and south-east of each other the strength of signals during the daytime varies within comparatively narrow limits.

2. That the ratio between the night and day strength varies with the time of the year, and also from day to day in any given month, as shown by Mosler.

3. That on a fine clear day the "sunset effect" occurs about ¾ hour after the actual time of sunset and varies with the weather conditions. When rainy conditions prevail, the strengthening of the signal after sunset is much less marked.

4. That the amount of the sunset effect varies with the direction in which signals are emitted.

5. That there is very little evidence that between two stations, such as Liverpool and Paris, where the difference in longitude is about 22 minutes, there is anything in the nature of a dense fog which is opaque to waves, and which causes a drop in signal strength when the dark-light band lies between the two stations.

6. That variations during the night are relatively great and occur within the space of a few minutes. The greatest increases in strength of signals have been observed after the cessation of rain either at the sending or receiving station.

7. That the character and extent of the variations in signal strength point to the conclusion that the main factor which controls the variations is the state of ionization of the atmosphere, and that it seems likely that clouds of ionized air may exist in the upper regions of the atmosphere which act as mirrors for the waves and cause the sudden changes in signal strength that have been observed.

Discussion at Liverpool

Mr. B. **Hoyle** (Manchester School of Technology) referred to experiments carried out in order to ascertain the effect of frequency on crystal sensitiveness. Carborundum, which was known as a definite rectifier of oscillations, and perikon and radiocite which were thermal in action, had been investigated and found to be very constant over a range of frequencies varying from 100,000 to 1,500,000 per second. Regarding the thermal action on low oscillating currents changing to valve action for large currents, experiments carried out by the speaker had shown that up to 12 or 14 microamperes the ratio of current in one direction to current in the other was unity, but above this value the ratio gradually increased to 3 or 4 to one. The author had referred to the effective resistance of his crystal being about 32 ohms. The speaker's experience gave an average of about 18 or 20 ohms.

Prof. **Marchant**, in reply, said that Mr. Hoyle's experimental results on the dependence of sensitiveness of crystal upon frequency were borne out by the experiments of Dr. Lutege of Berlin. Many tests were made, and it was found that crystals which were good for low frequencies were good for high frequencies. It was to be remembered, however, that the effect of frequency did not enter into the tests given in the paper. The value of the effective resistance of the crystal, given as 32 ohms, was a little uncertain as it was obtained by difference.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Government Electric Power Station of Bangkok, Siam.

Mr. Francis B. Shaw's description of the above plant in the Electrical Review of November last is likely to lead to misapprehension, very much to the detriment of Messrs. Babcock & Wilcox. The reader would naturally infer that whereas the German firm (A.E.G.) had supplied a highly efficient plant, Messrs. Babcock & Wilcox had been so negligent as regards the boilers, that by a slight alteration 30 per cent. increase of efficiency in the boiler plant was obtained. In fairness to British engineering industry, I think a more complete history of this portion of the plant should have been given.

Messrs. Babcock & Wilcox tendered for a standard B. & W. form of step grate with fire bars that allowed the angle of inclination to be adjusted to suit the different grades of paddy, and the varying amount of moisture in the fuel.

After the contract was signed Messrs. B. & W. were asked by the A.E.G. to modify their furnace and to adopt a form of fire bar and furnace *proposed* by Mr. Shaw and his consulting engineer. This they did, but they strongly declined to accept any responsibility or guarantee for the same. On Mr. Shaw's own showing, Messrs. B. & W. were fully justified in their decision.

The B. & W. paddy husk furnace is illustrated in their well-known book "Steam," and several of these are in successful operation in different parts of the world.

This furnace has one great point, namely, the burnt ash falls directly into the ash drain, whereas in the Bangkok design the fireman must rake the ash forward some four feet or more—no light task. Probably this accounts for the suggestion to use steam (page 661) for the removal of the ash, a scheme that has proved unsuccessful and dangerous to the fireman elsewhere. The air channel (page 659, fig. 7) is, of course, quite an old idea, being used in the Bangkok tramway station built some ten years ago, and also adopted by nearly all the Bangkok rice mills. To admit the air through the top of the bridge is surely nowadays a proven fallacy.

It is rather a pity that Mr. Shaw has omitted to give some figures or readings from the CO_2 recorder and the Lea water recorder.

Just recently it appears the furnaces have been rebuilt somewhat on the lines indicated, the bridge being hollow and porous. Tests carried out in December, 1914, on behalf of the Government, under careful supervision, show that the fuel consumption of the new furnaces is much below that of the furnace shown in fig. 7. Some modification in the ironwork of the furnace was made, and, I believe, the angle of the fire bars was increased slightly.

It is interesting to note that a British firm of gas engine makers have just installed in Bangkok a suction gas plant using paddy as fuel, with great success. Possibly gas-fired boilers on a similar system would prove to be the ideal method of steam raising.

I believe that Mr. Shaw has been absent during the greater portion of the erection of the Samsen station, otherwise he would have been aware that more or less serious subsidence of the building took place, the chimney tilting over to an extent plainly visible to the ordinary observer. The method adopted by the Government building engineers to get over the trouble was most ingenious. A trench was dug alongside the battery-room wall, extending somewhat at the chimney end, and carried down well below the foundations. This allowed the earth under the foundations gradually to squeeze out, so that the lightly-loaded side of the building could settle down to the same level as the boiler-house side. After some six or eight months it was found that the building had gradually gone back into level, and the trench was then filled in, all the machinery being again carefully put into alinement.

The contract for the whole of the plant, boilers, generators, switchboard, and sub-station equipment [illegible] and buildings) was placed with the A.E.G., of Berlin, whose tender was very much below that of English firms. It would be interesting to know the exact detailed cost of the plant *including extras*, as according to the Government Progress Returns, this power station has cost nearly three times the sum originally estimated, while the maximum (peak) load appears to be *under 500 kilowatts* with all lines in service except the cement works, now building.

Who is responsible for a [illegible]-kilowatt station being put down; surely the load does not justify the size of plant (135,000 units per month)? Is this a sample of Germans' engineering advice?

I have no connection with any of the firms tendering, and enclose my card; I strongly advocate a more active attempt to secure British trade in the East. I think more care should be taken by British firms to obtain information as to the exact state of affairs so that they are not *intimidated by heavy penalties for delay and failure of supply* into inflating tender prices to cover these risks. The German firms know full well the risks are small and easily circumscribed.

H. E. F.

January 4th, 1915.

The Capture of German Foreign Trade.

I do not know with what object "Galvo," of New Zealand, writes to you with respect to British trade, but should judge that it is done with the idea of damaging it; but it is easy to see from his statement "that Geelong is a small and rather insignifiant inland town in Victoria," that he is both ignorant and careless in his statements, and it can therefore be gathered that the rest of his highly-coloured statements, if not actual untruths, are certainly exaggerations.

For those few readers who may not know the district, Geelong is one of the four largest towns in Victoria, and is situated on the shore of Port Phillip Bay. It has a first-class electric light station, automatic telephones, and a large over-sea trade in wheat and wool.

P. R.

We have read with interest and amusement the two columns of "hot gas" contributed to your issue of February 5th by a New Zealand correspondent signing himself "Galvo." We think we know this gentleman, in fact, we are sure of it, because the "story" which is retailed at the top of page 171 obviously relates to us. We have no brief for the other offenders, so will merely state that when reading all cases of this kind one should remember the Latin proverb *audi alteram partem*. There is generally something to be heard on the other side, and to judge from our own experience, we should say that the other alleged offenders will be quite well able to offer a satisfactory defence. Without going into details, we may say that it is quite true we guaranteed our plant. In doing so, we assumed that our verbose friend would erect it as we should have erected it. We have no knowledge that he did so, because he has never, in spite of repeated letters, given us all the particulars that we asked for, and we do not know that he carried out the original job as instructed. Nevertheless, when he complained that the plant would not do its work, we told him to do so and so, and as a result the plant was accepted. He then made a claim on us for a considerable sum of money, which he said he was out of pocket of, and we had no difficulty in showing him by a little arithmetical calculation that he was trying to "have" us. We, however, offered to meet him in this way. We said that we would credit him with a certain smaller sum by considerably increasing the discount we allow off our goods until this sum was paid off. He then replied that he would accept the smaller sum in cash, but not in kind, because the original goods we sent him, apart from the installation in question, had proved unsatisfactory. We were able to give him documentary proof that he had continued to order further goods in spite of the alleged unsatisfactory working of the original goods, and we said that if he would send the original goods back we would see that they were repaired, brought fully up to date, and returned to him. We thought this a very fair offer, but he has only replied by stating that he has put the matter in his solicitor's hands.

Although our friend did not send us the full information we required regarding the job in question, he has always had a great deal of time for the writing of yards of facetious and sarcastic letters on all sorts of subjects, similar to the one you published, and we have often thought that he was more fitted to edit a Bush journal than to trade as an engineer.

Some of these Colonial engineers and merchants have seen nothing of the world, and always appear to look on their domain as the hub of the universe, and they forget that Great Britain supplies the world, whilst Germany and America have made it their business to try and cut her out. No doubt we have our faults, and one is insularity, but "Galvo's" letter reminds us that New Zealand is a very much larger group of islands than Great Britain and only has a population of about one million.

In conclusion, if this correspondence meets the eye of the firm who supplied "Galvo" with the marble, we should be glad if they would communicate with us through you.

British Specialists.

Salaries of Junior Engineers.

Referring to your Correspondence column of the 29th January, regarding "Collar and Cuffs'" statement comparing engine drivers with shift engineers, I should like to know what central stations he has been employed at to be able to condemn the engine drivers and stokers for obtaining a better position any more than the volt boy that wipes the engines down in his spare time or the office lad that is learnt the switchboard. After about twelve months they begin to feel their position, they get a shift engineer's job, know nothing, relying on the men under them to pull them through; then why not let those drivers or stokers that have their jobs at their finger tips qualify for the same if interested in their work? I am glad to see one or two have gained this position the last few months. The station superintendent's assistants, in my opinion, are the drivers and stokers in a great many of the provincial towns regarding the generating cost, and a good many know that. I will give you one or two instances in my fifteen years' experience in central stations as driver, stoker and switchboard attendant. In one station I was leading stoker; it happened one night they could not get on the battery, so the shift engineer had to run a small engine and boiler all night. This engineer was about 25 years old, and had been there two years. Everything went all right till 3 a.m., when his water got out of sight; then he came for me, living next street. I told him to shut his top cock on the water gauges and if the water did not rise in glass to pull the fire out at once; if it was all right to put his pump on a bit more—he would soon gain water—but to let me know if he was all right, to save me getting up at that hour, being on till 11 o'clock. So he went along on that, but in the morning about 8 a.m. I walked into the boiler house and there was the gauge cock still shut off, showing about half a glass, which he had been working to, so you see when I opened the cock it was the same, so I explained the working of the steam and water ways of the gauges and got his water up. I wonder if he has got a Chief's job yet. I saw a great many changes, but the majority of them were like the steady driver, did not know the firebox from the ash pit. Another job, they happened to have two boilers to pieces for cleaning leaving one to work on. It being summer-time I happened to have a day in the country that Sunday, as he said the fitter's mate could do that, but when I got home at 10 p.m. I was told the lights had been out since 7 p.m. They had blown some of the water off on Sunday morning to repair a valve, so they started the fires roaring about 6 p.m. as the battery was low, without putting any more water in the boiler. This could have been prevented if they had had an experienced engineer to see things right before starting fires up, but they preferred burning the tubes, so there were no lights for two days and nights through neglect. Another shift engineer had a joint to make on 1½ in. steam pipe, got it adrift after a struggle, cleaned it, put new joint in; four studs held it, but to make sure it would not blow, being a new man, he tore two of the studs off, so it blew worse. Then he gave it up and the fitter did it. Next job, packing the gland of a one-inch valve with asbestos string, winding round on top of the brass bush instead of pulling it out and stuffing inside; this man had been in two other central stations. It does open the eyes of drivers and stokers that they have charge of on shifts. Another shift engineer I know was on the day and night shift for twelve months because he could not run two alternators in parallel The same gentleman got a chief assistant's job from that. I should like to know what kind of engineers you call these. Good practical shift engineers are few and far between, so are drivers and stokers, as they get no encouragement at most places. I should like to hear how those drivers that have gained that position are getting on—I don't think for one minute they are grey-headed.

Driver,
Late Steam Generating Engineer.

Wonderful Accumulator Cells.

In reply to Mr. Faraday Hawdon's latest favour, I would simply refer him to his previous letter in which he kindly informs us that no lead type of cell can work without sulphate. Very well. This is a flat contradiction to the Notice to which I drew attention, in my original letter. As Mr. Faraday Hawdon has expressed a wish to close this correspondence, I think it best to leave him with his truly "Wonderful Accumulator" in which "the plates are free from sulphate" after being totally discharged ten months ago.

A. W. B.

[It appears that this discussion arose out of a quibble. The merest tyro in accumulator work knows that "sulphate" in this connection has two meanings.—Eds. Elec. Rev.]

Consulting "Engineers."

I think "Delta" touches upon a point of great importance. If an individual attempts to practise as a lawyer or medical man without first qualifying, he is immediately imprisoned or heavily fined.

Why is it our profession is not equally so guarded? I know of a commercial traveller who has actually had the audacity to fix a brass plate outside a suspicious-looking box-room in the City. There are a large number of these little rooms occupied by similar quacks, etc., the whole block is generally known by a high sounding name, and Fleet Street, Regent Street, or Queen Victoria Street, completes the tools-in-trade as it were; not to mention the illusion of the intending client. But let me proceed—this individual I have in mind has by some means or another become an associate of one of our leading institutions.

Now, Sir, what protection, I ask, have genuine engineers against such a state of affairs? We are actually faced with our well-known institutions aiding and abetting quacks, cheats, etc., by the fact that these wasters are admitted as members to these institutions, whose very existence should guarantee the *bona fides* of its members. I think this is a case the REVIEW should take up. At present the letters A.M.I.E.E., M.I.M.E., etc., sound ridiculous and foolish to many, and afford no guarantee of a member's competency.

Let us hope that such letters will in time convey the same sense of security to a client as M.D. or K.C. do to

Station Engineer.

Extra High-Tension Cable.

At several meetings recently held to discuss the above subject, suggestions have been made that a pressure of 30,000 volts should be the working limit of underground cables, and I believe this proposal was made by a representative of one of our leading cable firms.

If this view be taken by the remainder of the cable manufacturers, it will amount to an admission that we cannot tackle the larger stuff, and that we are lagging very much behind the Continental cable makers. The writer recently saw a consignment of 40,000-volt 3-core cable (50 sq. mm. section) lead-covered and armoured at the works of Messrs. Pirelli & Co., Milan (this cable was made for the Italian State railways), the lead and armouring being 2¼in. and 3 3/16in. respectively.

As pointed out by Mr. D. A. Starr, at Glasgow, Dr. Borel does not pin his faith to pure manilla paper, but prefers a paper with a proportion of wood pulp. This view is also held by many other Continental cable makers, and one is bound to admit that they do know something about cable.

Recently an inquiry was set afoot for a cable of about the size mentioned above, for a working pressure of 50,000 volts, and I learn that the business was turned down because the size of the cable would be too large to put through the lead press. A lead press will take up to about 3½in.; what amount of insulation was proposed in this case?

H. H. E. Wood.

Hampstead, N.W., *February 16th*, 1915.

OUR LEGAL QUERY COLUMN.

"ELECTRIC" writes:—With reference to your answer to my query in your issue of the 5th inst., I may mention that there was an agreement for the three years, but "light" was not mentioned in the same. The point was "whether a tenant having put in electric light wires in tubes could have legally taken (drawn) them out again without liability to himself, and leave switches which he would have to disconnect to do so?"

*** The duration or length of the lease does not appear to affect the question under discussion. It is clear law that if a tenant affixes anything to the freehold it becomes the property of the landlord and cannot be removed at the end of the lease.

If a tenant has a fancy for a marble chimney-piece, and puts one in, he makes a present of it to his landlord. With wires laid for the purpose of distributing electric light the principle is exactly the same. Anything that unscrews may of course be removed, but things which are fixed cannot be taken away.

"H.C.M." writes:—"My committee have recently had a case of a consumer claiming to utilise his motor service for the purpose of driving a dynamo for lighting his workshop. This dynamo would be driven from the workshop motor and he claims that our department have no right to stipulate as to the way in which he should use any surplus power that he may have from his motor, the main object, of course, being to obtain current for lighting at power rates. I have some recollection of your publishing articles on this subject, but I cannot give the dates. Will you therefore please let me know whether your files show any decision of the Courts on this matter, or could you forward me issues containing the information?"

*** This question has been frequently propounded. There has never been any judicial decision on the matter, and the answer must be based on first principles. The use of the word "power" or the words "power rates" in Acts of Parliament is now very common, and even the man in the street could say what is meant by a "power" Act. Then, too, the word "lighting" or the expression "supply for lighting purposes" is perfectly well understood, and it is obvious that a man who takes current at motor rates and uses it to run a motor generator and then to light his lamps is doing something which is very like defrauding the supply company. A supply for power can be given at cheaper rates for the reason that "power" is generally wanted during the day, when the normal lighting load is small. Hence that reduction in charges which is of such advantage to the manufacturer: but the electric lighting company or local authority supplying electric light would be deprived of a large part of its revenue if the practice referred to were often adopted.

It is interesting to notice that, although the matter has not hitherto been dealt with in any Act of Parliament of general application, those who were responsible for certain legislation applicable to London were fully alive to the difficulty which might arise, and have provided against it—first by defining "power," and secondly by imposing penalties on those who do the very thing referred to in the query.

A statutory definition of "Electricity for power purposes," which, of course, only applies to the Metropolis, is to be found in Sec. 7 (1) of the London Electric Supply Act, 1908. That section provides that "No authorised undertaker shall be bound to give a supply upon the terms of this section in any case where the maximum power required to be supplied is less than two kilowatts. For the purpose of this section the expression 'power purposes' shall include all purposes to which electrical energy may be applied other than for use either directly or indirectly for lighting."

By Sec. 7 (4) of the London Electric Supply Act, 1908 (8 Edw., 7 c. clxvii) (which is an Act of restricted application), it is provided that: "Any supply given for power purposes . . . . shall, if required by the authorised undertaker, be measured by a separate meter or other apparatus, and any person receiving a supply for power purposes who shall use the energy directly or indirectly for the purposes of lighting shall be liable to a penalty not exceeding five pounds for every day on which he uses such energy for such purposes, in addition to the sum payable for the energy so used at the price charged by the authorised undertaker by whom the supply is given for a supply for lighting purposes."

These statutory definitions are not, of course, binding, except in the area to which this Act relates; nor do they throw much light upon the way in which the Court might interpret the word "power" under other circumstances. Nevertheless, the insertion of the words "directly or indirectly" before "for lighting" shows that the Legislature had in mind a method of driving a coach-and-four through an Act of Parliament by using a motor-generator.

"H.K." writes:—"I should be very glad if you could help me in the following matter:—A, B, C, D, E, F, are a block of shops in a row, and to give a supply to the (E) a pair of temporary wires were run behind the facias of C and D from a point behind C for a period of five days, when permanent service was put in at E from the mains opposite the house. The landlord's permission had been obtained to lay service as before. Shops A B have permanent services run behind the facias, and the main supply is at a point behind C. C's and D's permission was not obtained to the running of the temporary wire. C did not object, but D objected after wires were fixed and wanted them moved at once. This was not done, as E would have been cut off. The circumstances were explained to him, and he was told wires would be removed. D now claims compensation for trespass, trouble and annoyance. As the wires were not attached to his facia-board, can he claim anything? If so, what would he be entitled to?"

*** It is plain that if a man owns or occupies a house, he is entitled to prevent any form of trespass thereon, whether the trespasser comes on the land himself or places any of his goods or chattels thereon. So to run a wire across a man's back garden (whether it be attached to his walls or not) is clearly a trespass for which an action lies. But it is difficult, in the present case, to see what damage D has sustained. If he brings an action let 40s. be paid into Court, and probably no more will be heard of the matter.

ELECTRICAL PATENTS OWNED BY ALIEN ENEMIES.

The following contains a list of British patents [illegible] resident in Germany, Austria [illegible] Hungary [illegible] interest in view of the new Patents Act. [illegible] ELECTRICAL REVIEW by Messrs. W. P. [illegible] & Co., [illegible] 285, High Holborn [illegible] 6, Lord Street [illegible]

1902.

1,544.—[illegible]

5,802.—[illegible]

7,995.—[illegible]

8,858.—[illegible]

12,159.—[illegible] lamps.

12,163.—[illegible]

12,574.—[illegible]

14,853.—[illegible]

16,959.—[illegible]

18,786.—[illegible]

20,424.—[illegible]

22,106.—Siemens & Halske Akt. Ges., Berlin. Electric cut-outs.

22,108.—[illegible]

26,476.—[illegible]

28,820.—[illegible]

1903.

1,088.—C. Rodenbourg, Hagen, Germany. Galvanic batteries.

3,704.—[illegible] machines.

4,536.—[illegible]

[illegible] Budapest. [illegible] deposition.
5,561.—[illegible] Vienna. [illegible] electric generators.
6,740.—Siemens & Halske Akt. Ges., Berlin. Telegraphs.
6,742.—Siemens & Halske Akt. Ges., Berlin. Telegraphs.
7,292.—V. Poulsen, P. O. Pedersen, Copenhagen, and [illegible] Schou, Krefeld. Telephone systems, etc., recording.
[illegible]442.—O. Vogel, Berlin. Electric lamps.
[illegible]—Siemens & Halske Akt. Ges., Berlin. Controlling electric motors.
[illegible]244.—H. Beck, Meiningen. Electric lamps.
[illegible]—G. A. Wedekind and H. P. Porscke, Hamburg. Galvanic batteries.
21,305.—Siemens & Halske Akt. Ges., Berlin. Electric synchronous movements.
[illegible]—K. [illegible] Vienna. Electric igniting apparatus.
27,712.—Siemens & Halske Akt. Ges., Berlin. Electric lamps.

1904.

2,829.—C. Schwabe, Berlin. Electric lamps.
6,305.—H. Beck, Meiningen. Electric arc lamps.
6,724.—H. Aron, Charlottenburg. Measuring electricity.
12,332.—C. de Kando, Budapest. Electric motors.
14,479.—H. Krantschneider, Berlin. Electric annealing and tempering.
16,751.—H. P. R. L. Porscke & G. A. Wedekind, Hamburg. Galvanic batteries.
17,423.—H. Rosenberg, [illegible] Rosenberg, [illegible] Dynamo electric machines.
[illegible]—Siemens Schuckertwerke Akt. Ges., Berlin. Electric cranes, winding engines.
20,277.—Siemens & Halske Akt. Ges., Berlin. Electric lamps (reg.).
22,342.—Korting & Mathiesen Akt. Ges., Lentzsch-Leipzig. Electric lamps.
22,511.—H. Beck, Meiningen. Electric lamps.
23,279.—H. Aron, Charlottenberg. Electric resistances.
23,622.—P. Mollmann, Berlin. Galvanic batteries.
27,713.—Deutsche Gasgluhlicht Akt. Ges., Berlin. Electric lamps.
27,714.—Deutsche Gasgluhlicht Akt. Ges., Berlin. Electric lamps.
28,018.—Siemens Schuckertwerke Akt. Ges., Berlin. Electric safety discharge apparatus.
28,036.—[illegible] Prague. Telephone systems.
[illegible]—H. Kuzel, Near Vienna. Electric lamps.
[illegible]—Deutsche Gasgluhlicht Akt. Ges., Berlin. Electric lamps.

1905.

184.—E. Arnold, Karlsruhe, and anr. Electric motors.
3,605.—Siemens & Halske Akt. Ges., Berlin. Rotary water meters.
3,669.—C. Henke, Witten a.d. Ruhr. Heat non-conductors.
4,375.—[illegible] Dynamo [illegible] machines.
[illegible]—L. Scholvien, Near Berlin. Electric lamps.
5,977.—[illegible] Akt. Ges. W. [illegible] & Co., Frankfort-Main. Dynamo electric machines.
8,975.—[illegible] systems.
9,443.—[illegible]
6,074.—Siemens & Halske Akt. Ges., Berlin. [illegible]

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

[illegible] W. C. [illegible] February 1st. (Complete.)

[illegible] A. G. [illegible] (R. Bosch, Germany.) [illegible] 2,046/13. [illegible]

1,612. [illegible] A. M. M. [illegible] February [illegible]

[illegible] W. [illegible] February 2nd.

[illegible] A. B. Webber & Standard Time Co. February 2nd.

[illegible] H. J. Candell. February 2nd. [illegible]

[illegible] H. W. [illegible] & H. E. Donnithorne. February 2nd.

[illegible] continuous currents." H. E. Donnithorne. February 2nd.

1,662. "Apparatus for facilitating the sterilising of liquids by the action of [illegible]." [illegible] Kowalski. (Convention date February 2nd, 1914. [illegible]) February 2nd. (Complete.)

[illegible] gas with an [illegible]." M. R. A. Samuel. February 2nd. (Complete.)

[illegible] W. J. Batley Bateman. February 2nd.

1,672. "Electrolytic apparatus for the production of liquor for bleaching and [illegible] purposes." A. Holliday & G. F. Ward. February 2nd. (Complete.)

1,684. "Electro-magnetic and vacuum lifters." J. P. C. Charlebois. February 2nd.

1,689. "[illegible] lamp." F. Rieu & G. Rieu. February 2nd.

1,693. "Method of and apparatus for controlling the relative speeds or difference in speed between the feed mechanism of two machines." Western Electric Co., Ltd., & E. W. Adams. February 2nd.

1,694. "Thermionic amplifying devices." Western Electric Co., Ltd. February 3rd. (Western Electric Co., United States.) (Complete.)

1,696. "Contact-maker for aerial bomb or any other form of shell." A. B. K. Bradley, W. J. Weaver, W. Zealand & T. E. Zealand. February 3rd.

1,697. "Electric tumbler switches." H. C. Heath & J. P. Keith. February 3rd.

1,715. "Incandescent electric lamps." W. Sanders & Co., Ltd., & W. Sanders. February 3rd.

1,733. "Apparatus for measuring or ascertaining radiant energy." Richmond Gas Stove & Meter Co., Ltd., & H. Hartley. February 3rd.

1,740. "Electric radiator." Majestic Electric Development Co. February 3rd. (Convention date February 3rd, 1914. United States). (Complete.)

1,751. "Device in stations for subaqueous sound signals." Signal G.m.b.H. February 3rd. (Addition to 3934/13. Convention date February 3rd, 1914, Germany). (Complete.)

1,755. "Sparking-plugs for internal combustion engines." R. G. Booth. February 3rd.

1,774. "Apparatus for electrically operating planing-machines and the like reciprocating tools." Lancashire Dynamo & Motor Co., Ltd, & W. Hargreaves. February 4th.

1,787. "Electric telemotors." W. J. Rodgerson. February 4th.

1,788. "Telephone transmitters." Western Electric Co., Ltd., & G. H. Nash. February 4th.

1,791. "Luminous electric switches." H. R. Rivers-Moore. February 4th.

1,802. "[illegible] motors." G. Kapp. February 4th.

1,818. "Magnetic compasses." F. Barker & Son, Ltd., & S. W. Barker. February 4th.

1,857. "Sending-device for subaqueous current line telegraphy." Signal G.m.b.H. February 5th. (Convention date February 5th, 1914. Germany). (Complete.)

1,869. "Starting electrode for vapour electric devices." S. W. Farnsworth & O. P. Schuster. February 5th. (Convention date February 5th, 1914. United States). (Complete.)

1,870. "Rectifier systems." S. W. Farnsworth. February 5th. (Convention date February 5th, 1914. United States). (Complete.)

1,876. "Safety devices for elevators." British Thomson-Houston Co., Ltd. February 5th. (General Electric Co., United States.)

1,880. "Electrolytic manufacture of cuprons and zinc oxides." C. G. Chance & W. J. Gibbes. February 6th.

1,892. "Self-driving electric heat and fluid-pressure motor." G. E. A. Holdsworth. February 6th. (Addition to 18511/09.)

1,896. "Electric lighting of railway carriages or other mechanically-driven vehicles." H. Helin. February 6th.

1,913. "Trolley heads of electric tramcars and the like." F. Kynman & F. Robson. February 6th.

1,917. "Means for and methods of increasing the current-carrying capacity of large cables for alternating currents." A. M. Taylor. February 6th.

1,928. "Magnetic skelp-charging machine." W. T. Garlitz. February 6th. (Convention date February 7th, 1914. United States). (Complete.)

1,918. "Electric motors." V. von Inthoudt. February 6th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

24,803. Reversing-gearing suitable for actuating the Rudders of Torpedoes. M. P. Otto. October 31. (November 22nd, 1912.)

26,495. Supply of Electricity. A. F. Berry. November 18th.

27,615. Automatic Regulation of Electric Circuits. C. A. Vandervell & A. H. Midgley. December 1st.

28,932. Electric and other Liquid Heaters. R. Weaving & Ferranti, Ltd. December 15th. (Patent of addition not granted.)

29,216. Electric Ignition and Starting System for use with Internal Combustion Engines. J. B. McNab. December 18th. (December 26th, 1912.)

1914.

940. Gyroscopic Steadying Apparatus. P. Schilowsky. January 11th. (Cognate application, 9751/14.)

941. Demonstratory Gyroscopical Apparatus. P. Schilowsky. January 11th.

971. Means for Locking Handropes for Lifts and the like by Electric Control. M. T. Medway. January 13th.

1,038. System for Controlling the Points of a Group of Railway Shunting Sidings. A. Descubes. January 14th. (January 16th, 1913.)

1,133. Electric Insulating Material applicable as a Heat Insulating Material. F. Rowley & Sanraine Syndicate, Ltd. January 15th.

1,791. Regulators for Blowing Engines, Centrifugal Pumps and Compressors. British Thomson-Houston Co., & R. H. Collingham. January 22nd.

2,174. Systems of Charging and Discharging Electric Batteries. A. V. Gifkins & H. S. Watson. January 27th.

2,215. Telephone Desk Sets. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). January 27th.

2,242. Switches for Electric Lighting. J. H. Collie. January 28th.

2,380. Electro-magnetically-operated Horns. H. Lucas & W. H. Edwards. January 29th.

3,358. Machine Telephone Switching Systems. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). February 9th.

4,414. Variable Resistances for Electrical Circuits. H. [illegible] February 20th.

4,742. Electric Furnaces. J. J. Dixon. February 24th. (Cognate applications, 8513/14, 16,263/14, and 17909/14.)

4,940. Dynamos. H. Leitner. February 25th. (Cognate application, 7083/14.)

8,700. Electric Motors for Driving Enclosed Machines. B. [illegible] April 6th. (January 10th, 1914.)

10,742. Electro-magnetic Train Stop for Steam or Electric Trains. J. Deeb. May 1st.

11,490. Protective Device for Ventilating Fans. T. A. Douglass & Devilless Manufacturing Co. May 9th.

11,510. Railway-signalling Apparatus. Tyer & Co., & J. E. Stringer. May 9th.

14,834. Electrical Condensers. A. L. B. E. Dart. June 20th. (June 21st, 1913.)

18,154. Selecting Devices for Automatic or Semi-automatic Telephone Systems. G. A. Betulander. July 31st.

18,711. Wireless Telegraphy. W. C. Woodland. August 15th.

21,774. Ignition Dynamos. C. F. Mason. October 30th. (Divided application on 174/14. January 3rd.)

23,142. Magneto-electric Machines. H. Wade. (C. F. Mason.) November 26th. (Divided application on 967/14. January 13th.)

Income-Tax.—At the annual meeting of the West Yorkshire Federated Chambers of Trade, at Leeds, last week, Mr. Thomas Pratt, head of the firm of Chr. Pratt & Sons, Ltd., electrical contractors, of Bradford, who was re-elected President, delivered an address on "The Income-Tax and its Exemptions," as a result of which the Federated Chambers decided to support the resolution to be considered by the National Chamber, "That in view of the enormously increased expenditure in recent years in local and national government, and the heavy burdens upon traders added by the war, this Chamber strongly affirms its opinion that the incidence of rating should be altered, and the basis of taxation broadened, and suggests that the limit of £160 per annum liability for income-tax should be lowered to £80."

THE

ELECTRICAL REVIEW.

VOL. LXXVI. FEBRUARY 26, 1915. No. 1,944.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: February 26, 1915. [No. 1,944.

Page
Neutrality and the Moral Law 273
Copper 274
Trans-Continental Telephony 274
Hand Regulation of a Hydro-Electric Plant in India, by J. W Meares 275
Indian Notes 275
Conditions Affecting the Variations in Strength of Wireless Signals, by Prof. E. W. Marchant 276
New Electrical Devices, Fittings and Plant (*illus.*) 276
War Items 277
Legal... 278
Distribution and Rise of Temperature in Field Coils, by M. Maclean, D. J. Mackellar and R. S. Begg (*illus.*) 279
Review 280
Electric Heating and Cooking 280
Trade Statistics of the Straits Settlements 281
Business Notes 281
Notes 287
The Electricity Supply to Port Glasgow from Greenock (*illus.*) 289
City Notes 294
Stocks and Shares 300
Exports and Imports of Electrical Goods during January, 1915 301
Polyphase Commutator Machines and their Application, by N. Shuttleworth (*illus.*) 302
Workers' Earnings and the War, by "Commercial" 306
Correspondence—
  Modern Wiring 306
  A.C. and D.C. for Lighting 307
  High and Low Voltage Metal Filament Lamps 307
  Consulting "Engineer" 307
  Half-Watt Lamp Fittings 307
  Trouble with Oil 307
  Electrical Patents owned by Alien Enemies 307
  A Quarter Turn Coupling 308
  Salaries of Junior Engineers 308
New Patents Applied for, 1915 308
Abstracts of Published Specifications 308
Contractors' Column ... ... Advertisement page xxii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.
BRISBANE: Gordon & Gotch, Queen St.
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MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: The Mining & Engineering Review, 278, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

1915 EDITION

IN THE PRESS.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

NEUTRALITY AND THE MORAL LAW.

THANKS to the labours of the pre-historian and the historian, we are able to trace with tolerable accuracy the path along which mankind has advanced both in his material and his moral development.

Some fifty thousand years separates the civilisation of palæolithic man from that of to-day, and the advance made during that period in man's knowledge of material things, and in the sphere of morals, has been immense. In the earlier part of this period the rate of progress was slow owing to the sparse distribution of the population and the difficulties in sustaining life. During the last few thousand years, however, the physical and mental environment of man has changed very rapidly, and this change in environment has in itself provided an atmosphere congenial to the birth of new ideas.

One of the chief factors in promoting progress has been the increased intercourse and co-operation between the various sections into which the human race is divided. New and rapid means of travel and communication have been created, systematic education has become general, and a daily interchange of ideas now sweeps freely over every quarter of the globe.

Our world has at once widened and contracted; it has widened, in that our knowledge and interests now extend to the utmost confines of the earth, and it has contracted since our thoughts and acts may now be known throughout the world almost at the moment of their birth.

This transformation, wrought largely by the magic of the engineer, has had, and will have increasingly in the future, a vast influence upon the moral as well as upon the material progress of mankind.

We can trace in the past the effect of the progressive widening of the mental and material horizons on the moral and material progress of the race.

These horizons were very restricted when the family of the nomad hunter formed the collective unit, they widened slowly, as first settlements, and then peoples, and nations came into being, until to-day, with our world-wide horizon, we are awakening to the consciousness of the unity of our Race, and feel within us the pulsing of the heart of Humanity.

In the material world the achievements and advances gained by man in his struggle with Nature have become the common property of the peoples of the earth, and in like manner, in the sphere of morals, a common store of ideals and moral obligations has been built up.

In this day of thunderous stress, amid the clash and shock of material conflict, it is difficult for us to realise as clearly as we should do, that the real issue that is being fought out in the bloody mire of Flanders and the stained snows of Poland is not a material one; it is a conflict between human ideals, the result of which will determine for many centuries to come the moral progress or retrogression of our race.

To what end is this fearful flood of blood and destruction poured out, sweeping away with it the hallowed sanctuaries, the garnered treasures, and the sweet amenities of a Continent, annihilating the spirit of its past, blasting the promise of its future and bringing woe and life-long tears to millions of our fellow men? In two words, it is as to whether Force or Freedom is to govern the future of our race, whether brute force is to be king, or whether the right of humanity freely to follow its ideals and the dictates of the Moral Law is to be paramount.

The German people, under the influence of its teachers, philosophers and military leaders, have come to believe in the Gospel of Force, and to think that the laws of Force govern the moral and material progress of mankind. There does not appear to be any sound biological basis for such a law when applied to mankind. Huxley showed us more than a generation ago that Man can, and does, cut athwart the laws of purely natural development, and that Nature "red in tooth and claw" is not only faced, but is mastered, by the spirit of Man.

Man is shaping his destiny in accordance with spiritual laws, he sets up a standard unknown to Nature, and one which it is beyond the power of Force to overwhelm. Whatever the ultimate fate of the race may be, there is no mistaking its present duty, the call is clear and high. What of the response?

The Teuton peoples fight for the right of Might; the Allies fight for Freedom; and the rest of the world is "Neutral." Neutral they may be so far as active participation in the material conflict is concerned, but what neutrality can there be in connection with the moral issues of the struggle?

It is evident that the material concerns of certain peoples are more closely involved in the present strife than are those of other nations more remote from the scene of conflict, but the moral issues indubitably and intimately concern the whole of the human race. For these issues the attitude of "neutrality" can only be a negative one, a passive waiting for the decision of the issue by others, and a flaccid acceptance of the ideals of the victor. Do the "Neutrals" recognise that their wills are only temporary manifestations of an ampler will, that their lives are passing phases of a larger life; if they hold themselves aloof, can they hope to wear the Crown Divine, the harvest of our blood and tears?

America should know; for Emerson has taught her that every spirit builds itself a house, and beyond its house a world, and beyonds its world a heaven, but only what she herself *is* can she really know and see. Is she prepared to sit silent and inactive in the land of Freedom while the world-building is done by other hands?—is the chinking of the almighty dollar so loud in her ears as to drown the still small voice of the All-Father of her race? We trust not, we think not, but she, with other "Neutrals," would do well to ponder the moral obligations they took upon themselves at the Hague in 1907 and to prepare to discharge them, for they still await discharge.

If we are to entertain any hope of the elimination of military domination in the near future, such hope can only be based upon the collective action of the race in the present crisis. The solemn obligations accepted by the Powers signing the Hague Convention must be upheld, must be discharged, or the Powers concerned must for ever be marked with the stigmata of dishonour and the brand of cowardice.

What shall it profit a nation if she gain the whole world and lose her own soul?

Copper.

There has been a continued and sustained demand for copper from the consuming trades, alike in this country, France, and the United States, and there has not been any yielding in the position of the leading producers, who have of late made such substantial sales that they are in a pretty comfortable position for some weeks to come. That a considerable amount of confidence is felt that the domestic trade across the Atlantic which has been in a languishing condition for a long time . . . a condition which is far more responsible for the complaints made as to the miserable state of the United States copper trade than is the British declaration that copper is contraband . . . is on the eve of solid improvement, goes without saying. It is high time that there was an extension of business enterprise there, and some signs of the stirring of the dry bones is indeed perceptible already. There has been a certain amount of reawakening of interest in the Stock Exchange in New York, and this usually betokens that the keener-witted element has scented something moving, and in view of the long depression it is out of the question that there should be any further contraction in the tonnage of general business passing. The European War has released immense orders for the British, French, and other allied Governments, which have put many branches of United States industrial effort upon a more active basis than has been experienced for years, and there can be no let-up in this direction until the Huns are finally smashed and their powers for further evil utterly demolished for a century to come.

Naturally, coming on top of a curtailment of production estimated at 50 per cent. of the refinery capacity, copper has sustained a considerable advance within recent weeks, and is still firmly held at about the top figures, but the price is now sufficiently advanced to stimulate production, and accordingly it is no matter for surprise to find that many of the largest mines in the United States have resumed normal working, and that others are following suit in all directions. The process of output restriction has indeed ceased to exist so far as the Lake Superior mines are concerned, and production has assumed an entirely normal appearance. This can only be the prelude to easier market conditions for copper sooner or later, for there can be no question but that it pays handsomely to turn out refined metal at round current selling prices. For this reason there is a disposition to take a rather conservative view of the future, and consumers have lately been only buying in strict relation to their needs and to the prospective orders. The immediate position seems to be firmly established enough, but excessive optimism as to the situation of prices might be unwise as regards the second half of the year.

Trans-Continental Telephony.

Considerable space has been devoted by our American contemporaries to the triumphant achievement of telephonic communication between San Francisco, on the Pacific coast of North America, and New York, Boston, and Washington on the Atlantic sea-board, a feat upon which they are entitled to our hearty congratulations. A specially noteworthy feature of the occasion was the fact that Prof. Alexander Graham Bell spoke with Mr. T. A. Watson over the 3,400-mile line, these gentlemen having been the first to hold conversation with the telephone invented by the former in 1876; moreover, they successfully used Dr. Bell's original transmitter for this purpose, and we cordially congratulate the inventor upon being privileged to witness this magnificent consummation of his pioneering work of 49 years ago. What would Faraday have said if he could have seen a modern 25,000-KW turbo-generator, the gigantic offspring of his creative genius?

The credit for overcoming the many engineering difficulties met with in the construction of the inter-oceanic line is ascribed to Mr. John J. Carty, chief engineer of the American Telephone and Telegraph Company; the commercial problems of finance and organisation were dealt with by Mr. Theodore N. Vail, president of the company. Some particulars of the line are given elsewhere in this issue. It is interesting to note that by special connections to the home of Mr. Vail, conversation was successfully carried on *viâ* Boston over a total distance of no less than 4,750 miles. We must not omit to mention that the feat was rendered possible by the use of the loading coils invented by Prof. Michael Pupin, of Columbia University, who, we have no doubt, would readily admit his indebtedness to the mathematical researches of our fellow-countryman, Dr. Oliver Heaviside, in this connection.

HAND REGULATION OF A HYDRO-ELECTRIC PLANT IN INDIA.

By J. W. MEARES.

In these days of automatic regulation, distant control, and so forth, it may be of interest to readers of the Electrical Review to hear of a water-driven power station which has for years been regulated entirely by hand, without governors.

The plant in question is at Darjeeling, the hill station of Bengal, and the summer headquarters of the Bengal Government. The original installation was laid down by the present writer in 1896, on behalf of Messrs. Kilburn and Co., in pursuance of an agreement with the municipality. It consisted of two 65-kw. Crompton-Brunton single-phase alternators, driven by Gunther Girard turbines. Soon after completion a disastrous flood caused a landslide which dammed up one of the two hill torrents which supplied the power, with the result that the power station was buried in mud over the top of the machines. They were excavated, however, washed and dried, and set to work again some few weeks later. These 2,300-volt generators are still working, and as an old Cromptonian I feel rather proud of them.

The present municipal engineer, Mr. G. P. Robertson,[*] M.I.E.E., M.I.Mech.E., took over charge in 1903, and under his able management this small plant has been extended from time to time, and has paid very well indeed. Incidentally, he adopted a "point-five" tariff for the winter heating load many years ago—earlier, I think, than our friends in Great Britain. From the very beginning, even before the mud episode, the hydraulic governors were very troublesome; they were not of a type calculated to assist in the parallel running of alternators, and they never recovered from the shock of being buried alive.

From this point I prefer Mr. Robertson's report, on the extension now contemplated, to speak for itself.

"The governors on the old machines gave so much trouble that they have been scrapped, and the machines are being controlled by hand. One of the difficulties was grit getting into the governor-controlled valves of the hydraulic gear. Oil-pressure gear was, therefore, specified for the new turbine, and the governor supplied acted splendidly for a time. One day, however, the machine started hunting so violently that it had to be shut down, but when opened out again it ran as smoothly as if nothing had happened.

"Some time afterwards I was in the power house when the same thing occurred again. I then thought that the effect was due to an electrical surge of such a nature as to set up mechanical pulsations, synchronising in some way with the surge, so that the machine was nearly hammered to pieces before it could be shut down.

"I made inquiries about this while at home this year, and heard of several similar cases, though very little is said about them. One man explained the case as being due to harmonics; he admitted that similar cases had occurred in Switzerland, and doubted if any governor would keep control in the circumstances. The governor may act like a charm for years at a time, taking care of all kinds of lightning and switchgear surges; but one day, for no apparent reason, the machine starts to hunt, sometimes with disastrous results.

"The machines at Sidrapong are now being run successfully without governors. A tachometer has been fitted to each machine, and a machine coolie stands by with his hand on the control wheel and his eye on the tachometer. His whole job for four hours at a stretch is to adjust the control wheel so that the tachometer pointer is always against a red line on the dial. He does this splendidly. An educated man would probably either smash up the machine or go to sleep before the end of the four hours, but the job neither worries nor bores the coolie. I propose to adopt this arrangement for the new plant."

I may add that we are fortunate in having no Trade Union to object to the employment of what may, perhaps, be called the "Coolie automatic voltage regulator," a type which is not described in Mr. C. C. Garrard's recent paper on the subject. The cost of each regulator of this type is Rs. 10, or, say, 13s. 4d. per mensem, and no repairs are necessary—not even a "little bit of string" is required to prevent them being too sensitive.

[* Mr. Robertson's regrettable decease is announced in the following article.—Eds. Elec. Rev.]

INDIAN NOTES.

[FROM OUR SPECIAL CORRESPONDENT.]

Allahabad and Lucknow Electric Lighting Schemes.—"Residents of Lucknow and Allahabad," says the *Pioneer*, "have heard so much of electric schemes that have come to naught, that they might be excused perhaps for feeling somewhat sceptical on the subject of the possibilities of electric lighting for the two capitals. It appears that an important new development in the carrying out of the much canvassed scheme has recently taken place. The licensees, Messrs. Crompton & Co., have been given guarantees by the two municipalities concerned of 4½ per cent. per annum on the paid-up capital required—a sum amounting to 15½ lacs of rupees (£100,000). The arrangement arrived at is that the municipalities are to share all the profits above the 4½ per cent. guaranteed for the seven years' period of their guarantee—the licensees anticipating that the concerns will pay at least 8 per cent. after three years' working. If this anticipation is realised the municipalities should do well on the deal. It is proposed to form a limited liability company, under the Indian Companies' Act, with the well-known firm of Messrs. Martin & Co., of Calcutta, as managing agents, the capital to be raised in India, and residents of the two towns being given an opportunity of taking shares in what is expected to prove a profitable investment.

"It is also, it may be mentioned, anticipated that when the supply of electric power is available, an additional demand is more than likely to arise in the way of small industries, which are wont to spring up where electric power is obtainable. The ideas of the promoters of the present scheme are, we understand, not confined to meeting the wants of the wealthier classes only; arrangements are to be made to install lamps in bazaar shops, the tenants to be charged a flat rate of a few annas per lamp per month."

The above has been taken from a recent article in the Allahabad *Pioneer*, and it gives some idea as to how matters stand regarding the proposed supply of electricity for lighting and power for the two cities mentioned. With regard to Lucknow, the residents may well indeed be sceptical, as there have been at least half a dozen schemes drawn up and discussed within as many years. The authorities, both civil and military, must have sheaves of estimates pigeon-holed somewhere appertaining to an electric supply: and, incidentally, the hotel-keepers of Lucknow must be a good deal in pocket, through the sums spent by the representatives of various contractors in Calcutta and Bombay who have been periodically invited, or, rather, seduced to Lucknow to draw up estimates, which, being sent to the authorities concerned, after much trouble and great expense, were not even acknowledged—a want of courtesy which, by the way, is characteristic of Indian methods.

It is reported that a wealthy Indian has promised to subscribe 7½ lacs (£50 000) for the Lucknow scheme if the municipality consent to give his name to the undertaking.

Calcutta Electric Supply Corporation, Ltd.—The consulting engineers of this prosperous company in London have recently given a contract to the British Thomson-Houston Co., of Rugby, for a 6,000-kw. set—the largest steam turbine set out East—for the new Cossipore power house, Calcutta.

The present plant consists of four 3 000-kw. Oerlikon steam turbine sets, one 800-kw. ditto, and four 500-kw. Belliss sets; the supply is at 6,000 volts, 50 periods, transformed at several sub-stations to 450 volts direct-current three-wire, and covering an area of 109 square miles.

Darjeeling.—The death is reported through drowning of the popular and very able municipal electrical engineer, Mr.

G. P. Robertson. He recently spent a period at home and on the Continent, inquiring into the most recent and modern improvements in long-distance hydro-electric transmission practice, and on his return to India was deputed to survey and develop a further scheme for the Darjeeling extension electric power system. It was while actively engaged in this operation that he recently met his end by his boat being capsized in the Rungeet River. He was an extremely able and energetic engineer, and a hard-headed Scotsman, whose advice and guidance will be sadly missed by the Darjeeling municipality. Besides being electrical engineer, he was in charge of the sanitary, drainage and buildings department of this flourishing municipality, and his work in each of the departments attest to his all-round capabilities.

CONDITIONS AFFECTING THE VARIATIONS IN STRENGTH OF WIRELESS SIGNALS.

The paper read before the Institution of Electrical Engineers by **Prof. E. W. Marchant**, and abstracted in our last issue, was discussed in London on February 11th.

Mr. W. Duddell, in opening the discussion, said the paper raised many questions, but he would confine himself to the problem of measurements, because insufficient results had been obtained to enable satisfactory conclusions to be arrived at as to the discrepancy between day and night signals. He referred to the necessity for organised observation over a wide area, pointing out that the programme discussed in Brussels for making such measurements, which had been abandoned owing to the war, showed the difficulty of keeping constant conditions of measurements in different places. He took issue with the author as to whether the Einthoven galvanometer was so sensitive as stated. Lately Abrahams had constructed an improved moving coil galvanometer in Paris, which was quite as sensitive as the Einthoven instrument, and it was evident that we were on the point of obtaining a sufficiently sensitive instrument to record long-distance measurements.

Mr. Vyvyan, who apologised for the absence of Mr. Marconi, mentioned that some long distance records of night signalling had been obtained from Melbourne, ship to shore and *vice versâ*, covering 2,000 miles with a 1½-kw. set, which was the greatest distance obtained with such a set. It was difficult to come to any conclusions as to conditions, &c., without some organised system of collaboration, extending over a period, for making observations.

Dr. W. H. Eccles thought the most useful feature of the paper would be the details of the use of the Einthoven galvanometer, especially when organised measurements could be made. In the Pacific it was found that with a 2-kw. wireless set it was normally possible to communicate over 2,000 miles at night, and freak signalling in the summer had been established over 3,000 miles and 3,500 miles in the winter. In the day the possible range was only some 200 miles. Dr. Marchant was only getting one-tenth of the variation that was being obtained in Pacific work. For short distances the upper layers of the atmosphere probably had little influence on the result, but it was otherwise in long distances. In wet weather, the loss of insulation increased the damping effect, and might account for 20 to 30 per cent. difference in measurements

Mr. J. E. Taylor said as regarded the theoretical assumptions as to causes of varying strength of wireless signals, he had little belief in any of the speculative theories put forward, particularly in regard to ionised air, &c. He suggested that the antenna had superimposed on its own field another field due to the atmospheric potential grade, which had the effect of greatly increasing the field in an upward direction, and this gave rise to radiation at a high level much above the normal. As the range increased defraction due to low level radiation would sift out, but the high level radiation would persist.

Admiral Sir H. B. Jackson thought the Pacific would be an excellent area in which to experiment on account of its numerous small islands and long-distance transmission.

Mr. Campbell Swinton expressed surprise at the uniform results said to have been obtained with the crystal detector, which was usually very variable. No other method of measurement was so sensitive as the galvanometer method, and it would be a great benefit if a method could be devised which eliminated rectifying the current.

Dr. J. A. Fleming, whose remarks were communicated, said that similar measurements had been carried out at University College on signals coming from the Eiffel Tower. The signals were received on an Einthoven galvanometer through the usual form of tuner. To calibrate the galvanometer they used two coils, the mutual inductance of which at various distances was known, so that by measuring the primary current by hot wire ammeter they could determine the value of the secondary current; the latter was made to take the place of the antenna current, and it was then possible to repeat the deflections of the Einthoven galvanometer produced by the Paris signals by a known current in an artificial antenna using the same frequency. The observations were made by Mr. Coursey; from the charts made it appeared that the greatest falling off in signal strength occurred when it was clouded both in Paris and London. But before any valid conclusions could be drawn it would be necessary to have an antenna set up near Paris and an automatic record kept of signal strength close to the sending station; such an antenna should be in duplicate—earthed and non-earthed. He could not believe that the large variations of strength in only 200 miles observed in London were entirely due to ionisation of the air; in short-distance transmission there was a considerable degree of propagation through and over the earth's crust, and reception was not entirely due to a true space wave.

Prof. Howe said he also had been making measurements of signals, &c., with a view to getting measurements of the actual field set up by the signals. He explained the difficulties of thermal galvanometer measurements, admitting the advantages of the Einthoven galvanometer method used by the author, which eliminated trouble due to other people sending signals. Basillie had showed that if the wave length was altered only a very little, great differences in results were obtained. He was very glad to hear a denunciation of the ionised atmosphere theory; it could be made to fit any desired condition at will.

Prof. Marchant, in replying, said he wished to stimulate observation of signals, and had put up theories with a view to their being demolished if necessary. It was extremely difficult to calibrate an aerial, and they were driven to calibrating the secondary. The Einthoven galvanometer was one of the best available. He agreed that the Pacific was a wonderful place for transmission, and that this result was due to local conditions, as such results had never been obtained anywhere else. The energy record was quite different from the distance record. He found it quite hopeless to try to take direct measurements of signals. The ionised air theory was excessively convenient as a medium of explanation, but he was bound to say he thought ionised air was a factor.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electric Heating and Ventilation.

The Credenda Conduits Co., Ltd., of Chester Street, Aston, Birmingham, after having spent a considerable time in experimenting and tests, have just placed on the market a system of heating and ventilating by electricity, and have now actually at work at the showrooms of their London agents (Messrs. Baxter and Caunter, Ltd., 219, Tottenham Court Road), an installation giving very satisfactory results in an exceedingly difficult situation, which they invite anyone interested to call and inspect.

Some of the advantages claimed for this system are set out below:—

It ensures proper circulation, distribution and equalisation of temperature, which is essential to a proper heating system.

Immediate results are obtained as soon as the electric current is switched on, in all parts of the building, and the heat is not localised as is the case when separate radiators or fires are used.

The system is entirely automatic in its action and requires no attendant.

It requires no coal or water, as in the case of steam heating plant, and does away with all boilers, radiators, steam pipes, valves, traps and pumps.

It can be used for cooling the atmosphere in hot weather, and can be fitted with air filters and ozonisers, which makes it an ideal system for hospitals.

The system is considerably less expensive both to install and maintain than steam heating and other systems.

The system is so arranged that by switching on the full load the desired temperature of about 60° F. is obtained during the first hour, and the consumption of current can then be reduced to about a third, which would maintain this temperature.

The company are prepared to undertake the installation of their system in any building, and to advise and quote for any work. They also make up these plants in a portable form, which can be easily carried from room to room. They will be pleased to give full particulars as to the capacity and output of their various plants, with the cost of running per hour, to those interested.

An Electric Kitchen in Derby.

The accompanying illustration shows the electric kitchen of the Whitehall Café, St. James's Street, Derby, which has recently been equipped under the direction of Mr. T. H. Thorpe, Derby, the architect for this imposing building and the Kinema Hall adjoining the Café.

The electrical equipment, which was all supplied by the **British Electric Transformer Co., Ltd.**, London, at present comprises 34 standard "Tricity" hot-plates, all of which are operated from indicating control panels, with separate "on and off" switch and fuse, the hot-plates being interchangeable; 18 are for boiling purposes, and the remainder for operating two double ovens and four single ovens. There are, in addition, two 24 in. × 12 in. 6-kw. radiant grills, and a carving table 5 ft. × 2 ft. 3 in. × 2 ft. 10 in. high with hot cupboard, and two carving dishes with a maximum loading of 7 kw.

The general arrangement was set out by Mr. F. S. Grogan, of the British Electric Transformer Co., Ltd., in conjunction with the manageress of the Café, Mrs. A. Etheridge.

In the view at the far end will be noticed the meat grill, and on the table on the left are shown 12 boiling plates together with two single ovens opposite the chef's table. On the adjoining table two double ovens and two single ovens are grouped, for the use of the patissier who makes the whole of the cakes, rolls and pastries for the restaurant, and also for the shop attached to the Café. At the far end of the kitchen on the right are the washing-up sinks.

The second grill, which adjoins the ovens, is retained for toasting work. On the opposite side of the kitchen are four hotplates, with water urns, and water-jacketed coffee and milk urns, these being immediately behind the tea dispatch counter. The carving table, which is in the centre of the kitchen, was installed here temporarily, but has since been removed to the restaurant.

"Khaki."—We have received a copy of the first number of a 6d. monthly magazine—*Khaki*—which, together with a called news sheet, has been published for the purpose of keeping the over-sea soldier posted with news from the Colonial home that he has left behind him the while he lends his aid to the Mother Country. The magazine is a very creditable production, containing a number of attractive features; the illustrations, some of which are executed in colour, are a strong point. Among the contributors to this number are Marie Corelli, the Earl of Ronaldshay, Lord Willoughby de Broke, Israel Zangwill, Rudyard Kipling, Jerome K. Jerome, Norman Bentley, W. T. A. Beare and Victor Grayson. The magazine *Khaki* is published at Imperial House, Kingsway, W.C., and is stated to be a patriotic—not a commercial—enterprise.

The Electric Kitchen of the Whitehall Cafe, Derby, Equipped with "Tricity" Apparatus.

The electrical arrangements have worked so satisfactorily that extensions are at the moment in hand for the equipment of the basement floor with four additional ovens and two more grills. It is hoped that this will be opened during the next week or two.

The business of the Café has during its first two months' working far exceeded expectations, and this result is undoubtedly due in a large degree to the appointment of Mrs. Etheridge, who has not only had West End experience, but was for a time associated with the "Tricity" House, London.

The Café is illuminated by indirect lighting, and its cosiness makes it an attractive rendezvous. The supply pressure is 230 volts, and the installation is balanced on the two sides of the three-wire system. There is also a duplicate service carried into the meter room, with a three-pole throw-over switch.

WAR ITEMS.

Board of Trade Reports.—The Board of Trade Commercial Intelligence Department has now issued list (8 B), which is the weekly list dated February 13th, of inquiries for sources of supply of goods. Copies may be obtained by British manufacturers on application.

Metal Prices in Germany.—According to *La Lumière Electrique*, the price of copper in Germany is about £110 per ton; of aluminium, £225 to £250 per ton, compared with £80 before the war; and of antimony £100 to £105, compared with £22 10s.

York Electricity Employés.—A return made by Mr. J. W. Hame, electrical engineer and tramway manager at York, shows that 55 of the staff are serving with the Colours—22 from the electricity department and 33 from the tramways department. Two men formerly in the latter have lost their lives—H. Rawson, of the King's Own Scottish Borderers, and G. Britton, of the Lancs. Fusiliers.

Notes from France.—M. H. Parodi, who bore a prominent part in the proceedings of the joint meeting of the Société Internationale des Electriciens and the Institution of Electrical Engineers at Paris in 1913, as chief engineer of the electric service of the Cie. des Chemins de fer d'Orléans, went to the front as lieutenant of artillery. *La Lumière Electrique* announces that in consequence of his eagerness to undertake any dangerous task that offers itself, and his excellent work in the trenches, he has been named Chevalier of the Legion of Honour and promoted to captain. His high position on the railways would have entitled him to higher rank than that of lieutenant had he chosen to accept it. M. J. L. Routin has also received the Order.

Amongst those who have fallen are P. Le Bœuf, a valued contributor to *La Lumière Electrique*; Henri Bureau, of the Laboratoire Central d'Electricité; and Paul Reuss, chief engineer to the Compagnie Thomson Houston.

The same journal gives a complete and detailed list of the enemy firms of an electrical character that have been sequestrated by the French Government.

Russian and British Relations.—A Reuter dispatch from Petrograd states that at a distinguished gathering of professors held there, which was attended by Councillors of the Empire and members of the Duma, M. Bieloff, librarian to the Duma, delivered a lecture in which he urged that a society should be founded for establishing closer relations between Russian and British professors and students. An influential Committee was appointed, and the desire was generally expressed for the eradication of German influence from Russian education.

German Electric Concern Sequestrated in Kieff. The *Kief Mysl* says that by decree of the War Department the Kieff branch of the German concern called the Siemens & Halske Russian Electro-Technical Factories Co. has been sequestrated. The property of the branch referred to is valued at several hundred thousand roubles.

Relief Fund. Messrs. Raphael Tuck & Sons, Ltd., have issued their patriotic subject "Defenders of the Empire," in popular postcard form, in the form of an "Oilette" picture for framing, and as a zig-saw puzzle. The entire proceeds are to go to the Prince of Wales's National Relief Fund

The Government and Engineering Labour. — As a result of the recent conference between the Engineering Employers' Federation and the Engineering Trade Unions to secure greater output required by the Admiralty and War Office, the Executive Council of the Amalgamated Society of Engineers has issued a statement to its members setting forth the proposals and suggestions of the Unions to overcome the shortage in various classes of workpeople. They are as follow:—

(*a*) Firms not engaged in manufacture of war goods to be given such work.

(*b*) Firms at present working short time to transfer their workmen to firms engaged on Government work.

(*c*) Joint representations to be made to the Government to pay subsistence allowance to men working in places a distance from their homes.

(*d*) That the Government draft skilled engineers from Australasia, Canada, and South Africa.

(*e*) In view of the fact that 10 000 skilled engineers have recently enlisted, thus reducing the supply of skilled labour, the Government should withdraw from military duties all those available for industrial purposes.

The men's representatives consider that if the foregoing suggestions were adopted, a sufficient supply of skilled labour would be at the service of the nation to cope with the national situation without encroaching upon the trade rights of operative engineers. We should have thought, however, that the present is not the time to insist upon "trade rights." There has never been a time in the history of Trade Unionism when there was more need for the co-operation of employer and employé. Apparently patriotism and Trade Unionism are not convertible terms.—*Machinery Market.*

A War Trade Department.—According to a statement published in several newspapers, in view of the complexity and volume of work involved in dealing with applications for export and import licences during the war, a Department under the Treasury (to be called the War Trade Department) has been formed to replace the Committee on Trade with the Enemy, so far as this work is concerned. At the request of the Prime Minister, Lord Emmott has consented to act as Director of this Department, and Sir Nathaniel Highmore will be the secretary. The War Trade Department will deal with all applications for the grant of export and import licences, and will embrace an intelligence division, which will serve as a clearing house for all war commercial information. The remainder of the work of the Trading with the Enemy Committee (relating to the movements of funds and other questions in which the Treasury is mainly concerned) will be transferred to the Treasury, and will be performed by Sir Arthur Thring, the Parliamentary Counsel, and his staff. Exporters and others concerned are informed that all applications for licences to export prohibited and restricted goods, and all communications in respect thereof, which have hitherto been sent to the Commissioners of Customs and Excise, should be sent to the offices of the new Department, addressed to the Secretary, War Trade Department, 4, Central Buildings, Westminster, S.W.

Incandescent Electric Lamps in Russia.—At a recent meeting of the electrical section of the Russian Technical Society, it was shown that the number of electric incandescent lamps in use in Russia is about 15,000,000, and that the increase in the use of electric light is about 15 per cent. per annum. It was calculated that the annual demand for lamps would be, 10 000,000—7,500,000 renewals, and 2 500 000 to supply increased demand; lamp sockets 3 500,000; switches, 2 000 000; plugs, about 1,000,000; and knife switches, about 10,000,000. On the question of the possibility of producing these goods in Russia no clear views were expressed. The meeting thought the estimated quantities were very moderate, and that the number of 10,000,000 as the annual consumption of lamps might be accepted in all safety.

Dublin Electricity Staff.—In a report issued by the Dublin Electricity Committee, authority is asked for to pay extra remuneration on a re-arrangement of the engineering staff owing to four of its members—Messrs. Donnev, Carrigg, Clancy and Cox—volunteering for Army Service. It having been decided to push forward the conversion of the gas lamps to electric, Mr. E. J. Davidson has been put in charge of the construction work. The total salaries of the four engineers referred to amount to £543; the allowance of half-pay to relatives is stated at £281, and the special allowance required for the war period is £191.

War Bonus.—The directors of the British Insulated and Helsby Cables, Ltd., Helsby, have decided, owing to the increased cost of living, to grant war bonuses as follows:—To workers receiving 30s. per week or over, a bonus of 3s. per week; over 20s. and less than 30s., 2s. per week; under 20s., 1s. per week. The bonuses, which started as from Thursday last week, and apply to male and female workers, will run for three months, and it will then be considered whether they shall be continued or modified or withdrawn.

Anglo-Belgian Co.—We observe that a new company known as the Société Anglo-Belge D'Exportation, Ltd., has been registered with a capital of £5,000 in £1 shares, to carry on the business of merchants, electrical, mechanical and building contractors, &c. Among the first directors are Mr. R. W. Blackwell and Mr. Philip Dawson. The offices are at 14, Great Smith Street, Westminster, S.W.

Learning Russian.—In reply to a question in Parliament the other day it was stated that the Board of Education were considering with the Board of Trade, possible extension of the teaching of Russian in commercial schools and classes and other educational institutions. It is stated that the City of London College, Moorfields, has some 60 students learning the language.

Blackpool Employés.—There are now some 64 members of the Blackpool Corporation electricity and tramways department serving H.M. Forces in different units.

"To What Base Uses."—*Eastern Engineering* says that the Allgemeine Elektricitäts Gesellschaft "no longer manufacture 10,000 KW. turbo-generators. They are making brass buttons instead."

Personal.—Sergt. J. Stephenson, of the 2nd South Lancashire Regiment, who had been mentioned in Sir John French's dispatches, was formerly employed in the Nelson tramways department.

London Gazette notice: Territorial Force—Cornwall (Fortress) Engineers, Electric Lights Company, Sergt. Bernard Harvey Peter to be Second Lieutenant. February 24th, 1915.

The *Times* states that King Albert of Belgium and Admiral of the Fleet Lord Fisher were elected honorary members of the Institution of Civil Engineers on Tuesday last.

Roll of Honour.—Lance-corpl. J. Alfred Donald, of Blackpool, formerly an employé of the Blackpool Corporation electricity department, died suddenly last week while on leave, the cause being cardiac trouble. He was 24 years of age, and had recently joined the Royal Naval Division Engineers stationed at Deal.

We have received from the British Aluminium Co., Ltd., a copy of the "Roll of Honour" prepared by the company, giving the names of the very large number of representatives from the different offices and factories who have joined the Army and Navy. It takes the form of a large wall sheet.

LEGAL.

SWANSEA GAS LIGHT CO. *v.* SWANSEA RURAL DISTRICT COUNCIL.

THE hearing of this case was concluded in the Court of Appeal, composed of the Master of the Rolls, Lord Justice Phillimore, and Mr. Justice Joyce, on Tuesday last week, upon the plaintiffs' appeal from a judgment of Mr. Justice Warrington.

Plaintiffs brought the action for a declaration that an agreement made between the parties dated November 5th, 1909, was still in force and valid. Plaintiffs were supplying gas in Swansea and district under statutory authority, and by the agreement the company agreed to extend gas mains to certain roads in Llansamlet and Clase Rural, and to supply gas to public lamps of the defendants upon certain terms, and during the continuance of the agreement defendants covenanted not to put in force the powers conferred upon them by the Llansamlet Electric Lighting Order (1908) for the supply of electrical energy for street or private lighting within that portion of their district agreed to be lighted with gas under the agreement, and that they would not during the period substitute any other method of lighting for gas supplied by the company; but nothing in the agreement should prevent the defendants at any time putting in force the order for the supply of power. The agreement was to run for 25 years. Some of the roads referred to in the agreement were outside the area within which the plaintiffs had power to supply, and by the Swansea Gas Order (1910) the limits were extended; the price of gas within one mile of Swansea was the same as that charged within the borough, and the gas mains were to be extended, &c. Relying upon that agreement the plaintiffs had incurred considerable expense in laying mains and running service pipes from the mains to the lamps for public lighting. Defendants contended that the effect of the order of 1910 was to supersede the agreement and to release them from liability thereunder, and they claimed that they were now at liberty to put in force their power of supplying electrical energy for lighting within any portion of the district agreed to be lighted with gas by the plaintiffs, and they had begun to lay cables for the supply of electricity in districts served with gas by the plaintiffs. Defendants also pleaded that the agreement was *ultra vires* and denied committing any breach of it, and they also relied on the provisions of the Public Authorities Protection Act, 1893. Mr. Justice Warrington held from what took place in the House of Lords' Committee Room in 1910 it was agreed that the agreement should be superseded, and he, therefore, gave judgment for the defendants with costs, and from this decision the plaintiff company now appealed.

Mr. George Cave, K.C., M.P., and Mr. Percy Wheeler appeared in support of the appeal; and Mr. Clauson, K.C., and Mr. Tomlin, K.C. for the respondents.

MR. CAVE contended that when the agreement was come to in 1909 it was contemplated by everybody that the plaintiffs should apply for a provisional order to extend their area of supply. At the trial the Council's witnesses said it was expressly agreed in the Committee corridors that the agreement should be rescinded, but that the Gas Co.'s witnesses denied, and the learned Judge had held that the question of rescission was not raised. Unfortunately, when the Committee was finally informed of the settlement, the company's agent, Mr. Cooper, used the following words:—"Would your Lordship allow me to mention in connection with the new clauses 6 and 6*a*, that they are the result of an agreement come to in reference to the terms of the order, which agreement is a compromise, and supersedes the agreement made between the promoters and the opponents in November last?" On that sentence the learned Judge had decided that the whole agreement had gone. He (Counsel) contended that the only point discussed between the parties was price.

Mr. Justice Joyce: Of what use is the rest of the agreement to you?

Mr. Cave: It gives us the public lighting of those parishes for 25 years on terms which have been very carefully laid down, and without which it would be impossible for any company to undertake public lighting in any district. He submitted that the appeal ought to be allowed.

Mr. Clauson and Mr. Tomlin having supported the judgment of Mr. Justice Warrington on behalf of the respondents, and Mr. Cave having replied at the conclusion of the arguments, the Master of the Rolls, in delivering judgment, said that for the defendants to succeed they had to establish that the agreement in question had been superseded by an agreement made in the House of Lords when the company were obtaining their provisional order. To succeed the defendants had to establish that there was a contract to that effect. Mr. Justice Warrington had come to the conclusion that there was no such bargain, and it was impossible for the Court to take a different view. But the Judge had held that although there was no binding agreement made in 1910 for the supersession of the document of November, 1909, yet the parties had proceeded on the footing that there was some such agreement. That was a proposition on which there had been no real argument, and it was not necessary to decide it. But Mr. Justice Warrington had held that the application for a provisional order extending the Gas Co.'s limits of supply was in the minds of both parties in November, 1909, and under these circumstances it was not open to the defendants to say that the contract could not be enforced.

The other Judges concurred, and the appeal was accordingly allowed, and a declaration made that the agreement of 1909 had not been cancelled by any such agreement as was suggested, nor was it varied save (if at all) so far as it was varied by the provisional order.

The appellants were awarded the costs of the appeal, there being no order as to the costs in the Court below.

L.C.C. v. Assessment Committee of the Borough of Islington.

In the House of Lords on Monday the hearing was concluded of an appeal by the L.C.C. against a decision of the Appeal Court, which set aside an order of Mr. Justice Bray and Mr. Justice Lush for the appointment of a person to make a provisional valuation list containing the gross and rateable value of the tramways as reduced. The Council made its application for a valuer on the ground that competition by motor-'buses had affected the tramways and entitled them to a provisional assessment. Their Lordships now allowed the appeal, and stated that they would give the reasons for their decision at a later date.

Fosbery v. Dublin United Tramway Co., Ltd.

On February 19th, a Dublin jury awarded £1,100 to Mrs. Fosbery, wife of Mr. George Fosbery, an official of the National Bank, Dublin, who sued the Dublin United Tramway Co. for damages for injuries caused to the plaintiff by defendants not having properly lighted a lorry in Dublin one night last December, whereby the plaintiff fell over the shafts of the vehicle. Defendants accepted the verdict, but contended that the damages were excessive. A stay of execution was granted to enable them to move further in the matter, and they agreed in the meantime to pay £200 to the plaintiff.

DISTRIBUTION AND RISE OF TEMPERATURE IN FIELD COILS.

By Prof. M. MACLEAN, D.Sc., M.I.E.E., D. J. MACKELLAR B.Sc., A.M.I.E.E., and R. S. BEGG, Grad.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Glasgow, February 9th*, 1915.)

The paper deals with the temperature rise at various points in a field coil of a 120 kw. variable-speed d.c. motor, under various conditions; the motor is installed in the Royal Technical College, Glasgow, driving an alternator, and is a six-pole 500 volt machine with commutating poles and a compensating winding. Thermo-couples of copper-constantan were provided by the makers in one of the coils, as shown in fig. 1; the rise of temperature of E was practically equal to that of A, and D to B, so D and E were omitted from the curves. The distribution of temperature is shown in fig. 2, for an armature current of 8 amperes, and fig. 3 shows the rise of temperature at the hottest point C for the same armature current, while fig. 4 shows the rise for an armature current of 150 amperes.

The field coil is cylindrical, with a superficial area of 1,746 cm²., excluding the area of the pole shoe, which is 1,450 cm.².

The ratio of the final rise of temperature to the number of watts is greater for the higher speeds as shown in Table I. A speed of 750 r.p.m. corresponds to a peripheral speed of the armature of 23·56 metres per second. On the other hand, the ratio for generators is less for increasing speeds.

TABLE I.

Field current, amperes.	Armature current, amperes.	Peripheral speed, m. per sec.	Final rise of temperature at C in degrees C.	Watts.	Rise in temperature ÷ watts after 6 hours.
1·2	8	23·56	9·4	28·82	0·326
1·65	8	17·9	11·4	55·14	0·207
3·5	8	12·25	51·2	295·8	0·173

Hawkins and Wallis give the following expression for the field coils of dynamos:—

$$\text{Rise of temperature} = \frac{\text{watts}}{\text{area}} \times \frac{a}{1 + b\,v},$$

where a and b are constants.

If this equation is applied to the results in the above table at a load of 8 amperes in the armature, and is solved for the three speeds, the three simultaneous equations give three results, the mean of which gives $a = 198·6$ and $b = -0·0263$. Substituting these values of a and b, the results set out in Table II are obtained.

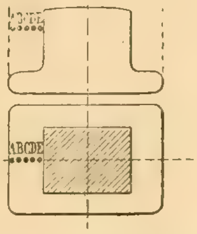


Fig. 1.—Position of Thermo-couples.

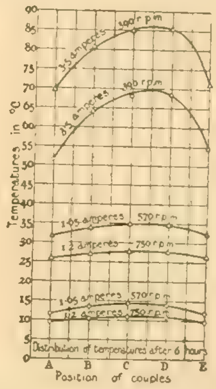


Fig. 2.—Distribution of Temperature.

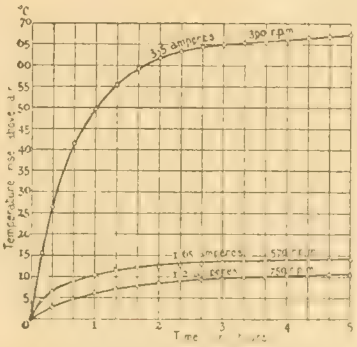


Fig. 3.—Temperature Rise of Couple C.; Armature Current 8 Amperes.

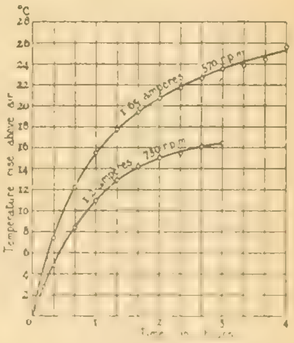


Fig. 4.—Temperature Rise of Couple C; Armature Current 150 Amperes.

The results obtained by dealing similarly with the rises of temperature in four hours, and with a current of 50 amperes in the armature are 512, 414 and 325 respectively, the mean values of a and b being 232·8 and $-0·023$ respectively.

TABLE II.

Peripheral speed of armature in metres per second.	$\dfrac{198·6}{1 - 0·0263\,v}$.
23·56	524
17·9	376
12·25	293

Electric-Light Switching Examinations.—We have on previous occasions alluded to the examinations instituted by Messrs. A. P. Lundberg & Sons, and the subject is brought to the front once more by the lists of successful competitors in the most recent of these examinations, which are published in this issue. Considering that the subject dealt with mainly concerns those of fighting age, the results given are eminently satisfactory so far as numbers go, and it is to be presumed that they are also satisfactory from the examiners' point of view. It seems that the subject of electric-light switching (otherwise, the control of glow-lamp circuits by means of more or less special tumbler switches), which has been brought into prominence by this means, has come to stay.

REVIEW.

Brown's Marine Electrician for Sea-Going Engineers. By A. E. and A. H. Larkman. Glasgow: J. Brown & Sons. Price 5/- net.

Since we last reviewed this book, in our issue of December 1st, 1905, it has been very considerably revised, and many of the criticisms we then made have apparently borne fruit. There is, however, still a need for the elimination of those parts which appertain only to land installations, whilst more space might be suitably devoted to "wiring," which is somewhat inadequately treated in the present edition as regards its special bearing on ship work.

It is news to us to learn that commutators are now made of phosphor-bronze instead of copper. We think the authors must be generalising from some particular instance they have in mind.

In discussing alternating current, the authors appear to be under the impression that high pressures are essential. On page 23, in discussing alternating currents generally, the reader is given the impression that the usual method of dealing with alternating current is to generate at 5,000 volts and transform in the station down to 2,000, and then transmit the current at this pressure to the point of consumption, where it is again transformed to about 50 volts. We learn also that "alternating currents have been used and discarded intermittently by engineers, but since the introduction of transformers their use aboard large vessels is probable," notwithstanding that, according to the authors, "the distribution of current to several points of consumption introduces difficulties where A.C. is used." All this is quite irrelevant to marine practice, as the question of high pressures does not arise.

There is a little inconsistency here and there, as, for example, in connection with single wiring. On page 3 the authors state "C.C. (continuous current) is very suited to the single wire system of distribution so much used in ship lighting," whereas on page 144 we learn that "single wiring is abolished in the Royal Navy, and is also disappearing in the newer types of mercantile marine." As a matter of fact, we believe that the single wiring system has been practically obsolete for many years.

Dealing with the methods of driving in vogue, the authors are behind the times in referring to belt driving of dynamos on board ship, as the almost invariable practice now is the direct coupled system. Seeing that one of the authors is a marine engineer, we are surprised at the suggestion to place a dynamo two decks vertically above its driving engine, and also that special multiple-cylinder engines such as "Brotherheads," *(sic)* "Williams," *(sic)* "Central Valve," "Tower" and "Globe" are now used for electric lighting on board ship.

The section on wires and cables is fairly well done, and the illustrations of joints are very clear, but we think the Britannia joint is hardly applicable to ship lighting work, as the only use to which it is put is in connection with overhead bare solid conductors. In this section there are one or two misprints in connection with the diagrams. The jointing system shown in fig. 102 is referred to as fig. 103, and the three-contact rose system is referred to as 104 instead of 103. This diagram, and also fig. 104 of the three-contact rose, refer really to land installations where flexible pendants are used from ceiling roses.

The chapter on accumulators contains some useful information, but the authors are weak on the theory of the accumulator, as, according to them, the action of charging coats one plate with a layer of hydrogen bubbles, and the other with a thin layer of lead sulphate, the lead having united with the SO^4 of the acid. On discharging, a current flows in the opposite direction and the plates return once more to their normal condition—"that is the whole theory of accumulators." The illustration, as in the previous edition, shows a group of accumulators in glass boxes, although the authors now rightly add that cells for ships' use are more usually made of lead or teak. The fact is they are almost invariably of lead-lined teak, and we would suggest that if any future edition is called for the illustration should be amended accordingly.

Generally speaking, there is much useful information in the book for marine electricians, but its value is impaired by the insertion of matter which has very little bearing on marine work and by inaccuracies here and there, some of which we have pointed out above.—F.B.

ELECTRIC HEATING AND COOKING.

A paper was read on this subject at a recent meeting of the Birmingham and District Electric Club by Mr. R. Weaving (Manchester). The author said that for the past four years electrical heating and cooking had been serious competitors for older methods to meet, and there was no doubt that the invention of the nickel-chrome resistance alloy had been of the utmost importance in aiding the development of the apparatus. Previous to this discovery there was no common metal which could be safely run at a bright red temperature for any length of time when exposed to the air; consequently the most popular electric heater, the electric fire, could not have existed without nickel-chrome wire. He regarded the electric fire as the best heater, as it had the following advantages: (1) It warmed immediately by means of radiant heat, any solid body placed before it; (2) it warmed the air gradually, but much more quickly and directly than a lamp radiator; (3) it had the appearance of a fire. To be a commercial success the electric heater must be reliable, inexpensive to maintain and low in first cost; the terminals should be heavy and placed in a convenient position; the amount of wire used in the element should be as large as possible, and an earthing terminal should be provided. As on most electric heaters the switches were near the ground, a tumbler switch was more convenient than the rotary type, and although the tumbler was more often operated by the foot than the hand, a good switch would stand this treatment quite well. The electric heater to compete commercially must be roughly 19 times as efficient as the coal fire and 3-1/3 times as efficient as the gas fire. These were very great disadvantages, but still they found that electricity could hold its own. With an electric heater no combustion took place and if proper precautions were taken the whole of the heat generated was useful. With a gas or coal fire the products of combustion had to be taken away, and with them went the greater part of the heat. This was fatal to high efficiency. Electricity had many advantages the value of which was hard to express in money. One great advantage was portability; this enabled two or three fires to do duty for a house, whereas the gas fire must be fixed. To this might be added the absence of risk of explosion, or of fire due to spent matches, and smoke on decorations, etc. A rating giving the best results was 1.5 watts per cubic foot; this would give a temperature rise of twelve degrees in one hour, and half this consumption would maintain the temperature.

The chief points to be considered in electric cooking were reliability, low first cost, and low running costs. Reliability was largely a matter of design. All efforts of design from the engineer's point of view were directed to securing the proper conditions for long life in the heating element. For good and economical cooking the heat should be evenly distributed in the oven, yet the elements should be arranged so that the cook could make any portion of the oven hotter than the rest. The size of terminals was even more important than on electric heaters. They should be heavy enough to remove the slightest doubts of their electrical carrying capacity or mechanical strength. The elements should be easily replaced and cheap to renew. The position of the heating elements was important; bottom heating only did not give good browning on the top of pastry; top and bottom heat was better, and when used in an oven which was broad in proportion to its height, was quite good, but when the oven was of ordinary shape, that is in a ratio of height to width of 3/2 the best results were undoubtedly obtained by the use of side elements. The whole of the interior of the oven should be vitreous enamelled including shelf and shelf racks. The loading of the elements should be enough to raise the oven to a cooking temperature in 25 to 30 minutes, and a temperature of 350 degrees should be maintained by 1/3 heat. It was necessary to get direct radiation on to pastry and meat to insure a good colour, and this could only be obtained by running the elements at a temperature giving the correct proportion of radiant and convected heat to suit the oven. Too much radiant heat would brown the outside without cooking the inside, while too low a temperature on the elements would tend to give tough pastry of poor colour. At present the rotary switch was most favoured by designers, but the author had used tumbler switches with first-class results, and had had a switch of this type rated at ten amps. breaking 25 amps. at 230 volts 20 to 30 times daily for three months. If the best and most economical results were to be obtained a thermometer must be used. After dealing with the various apparatus, he said there was no doubt that electricity at a penny or even 1½d. per unit compared favourably with gas for all oven work, and when energy could be purchased at a penny per unit or under a complete cooking outfit would not cost more to run than the corresponding gas cooker. In addition there was the unchallenged superiority of the results obtained in an electric oven.

TRADE STATISTICS OF THE STRAITS SETTLEMENTS.

The following statements, showing the imports of electrical and other materials into the various Straits Settlement ports in 1913, is taken from the recently-issued official trade statistics. The values for 1912 are added for purposes of comparison, with notes of any increases or decreases.

IMPORTS INTO SINGAPORE.

	1912. Dollars.	1913. Dollars.	Inc. or Dec. Dollars.
Telegraph and telephone materials.—			
From United Kingdom ...	245,000	724,000	+ 479,000
,, Belgium	6,000	37,000	+ 31,000
,, Germany	—	5,000	+ 5,000
,, France	27,000	—	− 27,000
,, Other countries ...	10,000	9,000	− 1,000
Total	288,000	775,000	+ 487,000
Tramway and railway materials.—			
From Belgium	34,000	71,000	+ 37,000
,, Germany	11,000	8,000	− 3,000
,, United Kingdom ...	68,000	99,000	+ 31,000
,, Other countries ...	—	3,000	+ 3,000
Total	113,000	181,000	+ 68,000
Electrical machinery.—			
From United Kingdom ...	210,000	409,000	+ 199,000
,, Germany	39,000	40,000	+ 1,000
,, Italy	17,000	5,000	− 12,000
,, Sweden	—	4,000	+ 4,000
,, Belgium	1,000	1,000	—
,, United States ...	1,000	6,000	+ 5,000
,, Japan	10,000	7,000	− 3,000
,, Other countries ...	19,000*	16,000	− 3,000
Total	297,000	488,000	+ 191,000
Engines, boilers and parts.—			
From United Kingdom ...	220,000	267,000	+ 47,000
,, Germany	2,000	9,000	+ 7,000
,, Netherlands	—	14,000	+ 14,000
,, United States ...	10,000	12,000	+ 2,000
,, Other countries ...	24,000	16,000	− 8,000
Total	256,000	318,000	+ 62,000
Machinery, other (except sewing machines).—			
From United Kingdom ...	649,000	821,000	+ 172,000
,, Australia	8,000	21,000	+ 13,000
,, Belgium	32,000	14,000	− 18,000
,, Germany	48,000	60,000	+ 12,000
,, Holland	10,000	7,000	− 3,000
,, United States ...	79,000	130,000	+ 51,000
,, Other countries ...	87,000	85,000	− 2,000
Total	913,000	1,138,000	+ 225,000
Lamps and lampware.—			
From Belgium	3,000	7,000	+ 4,000
,, Austria	31,000	12,000	− 19,000
,, Germany	186,000	239,000	+ 53,000
,, United Kingdom ...	128,000	126,000	− 2,000
,, United States ...	16,000	28,000	+ 12,000
,, Other countries ...	26,000	31,000	+ 5,000
Total	390,000	443,000	+ 53,000

* Denmark 3,000 dollars.

IMPORTS INTO PENANG.

	1912. Dollars.	1913. Dollars.	Inc. or dec. Dollars.
Electrical machinery.—			
From United Kingdom ...	66,000	91,000	+ 25,000
,, Germany	38,000	41,000	+ 3,000
,, Other countries ...	6,000*	14,000*	+ 8,000
Total	110,000	146,000	+ 36,000
Engines, boilers and parts.—			
From United Kingdom ...	679,000	657,000	− 22,000
,, Germany	33,000	16,000	− 17,000
,, Belgium	12,000	61,000	+ 49,000
,, United States ...	6,000	24,000	+ 18,000
,, Other countries ...	31,000	30,000	− 1,000
Total	761,000	788,000	+ 27,000
Machinery, other (except sewing machines).—			
From United Kingdom ...	36,000	158,000	+ 122,000
,, Belgium	3,000	6,000	+ 3,000
,, Germany	6,000	10,000	+ 4,000
,, Other countries ...	3,000	11,000*	+ 8,000
Total	48,000	185,000	+ 137,000
Lamps and lampware.—			
From Austria	1,000	1,000	—
,, Belgium	4,000	3,000	− 1,000
,, Germany	56,000	65,000	+ 9,000
,, United Kingdom ...	81,000	60,000	− 21,000
,, Other countries ...	7,000	6,000	− 1,000
Total	149,000	135,000	− 14,000
Telegraph and telephone materials.—			
From United Kingdom ...	40,000	14,000	− 26,000
,, Other countries ...	2,000	3,000	+ 1,000
Total	42,000	17,000	− 25,000
Tramway and railway materials.—			
From United Kingdom ...	2,000	4,000	+ 2,000
,, Belgium	10,000	1,000	− 9,000
,, Holland	—	4,000	+ 4,000
Total	12,000	9,000	− 3,000

* Includes Denmark 5,000 dollars.

* Includes United States 2,000 dollars.

IMPORTS INTO MALACCA.

Telegraph and telephone materials.—			
From United Kingdom ...	1,000	20,000	+ 19,000
Engines, boilers and parts.—			
From United Kingdom ...	4,000	1,000	− 3,000
Machinery, other (except sewing machines).—			
From United Kingdom ...	15,000	116,000	+ 101,000
,, Other countries ...	9,000	18,000	+ 9,000
Total	24,000	134,000	+ 110,000

N.B.—Dollar = 2s. 4d.

BUSINESS NOTES.

Consular Notes.—SPAIN.—An interesting description of the operations of the Barcelona Traction, Light and Power Co., and of its offshoot the Ebro Irrigation and Power Co., is contained in the report by the British Consul-General at Barcelona, which has just been issued.

The effect of all this hydro-electric development on the machinery trade of Barcelona has naturally been to discourage the importation of steam engines and boilers, and correspondingly to stimulate that of electrical plant. Oil engines are not imported nor are they likely to be as long as the duty levied on oils is so high. Gas engines are not asked for at present.

As regards Valencia, the British Consul says that every year there is an increased demand in his district for small motor engines, chiefly petrol, for use in working small pumps for irrigating, and although a certain percentage of British makes are seen, the majority of such motors appear to be of Continental manufacture.

Our Vice-Consul at Palma de Mallorca reports that in view of the successful installation of electric light and power plants in Palma, several companies have been formed for this purpose in the most important towns in the interior, viz., Soller, Alaro, Binisalem, Manacor, Santa Margarita, Inca, &c. It is also hoped to establish a tramway system.

CHINA.—A report has just been issued by H.M. Commercial Attaché at Peking dealing with the foreign trade of China for the year 1913. There is much in this report, despite its lateness, which is still of interest. The vast potentiality of the market is shown by the figures giving the gross value of the foreign trade coming under the cognisance of the Chinese Maritime Customs, viz., £152,000,000 in 1913 (as compared with £132,500,000 in 1912), and by those giving the net value of foreign imports, viz., £86,000,000, being nearly £14,000,000 more than in 1912. The increase in imports is due to a growth of trade all round, and cannot be entirely accounted for by any fortuitous or impermanent circumstances, such as the piling up of import stocks, or a boom in any particular product. Metals and minerals account for an increase of £1,500,000, and machinery for an increase of £300,000. In connection with these imports there is no indication of the increases being due to over-trading, and from the point of view of those interested in the general trade of China, the figures may be regarded with satisfaction, as compensating to some extent the depression in other branches.

The total entries under the two heads, "Machine Tools and Machinery" (including cotton gins, which appear separately in the Customs returns) amounted in 1913 to a value of £1,087,862, being an increase of £382,863 over the corresponding figures for 1912. The increase is distributed under every item, and especially under the head of "Machinery, Unclassified," which forms nearly three-fourths of the whole; but the increase in textile machinery may be specially noted in connection with the growth of the cotton spinning industry of Shanghai. Hand tools, which are not included in the above figures, rose in value from £30,696 to £41,337. A good deal has been written about the rising demand for hand tools in the China market, and it may be worth while to point out that, great as the demand for such articles may be in the future, the trade in them is at present confined, as these figures show, to very small dimensions. Electrical materials and fittings rose in value from £256,419 to £350,770. The steady increase shown by the figures for this item during several years past is to be attributed to the growing use of electric lighting, which continues to spread in Chinese cities, in spite of financial difficulties. Two or three new installations in minor towns were carried out during 1913, mostly with plant of British manufacture.

The continued rise in the volume of the principal articles of export, and the continually extending variety of articles of native produce, are the most promising features of the foreign trade of China during the last decade, inasmuch as hopes of future development rest primarily on the increase of exports. The percentage of exports to imports went down to 70·7 per cent. in 1913 after an average of 80·3 per cent. in the four preceding years. The export trade had to suffer from high exchange, low prices in the European markets, and especially from the want of silver to finance it. With all these adverse circumstances the Commercial Attaché considers it wonderful that the disproportion between exports and imports in a year characterised by so enormous an increase in the latter, was not much greater than it turned out to be. The situation was, in fact, saved by the fortunate circumstance that the country on the whole enjoyed good harvests in 1913 as it did in 1912.

The following table shows the shares taken by the United Kingdom, Hong-Kong, Japan, and Germany in the import and export trade of China in 1912 and 1913. Two-thirds of the imports, *viâ* Hong-Kong, may be credited to the United Kingdom. Japan is included because the growth of its trade is enormously greater than that of any other country, and Germany, for the reason that German competition has followed perhaps more closely than that of other European countries the lines of British trade. The heading "other countries" includes the trade of India and of the other British Dominions. The figures are approximately in 1,000,000 Haikuan taels (reckoned at 3s. 0⅝d. in 1912 and 3s. 0¼d. in 1913):—

	Imports.		Exports.	
	1912.	1913.	1912.	1913.
United Kingdom ...	75	97	16	16
Hong-Kong	148	172	103	117
Japan	88	119	55	66
Germany	21	28	14	17
Other countries... ...	151	170	182	188

The percentage of the trade of the United Kingdom and Hong Kong together to the total foreign trade, has fallen from 48 per cent. in 1905 to nearly 41 per cent. in 1913, that of Japan has risen from 14 per cent. to nearly 19 per cent., that of Germany has risen from 3 per cent. to over 4 per cent., and that of other countries has risen from 35 to 36 per cent.; 40 years ago the United Kingdom and Hong-Kong together accounted for 67 per cent. of the trade, and as trade expands this proportion tends to diminish still further. So long as the trade between the United Kingdom (and Hong-Kong) and China continues to increase in itself, it cannot be said to be in an unhealthy condition. A consideration of the relative growth of the trade of other nations is, however, a useful reminder that the days of unchallenged supremacy are over, and that in order to retain that supremacy a much closer attention to the requirements of the China trade and to the means of supplying these requirements than has been considered necessary in the past is increasingly called for.

Liquidations.—THE LIGHTHOUSE RADIATOR CO., LTD. Particulars of claims must be sent by March 6th to the liquidator, Mr. J. B. Rapkins, 10, Wellington Place, Guildford. A meeting will be held on March 23rd to hear an account of the winding up.

EBRO LIGHT AND POWER CONSTRUCTION CO., LTD.—A meeting will be held on March 22nd, at 232, Strand, W.C. to hear an account of the winding up from the liquidator, Mr. R. H. Bentley.

STOLZ ELECTROPHONE CO. (LONDON), LTD.—A meeting will be held at 4B Frederick's Place, Old Jewry, E.C., on March 24th, to hear an account of the winding up from the liquidator, Mr. A. F. Whinney.

Anchor Hospital and Distress Fund.—The fourth annual general meeting of members of this fund, which is in operation at the ANCHOR CABLE WORKS, LEIGH, was held on February 16th, Mr. J. Bowyer (the works manager) presiding. The fund exists for the purpose of making annual grants to hospitals, convalescent homes, &c., thereby ensuring to members hospital treatment in case of accident or other sickness, and for granting temporary relief to members in exceptionally distressed circumstances, so that shop collections may be discontinued. The Hon. Secretary (Mr. A. Crooke) reported that all the employés in the works and offices at Leigh, aged 17 or over, were members, each member paying 1d. per week. He pointed out the useful work which had been done by the fund. Members have been sent to convalescent homes, and recommendations issued to those requiring attention at the various medical, surgical, and other institutions to which the Fund contributes. Particular attention has been given to eye trouble amongst the employés. Proper examination and treatment have been afforded, and where necessary spectacles have been provided. Grants have also been made to members during sickness, and young employés from poor families have been clothed and fed, as found necessary. The Committee of the Fund are responsible for the administration and distribution of the allowances made by the firm to dependents of members who have joined H.M. Forces, and are also responsible for the maintenance of a Belgian refugee family at Bedford, to whose support all the members of the Fund contribute. Under the auspices of this Fund fortnightly grants are made to the Mayor of Leigh's branch of the Prince of Wales's National Relief Fund, and to date a total amount of £37 11s. 7d. has been handed over. Out of the balance in hand of £74, grants, to the value of £48, to infirmaries, hospitals, &c., have been made. The officers were unanimously re-elected for the ensuing year. The Fund is generously and sympathetically assisted by the Anchor Co., its directors and management.

Catalogues and Lists.—MESSRS. J. H. HOLMES AND CO., Newcastle-on-Tyne.—Pamphlet No. 72 (four pages), gives half-tone views of various types of switchboards for lighting and power service, and for mining, mill and marine installations.

MR. H. C. SLINGSBY, 142, Old Street, London, E.C.—Sheet of designs of trucks, ladders and barrows.

MESSRS. MARSHALL SONS & CO., LTD., Britannia Ironworks, Gainsborough.—Catalogue No. 891 (16 pages), containing full descriptive particulars, with illustrations, and tabulated sizes, dimensions, &c., of fixed and portable types of oil engines.

MESSRS. SIMPLEX CONDUITS, LTD., 116, Charing Cross Road, W.C.—New electric light fittings catalogue of 276 pages. It begins with information relating to the Simplex "Unit" system of electric light fittings and notes on fittings design, and closes with a numerical reference number index, and between these two extremes there lie hundreds of illustrations and prices of a wide and varied selection of electric light brackets, pendants, electroliers, ceiling fittings, table standards, shop window and outdoor signs, glassware and silk shades, and some 50 pages displaying many designs of electric heating and cooking appliances.

PREMIER COOLER AND ENGINEERING CO., LTD., Broadway Court, Westminster, London, S.W.—Pamphlet No. 700 describes the Premier wet-air filters, and No. 701 is a 16-page catalogue fully describing, with diagrams and half-tone illustrations, the Premier dry-air filter plants. Both types of filters are stated to be largely used in electric power stations.

Book Notices.—"Sell's Directory of Registered Telegraphic Addresses," which has just been issued for the year 1915 (166, Fleet Street, E.C., 25s.), is, as usual, a very imposing volume. In the sections relating to (*a*) British Empire Overseas and (*b*) Foreign Countries, names and cable addresses of no fewer than 30,000 firms appear. The usefulness of such a publication needs no emphasis when communication by cable between this country and Overseas markets is so important a matter to all manufacturers and traders. The volume (2,600 pages) also contains an index to 80,000 telegraphic addresses registered in the United Kingdom, the information as usual being compiled from official lists. A classified list of trades is entitled "The National Directory of Commercial Houses," and it contains about 100,000 names.

"*Proceedings* of the Physical Society of London." Vol. XXVII. Part 2. February 15th, 1915. London: *Electrician* Printing and Publishing Co. Ltd. Price 4s. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol XXXIV, No. 2. February, 1915. New York: The Institute. Price $1.

"Scientific Papers of the Bureau of Standards." No. 238. "Characteristic Equations of Tungsten-Filament Lamps and their Application in Heterochromatic Photometry." Washington, U.S.A.: Government Printing Office.

"The Engineer's Year-Book of Formulæ, Rules, Tables, Data, &c., for 1915." Edited by H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood & Son. Price 15s.

A Meldrum Destructor in Australia.—A refuse destructor has been erected for the North Sydney Council by MESSRS. SWARBRICK & CO., representing Messrs. Meldrums, Ltd. It is of the Meldrum Simplex, breast-feed type with four grates, each grate being capable of treating 12 to 15 tons of garbage, or a total of 50 to 60 tons in 24 hours. The actual cost of burning has been 1s. 7d. per ton. Provision has been made for dealing with noxious gases and smoke, which are consumed and rendered harmless and inoffensive. It is proposed to utilise the steam generated in connection with tar plant adjoining the destructor, and for other municipal purposes. The cost was about £7,000.

New Zealand.—A Christchurch firm which formerly acted as agent for German firms wants to get into touch with British makers of pocket lamps and batteries, small motors (1½ to 6 volts) and dynamos, metal-filament lamps, and electrical novelties. Communications to H.M. Trade Commissioner for New Zealand, P.O. Box 369, Wellington.

Bankruptcy Proceeding.—G. J. T. PARFITT, consulting electrical engineer, Keynsham, Bristol.—Receiving order made February 17th, on creditor's petition.

Trade Openings in Argentina.—The *Financial Times* states that the Secretary of the British Chamber of Commerce in the Argentine has written to the London agents of the Chamber drawing attention to the volume of Germany's trade with the Republic, and giving advice to British manufacturers in regard to the dispatch of samples, &c. He says:—"Postal parcels from Great Britain addressed to business houses in this country are presumed, in the absence of any special indication, to contain articles of a dutiable nature. It is a common occurrence that the addressee is mulcted to the extent of 8s. or 10s. to obtain possession of a packet containing, for example, samples of no value, catalogues, printed matter, or descriptive pamphlets. This could be avoided by the simple expedient of indicating on the wrapper the contents of such parcels. These indications should be, of course, in the language of the country, and for the convenience of British firms who may be desirous of sending their samples, catalogues, &c., either direct to the Chamber or to individual British firms, I give the Spanish equivalents of some of the phrases in most common use:—Samples of no value—Muestras sin valor. Catalogues — Catâlogos. Printed matter, descriptive pamphlets—Impresos."

Russia.—In his report on the trade of that Consular District in 1913, H.M. Consul at Riga (Mr. V. H. C. Bosanquet) remarks that it should be realised by British firms that the opportunity offered by the war to capture Germany's share of the import trade to Russia is one which it would be foolish to disregard. The volume and variety of manufactured goods hitherto supplied to Russia by German firms is immense, and it is quite impossible to enumerate all the different classes and sub-classes of goods in which Germany holds the field. Her position as Russia's nearest neighbour, her commercial enterprise, her extreme adaptability, and the study she has made of Russian markets, have all contributed to secure her the commercial position which she has held. It is satisfactory to learn that an organised effort is being made in the United Kingdom to profit by the present opportunity, and it may be hoped that the great field for enterprise offered by Russia will not be neglected by British manufacturers and merchants. Germany has supplied a very large proportion of the electrical machinery and accessories used in the district, the total imports of which amounted to 3,235,000 roubles in 1913. There should now be a great opening in this class of goods for United Kingdom manufacturers.

The British Vice-Consul at Archangel (Mr. T. Woodhouse) reports that an agent in that town wishes to secure the representation of United Kingdom manufacturers and exporters of fire bricks, steel, steel tools, and electric lamps and fittings.

H.M. Consul-General at Odessa (Mr. J. F. Roberts, C.M.G.) reports that a technical engineer at Ekaterinoslav wishes to secure the agencies of United Kingdom manufacturers of motors, boilers, pumps, technical accessories, electric light plant, &c. Communications regarding the inquiry should be addressed to the British Consulate-General, Odessa.—*Board of Trade Journal.*

Australia.—H.M. Trade Commissioner for Australia (Mr. G. T. Milne—address, Commerce House, Melbourne) reports that a number of importing firms in Melbourne, who in the past have imported the undermentioned classes of goods from foreign sources, have requested that United Kingdom manufacturers of these goods should communicate with them:—Thermometers, mathematical instruments, X-ray tubes and apparatus, electric glow lamps, glass, glassware, bitumen.

Change of Name.—The Institute of Industry and Commerce, which was inaugurated a few months ago, has now changed its name to the Institute of Industry and Science.

Deed of Assignment.—R. D. Cundall (The Cundall Gas and Oil Engine Co.), engineer and ironfounder, Keighley.—Particulars of claims must be sent in by March 31st, to the trustee, Mr. J. Rhodes, 37, Manor Row, Bradford.

LIGHTING and POWER NOTES.

Australia.—The Petersham (N.S.W.) Council has inaugurated its electric lighting scheme, which includes public lighting by arc and numerous high powered metal lamps. A joint scheme of the Petersham, Leichardt and Annandale Councils to be completed in June includes 2,000, 1,000 and 300-C.P. nitrogen-filled metal lamps. Over 1,000 poles and 50 miles of cable have been used in the Petersham contract, which was entrusted to the Electric Light and Power Supply Corporation of Balmain.

The Parramatta Supply Co. has started work; some 320 incandescent and 20 1,000-C.P. lamps are installed in the streets.

The proposal of the Melbourne Council to supply free metal lamps to consumers paying an extra ½d. per unit in place of carbon lamps, has brought a protest from the local Electrical Traders' Association. The Council at the present time supplies 65,000 carbon lamps per annum.

The Sydney Municipal Council has notified electrical contractors that in future it will require the provision of a red pilot lamp with any non-luminous heating apparatus, and where separate pieces of apparatus are used simultaneously a pilot lamp must be provided for each.—*Commonwealth Engineer.*

Ballymena.—Workhouse Lighting.—The B. of G. has decided to postpone the lighting of the old infirmary with electricity for six months.

Barford.—E.L. Scheme.—An E.L. scheme for this parish has been completed by the Barford Electric Supply Co., Ltd. For public lighting 11 lamps have been provided, and are lit for 25s. each per annum; current is supplied for lighting at 7d. per unit, and for cooking, heating and power at 2d. Connections secured are equivalent to 1,784 16-C.P. lamps, and extensions to the villages of Wasperton and Sherbourne are projected.

Barking.—Proposed New Plant.—A Sub-Committee of the Electricity Committee is considering the electrical engineer's report upon the question of the extension of the plant and mains in order to cope with the increasing demand for power.

Bingley.—The Electricity and Tramways Committee has decided to accept the offer of the Keighley Corporation to maintain a continuous supply of electricity on Sunday mornings.

Blackburn.—New Power Station.—An extension of the electricity undertaking, involving the erection of a new station and equipment at Whitebirk, at a cost of £100,000, is being considered.

Brighton.—The T.C. has considered the application of the B. of G. that the energy consumed at the various premises which the Guardians have taken owing to the acquisition of the workhouse by the military authorities should be charged for at the hotel rate. The application was refused, the Electric Lighting Committee reporting that separate cables and meters had been provided for the houses taken, and owing to the increased price of coal, the question of increasing the price to all consumers would have to be considered.

Burnley.—The Guardians have adopted a recommendation of the Assessment Committee that Messrs. Cross and Sons, Ashworth & Morris, re-value the gas and electricity undertakings of the Nelson Corporation.

Cheshire.—The C.C. has decided to petition against the Bill of the Stalybridge Joint Tramways and Electricity Board.

Continental.—Italy.—A little storm in a teacup has just been settled in Italy in connection with the annual tax on electricity which is in force in that country. It appears that the tax collectors in the Milan and Palermo districts recently had the bright idea of augmenting the revenue from this tax by serving a demand note for 20 lire (about 16s.) on all the motorists in the districts named whose cars are fitted with electric lighting installations. Their justification for the demand was that such sets were miniature electricity generating stations, and hence fell into the minimum annual tax category, this being the same as the tax on a central electricity station in a little town or village of 5,000 inhabitants. The matter was taken up with the Government by several of the leading automobile clubs in Italy, with the result that the action of the tax collectors has been declared illegal, the motorists thus again breathing freely.

Dover.—Refuse Destructor.—The T.C. has appointed a deputation to inspect dust destructors at other places, with a view to one being provided for the town.

Dublin.—Proposed Price Increase.—The Electricity Supply Committee has decided to recommend the Corporation to increase the charge by 1d. per unit for lighting, and ½d. per unit for power. The estimated expenditure for the next 12 months is £37,500 over that of last year, owing to coal prices, higher cost of carbons, maintenance, materials, &c. The Committee proposes also to ask the Council to reduce the rates immediately coal drops to normal prices.

By order of the Electricity Committee the number of street lamps in use after 10.30 p.m. has been reduced from 600 to 300, the object being to economise the consumption of carbons, the supply of which has been greatly interfered with by war conditions.

Frodsham.—Electric Pumping.—The Joint Water Committee has appointed a Sub-Committee to report on the cost of working pumps by gas and electricity. The pumps are being worked at present by electric motor.

Glasgow.—The Clyde Valley Electric Power Co. is installing electricity for lighting and power in the works of the Ellangowan Paper Co., at Milngavie.

Greenock.—It was reported at a meeting of the Corporation that the output of electricity during January showed an increase of 41 per cent. over the same period last year.

Harrogate.—The Knaresborough R.D.C. has decided to consent to the application for a prov. order for electric light being made by the T.C., and has agreed to a modified scheme by which the area of supply will be extended in the Council's district. The area of the Wetherby R.D.C. has been deleted from the order on account of the attitude of the Council, and Pateley Bridge has been secured. The charges that rule in Harrogate are to be instituted for the proposed area in the rural district.

Horsham.—Refuse Destruction.—The first year's working of the destructor, according to the report of Mr. J. B. Morgan, the electrical engineer, shows that 104,534 KW.-hours were generated, an average of 72½ per ton of refuse burnt. The coal figures for 1913-14 were 942 tons at £931, and for 1914-15, 678 tons at £656, showing a saving of £275, to which should be added £46 in respect of increased output, bringing the saving up to £321. Including clinker sold, and deducting financial charges, labour, &c., the net profit was £140.

Huddersfield.—Year's Working.—The accounts of the electricity department for the year ended December 31st show income £52,518, and expenditure £32,422, leaving a balance of £20,095, as compared with £18,215 for 1913. Of this £1,925 is to be transferred to the depreciation and contingencies account, and £2,100 carried forward for the relief of the rates.

The Electricity Committee has decided that the sum of £2,977 for a new switchboard, in replacement of the old one, shall be charged to depreciation account.

Hull.—Electric Cooking.—The Electricity Committee has instructed the engineer to report on the question of supplying electricity for cooking and lighting to the houses of the working classes.

Kingstown.—Arbitration Result.—The arbitrator (Mr. S. L. Brown) has decided that the Urban Council shall pay £3,607 to the Dublin Southern District Electric Supply Co. for the transfer of the undertaking in the town, the Council to pay all costs.

Leicester.—Public Lighting.—The Watch Committee of the Corporation recommends that the main thoroughfares on tramway routes be lit by electric incandescent lamps suspended in the centre of the road between the poles, and has arranged with the Tramways and Electricity Committee to undertake the lighting of the streets in question for an annual payment of £6 8s. 7d. per 600-C.P. lamp, to include the supply, repair and maintenance of mains, overhead services, fittings, and the lamps themselves, and the supply of the necessary current. It is found that for the existing tramway routes the provision of 938 600 C.P. half-watt lamps will be required, and the annual cost of street lighting will be increased by approximately £2,000 per annum, but the Committee considers the improved lighting will amply compensate for this outlay.

Liverpool.—Restricted Lighting.—This city and the surrounding areas have now adopted a reduced scale of lighting. Public arc lighting has been dispensed with and metal-filament lighting substituted, but the illumination of the tramway cars has not been reduced.

Llandudno.—Proposed Loan.—The Council has decided to apply to the L G.B. for sanction to borrow £1,720 for an engine and dynamo, &c., and an induced-draught plant, and is to spend £269 out of revenue on a new office, and alterations to the battery room.

London.—The L.C.C. Finance Committee recommends the sanctioning of the application of the Battersea B.C. for a loan of £15,750, viz., £8,750 for rotary converters, switchgear and transformers, and £7,000 for H.T. feeder cables.

Hammersmith.—The Electricity Committee states that a satisfactory trial has been made of the plant recently installed for pumping coal from the Council's wharf to the electricity works, and it is expected that the same will soon be in use.

The Council is recommended to take up a loan of £10,000 from the L.C.C. in connection with the electricity undertaking.

London Electric Supply Bills.—The L.C.C. has notified the various Councils that consideration is still being given to the question of what further action, if any, shall be taken with regard to the supply of electricity in and near London, and states that any observations which the authorities of the districts concerned wish to make on the subject should be submitted as soon as possible.

The Chairman of Parliamentary Committees has undertaken to ask promoters of contentious Bills before Second Reading not to proceed with their proposals. The London Electric Supply (No. 2) Bill, promoted by the West End companies, comes under this heading, as already 50 dissenting petitions have been presented. The promoters of the Bill represent only 32 out of the 117 sq. miles in the County of London, and it is being opposed by both municipalities and companies.

Manchester.—Restricted Lighting.—The order for reduction of the lighting of streets and public buildings comes into force on March 1st. The order will affect the mills, in which many of the windows will require screening at night.

Nantwich.—The R.D.C. has deferred consideration of the question of a scheme for extending the E.L. to Wistaston, pending the result of a conference with Mr. Denton, electrical engineer, of Crewe.

New Zealand.—The Christchurch City Council is having difficulty in the distribution of light and power from the Lake Coleridge supply owing to the shortage of insulators. The Dominion supplies appear to have come largely from Germany in the past, and the possibility of having insulators made in New Zealand is being discussed, and the Christchurch Brick Co. has been approached. The Government geologist has been communicated with in order to ascertain whether there are deposits of suitable clay in New Zealand. In the event of a favourable reply being received, there is a possibility of a new industry being established in the Dominion.

Nelson (Glam.).—E.L. Scheme.—The inauguration of the supply of electricity by the South Wales Electrical Power Co. took place at Abernant on the 13th inst. The company will shortly give a supply in the Abercarn Urban District and in portions of the Llantrisant, Crowbridge and Penybont districts.

Plymouth.—The quarterly return of the electricity undertaking in the Devonport and Stonehouse areas, to the end of December shows that 1,778,350 units were sold producing £15,150, compared with 1,601,629 units sold and £13,855 received in the corresponding period of the previous year, an increase in receipts of £1,294.

Rawtenstall.—It is recommended by the Tramways and Electricity Sub-Committee that the charge per lamp per annum be increased to £2 5s. 9d. for 100 C.P. lamps, and to £1 18s 9d. for 50-C.P. lamps, for the year ending March 31st, 1916.

Reigate.—The R D.C. has been asked if the Council's letter of December 29th is a formal refusal to consent to the Chipstead and District E L. Order, in which event it is proposed to apply to the B. of T. to dispense with the Council's consent. The Council has replied that it is of opinion that nothing should be done to facilitate the granting of the order until the new Urban Council of Coulsdon and Purley was able to consider the matter, and for that reason the Council proposed to ask the B. of T. to refuse the order being applied for.

Romsey.—E.L. Scheme.—The T.C. has referred to the General Purposes Committee a proposal by a private firm to introduce electric light into the town.

Skerries (Co. Dublin).—E.L. Scheme.—The new electric lighting system. introduced by Mr. W. Flanagan under an arrangement with the U.D.C., was inaugurated on Monday night.

Southend-on-Sea.—The T.C. has decided to extend the mains along the Lower Esplanade to the new swimming baths, at an estimated cost of £291.

Stirling.—Proposed Works Extension.—In view of a report by the electrical engineer that the time had come to consider the advisability of increasing the capacity of the works, the Lighting Committee is to consult Mr. J. A. Robertson (Salford) on the matter.

Tullamore.—Workhouse Lighting.—The B. of G. has been informed that the installation of electric lighting in the workhouse would effect a net saving of £140 per annum.

West Ham.—In reference to the Council's dispute with the Hart Accumulator Co , Ltd., in regard to the amounts deducted by the company from the electricity accounts for alleged damage caused by interruptions in the supply of current, the Electricity Committee, having carefully considered certain conditional arrangements made has recommended the Council to confirm them, and to instruct the solicitors to proceed accordingly.

Willesden.—New Plant.—The Electricity Committee has had under consideration complaints from consumers with reference to interruptions in the supply. The engineer reports that in order to ensure greater security from interruptions, and to cope with the increased demand, it would be advisable to install a battery at Acton Lane ; the cost would be—for buildings, £1,000 ; battery, £2,750 ; booster, switchgear and connections, £1,000 ; new feeder cable, £1,112 ; total £5,862. The Committee considers the expenditure is urgent, but in view of the present conditions is reluctant to enter into any heavy commitments, and recommends that application be made to the L G.B. for sanction to borrow £5,862, the commencement of the works in question to be deferred for such a period as will allow completion of them before next winter.

Yorkshire Electric Power Bill.—The Birkenshaw and Mytholmroyd Councils have decided to ask the Power Co. to strike them out of the first schedule of the Bill ; the Bingley, Earby and Thurnscoe Councils have decided to oppose the Bill.

TRAMWAY and RAILWAY NOTES.

Ashton-under-Lyne.—The employés of the Ashton, Oldham and Hyde Tramways, the Stalybridge Joint Tramways Board and the Ashton Corporation Tramways have decided to make an effort to secure an increase of 1d. per hour in wages for all grades, on account of the greatly-increased cost of living. The employés concerned number about 300.

Australia.—In connection with the suburban railway electrification scheme, the first consignment of G E.C. apparatus, consisting of 90 traction motors, has now reached Melbourne from America. The first instalment of new motor coaches, 120 in number, is being constructed in the Newport workshops. A number of existing cars are being reconstructed for electric traction.

Tenders were recently invited for the steel gantries for the overhead equipment, &c., of the Sandringham-Broadmeadows line.

The Melbourne Tramways Co.'s lease expires in June, 1916, and the Melbourne Tramway Trust is considering the question of negotiating the purchase of the company's buildings, cars and plant.

The Assistant Minister of N.S.W. Railways has stated that it was intended first to convert to electric traction the North Shore section from Milson Point to Hornsby. If successful it would be followed by other suburban lines round Sydney, and by the section from Sydney to Newcastle, nearly 100 miles long.

The Victorian Railway Commissioners are shortly to introduce 10 new bogie cars on the St. Kilda-Brighton line, which will contain three passenger compartments and two drivers' compartments, and sliding central doors for the passengers' entrance.

Birmingham.—Electric Vehicles.—According to the *Commercial Motor* an order for 2½-ton "Orwell" electric tipping wagons has been given by the Corporation to Messrs. Mossay & Co.

Blackpool.—Traffic Returns.—The tramway receipts during January were £2,546, an increase of £399 over the previous month. The revenue from April 1st to the end of January was £71,210, against £80,100 during the same period of the previous year. The greatest decrease followed the outbreak of war, but since the troops came in November there has been a recovery to the amount of about £100 per week.

Brighton Railway Electrification.—At this company's meeting held on Wednesday, the chairman mentioned that they were proceeding with the electrical equipment of their suburban lines, for which contracts had been placed. Their existing electrical services had shown marked expansion.

Canada.—According to the report for the year ending October 31st, 1913, of the Minister of Public Works for the Province of Ontario, there were 761·16 miles of electric railway completed, and 47·00 miles under construction of that date. Of 37 different companies, 8 were using hydro-electric power.

Continental. — Switzerland. — It is stated that 1,873 miles of the Swiss State lines are to be converted from steam to electric traction, power being derived from the wealth of water power available. The first section will include the St. Gothard Tunnel, the section being 67·7 miles in length. Current will be transmitted single-phase at 60,000 volts to various sub-stations, whence it will be distributed.—*Railway News.*

Edinburgh.—Experimental Cars.—The Tramway Sub-Committee of the T.C. has decided to experiment with self-propelled cars, with a view to the possible introduction either of electrically or petrol-driven vehicles.

Hull.—Rate Relief.—The Corporation has decided to grant £10,000 from the tramway profits for the relief of rates, being £3,000 more than last year, and to carry forward £5,323 to the reserve fund, which will then stand at £140,000.

It is estimated that 100,000 soldiers per week have been carried free on the cars during the last eight months, this privilege not having been withdrawn in Hull.

Leeds.—Goods Traffic.—A scheme for dealing with extraordinary traffic is under consideration; it is proposed to construct hopper wagons, to be drawn over the tramway lines by electric locomotives. The wagons are to have a capacity of 10 tons each, and a charge is to be made of about 4d. per ton-mile.

London.—L.C.C. Tramways Assessment.—The House of Lords, on Monday, allowed the appeal of the L.C.C. on its claim to have a reduction of the valuation of the tramways in the borough of Islington, by reason of the rateable value having been reduced by the competition of the motor-'buses.

In reply to a question in Parliament by Mr. Kellaway, Mr. McKenna stated that in the last four months of 1913 57 persons were killed by motor-omnibuses, and 25 by electric tramcars in the Metropolitan Police District. In the last four months of 1914 79 persons were killed by omnibuses and 17 by tramcars.

The L.C.C. has intimated to the B.C.'s that the clause in its Tramways Bill to which there is opposition on the ground that it would affect their veto with regard to the overhead system, would be modified to meet the wishes of the B.C.'s concerned.

Morecambe.—Tramway Extensions.—The T.C. has approved of a scheme which provides for an extension of the tramway system.

Newcastle-on-Tyne.—Tramway Estimates. — The Tramways Committee's estimates for the coming year show traffic receipts £270,980, and a total income of £282,200. For the year just closing the estimated receipts were £255,150, but it is expected that this sum will be exceeded by at least £2,200. The total expenditure will be £160,300, an increase of £15,400 on the current year's estimate. From the surplus of £121,900 the sum of £75,000 will be required for interest and redemption, and £8,000 for income-tax; but as a set off to these items is £3,500 interest on investments. These figures yield a net surplus of £39,400, but a further deduction of £8,000 must be made on account of allowances to employés who are on active service. At the beginning of the current year the reserve fund stood at £94,000, or £6,000 short of the amount the Committee considers should be maintained. By the end of the current year it is estimated that the shortage will have reached £22,000, a deficiency which, it is hoped, may be made up by the surplus on the present year. It is estimated that £34,000 will be spent during next year on renewals.

West Ham.—New Cars, Motors, &c.—The tramway manager has reported upon the provision of new tramcars, and says that he has recently succeeded in getting amended offers for the car bodies and trucks, bringing the price down to £1,145 per car, which is equal to an increase of about 15 per cent. on the prices prevailing in 1912-13. As the undertaking is badly in need of more cars, the manager recommends the Committee to accept the tenders of the Brush Co. for bodies and trucks; British Thomson-Houston Co., for equipments and brakes; and British Westinghouse Co., for controllers, the total for the 15 cars, including spares, amounting to £17,705. The manager states that in May last year his attention was drawn to a greatly improved type of motor. It would, the manager remarks, more than pay the Corporation to replace the whole of the present equipments by an equipment of this class, which has a reserve amply sufficient to meet any growth of traffic that may reasonably be anticipated during the next 10 years. The manager estimates that the saving that could be effected, after completing the change-over of the equipments, would be in the neighbourhood of £4,000 per annum, making no allowance for the benefits that are bound to accrue from fewer breaks in the service. The replacement of the equipments would take about 18 months, and cost £28,000. It is proposed to refer the matter to the Finance Committee, with a view to providing the necessary money to carry out the manager's suggestion.

York.—Electric 'Buses.—During the past week the first of the new electric 'buses purchased by the Corporation has been running to and from Heworth, and has been well patronised. The journey is completed in about 10 minutes.

TELEGRAPH and TELEPHONE NOTES.

Landing Licences for Trans-Atlantic Cables.—Notice is given in the *London Gazette* that the Commercial Cable Co. has applied to the Board of Trade for the renewal of its landing licences for submarine cables at Weston-super-Mare and Waterville, connecting these places with one another and with North America and the Azores. On March 22nd the Board will proceed to consider the application, and in the meantime will receive any objections that may be made thereto.

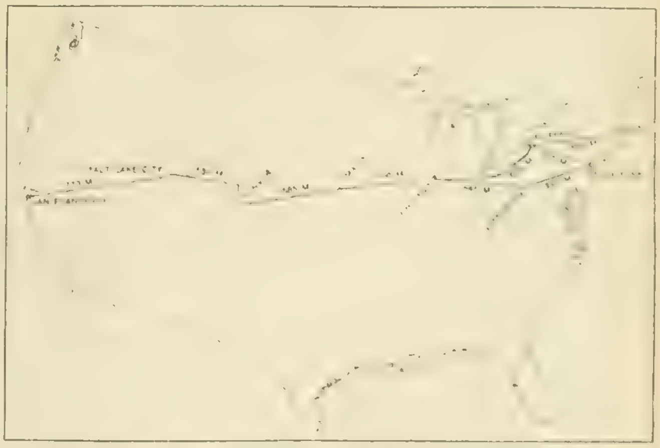
London Telephones.—Answering a question in the House of Commons, the Postmaster-General stated that out of the 11,000 telephone lines in the south of the metropolitan area which were put out of service by the snowstorm on January 22nd, some 2,000 were still unrepaired. Great efforts were being made by the engineering staff to push on the work of restoration.

Rawtenstall.—The T.C. has resolved that a new scheme of street fire alarm and telephone service be adopted, and that a tender for the work be obtained from Messrs. Siemens Bros. and Co., Ltd.

Telegrams for Places Abroad.—It is announced that telegrams may now be forwarded to British New Guinea, Macquarie Island, and the Sandwich Islands, at rates varying from 2s. 3d. to 3s. 3d.

Trans-Continental Telephony.—On January 25th, as previously noted in this column, telephonic communication between the Atlantic and Pacific coasts of the United States was formally inaugurated; the route of the line is shown on the accompanying map, and some particulars of its construction are given below, for which we are indebted to our American contemporaries.

The line took two years to construct; in addition to the building of the section from Denver to the coast, the whole of the line between New York and Denver had to be overhauled and equipped with loading coils. The wire was hard-drawn copper 0·165 in. in diameter; one two-wire circuit weighs 1,480 tons, and in two physical two-wire circuits there are 13,600 miles of wire, carried on 130,000 poles. The phantom circuit derived from these two circuits gives the best results over long distances. The wild and mountainous character of the country in the Far West made the work of construction exceedingly difficult; long stretches of the line run over swamps and deserts, and there are no roads. The loading coils are mounted on the poles. The first large city touched by the line after leaving San Francisco is Salt Lake City, 770 miles to the east. The poles are of red-wood, and usually measure 4 in. square at the top, 8 in. at the bottom, and are 18 ft. long.



The line consists of two physical circuits and one phantom circuit; all the circuits are loaded with Pupin coils 4 or 5 in. in diameter, with cores of iron wire 4 mils in diameter. Beginning at Boston, the first line ran to Cambridge in 1876, and was extended to Providence, 45 miles, in 1882, and to New York, 235 miles, in 1884. The line between New York and Chicago, 900 miles, was opened in 1893, and was extended to Omaha in 1898, to Denver in 1911, and to Salt Lake City in 1913.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 6th. U.D.C. Twelve months' supply of cables, meters, joint-boxes, &c., lamps, uniforms, tickets and other stores. See "Official Notices" February 5th.

Australia.—Brisbane.—March 10th. Motor-generator, power board, &c., for Postmaster-General. See "Official Notices" January 15th.

April 7th. Wheatstone receivers and transmitters, for the Postmaster-General. See "Official Notices" February 19th.

Melbourne.—March 16th. White Wheatstone receiving tape, for Postmaster-General. See "Official Notices" February 5th.

Bedwas.—March 4th. Electrical goods for 12 months, for the Bedwas Navigation Colliery Co., Ltd. Forms of tender from the Secretary.

Belfast.—March 15th. Twelve months' supply of stores for the Tramways and Electricity Committees. See "Official Notices" February 19th.

Birkenhead.—March 9th. Corporation. Continuous-current meters and house-service fuse boxes. See "Official Notices" to-day.

Bolton.—March 4th. Corporation. Twelve months' supply of stores for the Electricity Department. See "Official Notices" February 19th.

Bury.—March 8th. Constructional steelwork (contract 2AA) in connection with the electricity generating station extension at Chamber Hall, and steel window frames (contract 4A). Specifications, &c. (£2 2s. for each contract, returnable) from Mr. J. Ainsworth Settle, Borough Engineer, Bank Street.

Dover.—March 9th. Electrical sundries and cables for a year, for the Harbour Board. Mr. Martyn Mowll, Registrar, Castle Street.

Dundee.—March 3rd. Corporation Tramways Committee. Stores for a year from May next. Specification from Mr. Peter Fisher, General Manager.

Edinburgh.—March 4th. Corporation. Electric lighting installation at Labour Exchange offices (Old Corn Exchange Buildings, Grassmarket). Tenders to the Town Clerk.

Edmonton.—March 10th. Electric lamps for the B. of G. Mr. F. Shelton, Clerk, The Grange, White Hart Lane, Tottenham.

France.—March 17th. Two electric travelling cranes for the repair shops at Mézidon, for the Administration des Chemins de Fer de l'Etat. Particulars from the Bureaux du Service Electrique, 43, Rue de Rome, Paris (1re).

Gloucester.—April 1st. Twelve months' supply of stores, for the Electricity and Light Railways Committee. Forms of tender from Mr. F. H. Corson, General Manager, Light Railways Offices, Bristol Road.

Grimsby.—March 8th. Corporation. Two years' supply of motor-type meters. See "Official Notices" to-day.

Guildford.—Water softening and filtering plant, 50,000 gallons per hour, for Guildford Electricity Supply Co., Ltd. See "Official Notices" February 19th.

Heston and Isleworth.—March 6th. U.D.C. Twelve months' supply of electrical stores. See "Official Notices" to-day.

Huddersfield.—March 2nd. Corporation. Electricians' work at new Tuberculosis Hospital. Forms of tender from Mr. K. F. Campbell, Borough Engineer.

Hull.—March 2nd. Air-space telephone cable, for the Telephone Committee. See "Official Notices" February 19th.

London.—L.C.C.—March 16th. Reconstruction of three miles of single-line tramway on the underground conduit system. Specifications, &c. (£5), from Chief Engineer, County Hall, Spring Gardens, S.W.

Finsbury.—March 1st. B.C. Six or twelve months' supply of electric fittings. Forms of tender from the Borough Surveyor, Town Hall.

Battersea.—March 2nd. B.C. Supply of stores for Electricity Department. See "Official Notices" February 12th.

Hornsey.—March 16th. Meters, cables and stores, &c., for the T.C. See "Official Notices" February 19th.

Bow.—March 9th. Electrical supplies, for the Managers of the Poplar and Stepney Sick Asylum District. Forms of tender from the Clerk, Devons Road, Bow, E.

Macclesfield.—March 10th. Cheshire County Asylum, Parkside. Electrical goods for one year. Mr. Wm. Tingay, Clerk.

Manchester.—March 2nd. G.C. Railway Co. Six or twelve months' supply of wires, cables, carbons, electrical accessories, lamps and telegraph material. Mr. W. Williams, Stores Superintendent, G.C.R., Gorton.

Newport (Mon).—March 2nd. Electric light fittings, for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

New Zealand.—May 3rd. Electrically-driven turbine pumps of 80,000 and 100,000 gallons capacity per hour, together with direct-coupled motors. Commercial Intelligence Department, Board of Trade, London.

Pontypridd.—March 8th. U.D.C. Twelve months' stores for Electric Light and Tramways Department. See "Official Notices" February 19th.

Spain.—Tenders have just been invited by the municipal authorities of San Pedro de Latorce (Province of Valladolid) for the concession for the electric lighting of the town during a period of 15 years.

Swindon.—March 13th. Corporation. Twelve or six months' stores for Electricity and Tramways Departments. See "Official Notices" February 19th.

Transvaal.—Bethal. March 25th. Municipality. Supply and erection of generating and pumping plant and overhead electric distribution system. Specifications from the consulting engineer, Mr. H. Hancock, A.M.I.C.E. P.O. Box 62, Klerksdorp (deposit £1 1s.). Tenders to Town Clerk, P.O. Box 3, Bethal, Transvaal.

Tynemouth.—The Electricity Committee has resolved to enter into contracts for the supply of electrolytic and other meters during the next 12 months.

Wigan.—March 2nd. Twelve months' stores and materials for the Tramways Department. Mr. F. Buckley, General Manager, Market Place.

Wrexham.—March 17th. Meters, oils, coal, &c., for the Corporation Electrical Department, for a year. Borough Electrical Engineer, Willow Road.

CLOSED.

Australia.—The Public Works Department has accepted the following tenders:—

Motors and control gear for Newcastle Government Dockyard.—Standard-Waygood-Hercules, Ltd., £4,906.

Motors and switchgear for Homebush new public abattoirs.—Australian General Electric Co., £662.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

War Office.

Electric cable and wire.—T. Bolton & Sons, Ltd.; British Insulated and Helsby Cables, Ltd.; Craigpark Electric Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Liverpool Electrical Cable Co., Ltd.; Shropshire Iron Co., Ltd.; Siemens Bros. & Co., Ltd.; F. Smith and Co. (incorporated with London Electric Wire Co. & Smiths, Ltd.); Ward and Goldstone; Yorkshire Cable Co.

Electric cells.—J. C. Fuller & Son, Ltd.; I.R., G.P. & Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.

Electric light generating sets.—Austin Motor Co.; Boulton & Paul.

Generators.—Austin Motor Co.

Gutta-percha (sheet).—Craigpark Electric Cable Co., Ltd.

Electric lamps.—Corona Lamp Works, Ltd.; Edison & Swan U.E.L. Co., Ltd.; General Electric Co., Ltd.; "Z" Electric Lamp Mfg. Co., Ltd.

Electric lathes.—Drummond Bros., Ltd.

Telephone sets and parts.—Automatic Telephone Mfg. Co., Ltd.; Gent and Co., Ltd.; New Phonopore Telephone Co.

Tramway track.—Kerr, Stuart & Co., Ltd.

Wire (steel).—W. N. Brunton & Son; Connolly Bros., Ltd.; London Electric Wire Co. & Smiths, Ltd.; Siemens Bros.

Electric light installation.—For huts at Riby Park, S. Dixons & Sons, Ltd.; at Scott's House, Newcastle, Edmundson's Electricity Corporation, Ltd.

Electrical work on the Pinehurst Estate.—Siemens Bros., Ltd.

Crown Agents for the Colonies.

Turbo-alternator.—British Thomson-Houston Co., Ltd.

Telegraph poles.—J. Spencer, Ltd.

India Office.

Accumulators.—Edison Accumulators, Ltd.

Apparatus. Marconi Wireless Telegraph Co.

Boosters.—Lancashire Dynamo & Motor Co.

Exchange extension.—Automatic Telephone Mfg. Co.

Telephones.—General Electric Co.

Post Office.

Apparatus protective (lighting and power).—British L. M. Ericsson Mfg. Co., Ltd.
Ditto (telephonic).—Automatic Telephone Mfg. Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; Milner's Safe Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Western Electric Co., Ltd.
Cable (submarine).—I.R., G.P. & Telegraph Works Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Cable (telegraphic).—Telegraph Construction & Maintenance Co., Ltd.
Cable (telephonic).—B.I. & Helsby Cables, Ltd.; W. T. Glover & Co., Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Ebonite parts.—British L. M. Ericsson Mfg. Co., Ltd.; Siemens Bros. and Co., Ltd.
Insulators.—Taylor, Tunnicliff & Co., Ltd.
Laying conduits (short lengths, non-continuous).—At Hornsey, Islington, &c., O. C. Summers; Lewisham, O. C. Summers; Willesden, Harrow &c., O. C. Summers; Glasgow, A. Duncan.
Laying ducts.—South Lambeth Road, J. Mowlem & Co., Ltd.; Gerrard Exchange, J. Mowlem & Co.
Laying ducts and pipes.—Bishopsgate and Kingsland Road, F. G. Brummell; Oxford, J. Mowlem & Co., Ltd.
Rearrangement and extension of power plant at the London Wall Exchange.—Western Electric Co., Ltd.
Telephone exchange equipment.—Perth, Peel-Conner Telephone Works, Ltd.; Hammersmith, Western Electric Co., Ltd.; Sutton, Western Electric Co., Ltd.
Spindles (insulator).—Bayliss, Jones & Bayliss; Guest, Keen & Nettlefolds, Ltd.
Troughing and covers.—Doulton & Co., Ltd.
Lead (tube).—Baxendale & Co., Ltd.
Bronze wire.—T. Bolton & Co., Ltd.; B.I. & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.
Bronze insulated wire.—Connolly Bros., Ltd.
Copper wire.—Shropshire Iron Co., Ltd.
Copper insulated wire.—Siemens Bros. & Co., Ltd.

Hong-Kong.—The General Electric Co. of China, Ltd., has secured the contract for all the Government requirements for Osram drawn wire tungsten lamps and electrical supplies for Hong-Kong for the year 1915.

Kettering.—The Admiralty having placed an embargo on the rotary converter being supplied by the Brush Electrical Engineering Co., Ltd., the U.D.C. has accepted the offer of the company for the temporary use of a 500-KW. rotary plant until a Siemens rotary converter of the original type can be installed, the cost of the installation of the temporary plant to be borne by the contractors.

Llandudno.—The Council last Friday accepted the tender of the Electric Construction Co., Ltd., at £425, for a dynamo, and that of Messrs. Browett, Lindley & Co. for an engine for the municipal electric light works. At the previous meeting the Council had been divided on the question of introducing the Diesel engine, but the Committee subsequently decided on steam plant.

London. — Battersea. — The Electricity Committee reports having accepted the tender of the British Westinghouse Electric & Manufacturing Co., Ltd., to supply additional plant in connection with the supply of energy to the Nine Elms district, at £6,525. The cable, &c., will be obtained from Messrs. Callender's Cable & Construction Co., Ltd., under the Council's contract.

Hackney.—The Electricity Committee recommends that the tender of Messrs. Rice & Co., at £698, for foundations, &c., for the 5,000-KW. turbo-alternator and auxiliary plant at the Millfields Road generating station, be accepted.

Hammersmith.—The Electricity Committee reports having accepted the following offers for coal :—

Myers, Rose & Co.—100 tons of Shipley, at 14s. 4d. per ton, with option to supply 1,000 tons if satisfactory; 100 tons of Kirkby Nottingham slack, at 13s. 9d. per ton.
Cory Bros. & Co., Ltd.—2,400 tons of Kirkby Nottingham slack, at 13s. 6d. per ton; 800 tons of Gedling, at 13s. 6d. per ton.
South Metropolitan Gas Co.—100 tons per week, until December 31st, 1915, of coke breeze, at 7s. per ton.
Wandsworth, Wimbledon, Epsom & District Gas Co.—1,800 tons of coke breeze, at 7s. per ton.

The Committee recommends that the tender of the Cadogan Iron Works, at £42, be accepted for replacing the troughing of the Bennis coal-conveyor at the electricity works.

Willesden.—The District Council has been recommended to accept the tender of the British Thomson-Houston Co., at £665, for renewing the H.T. switchboard at the Salusbury Road substation.

Rawtenstall.—The T.C. has resolved that the specification of Messrs. Siemens Bros. & Co., Ltd., for the supply and installation of a proposed new street fire-alarm and local telephone service be accepted, and their tender for carrying it out be adopted.

Scotland.—Messrs. Nobel's Explosives Co., Ltd., have placed an order with Messrs. Johnson & Phillips, Ltd., for overhead power mains for their factory in Scotland.

Ship Lighting.—The Booth S.S. Co. has placed a contract with the Edison & Swan Co. for Royal Ediswan metal-filament and carbon-filament lamps.

Southend-on-Sea.—The T.C. has accepted the tender of Messrs. E. & H. Davey, of Southend, for the erection of a substation at Thorpe Bay, at £4,695.

Walthamstow.—The U.D.C. is recommended to pay, as from February 1st last, an extra 1s. 6d. a ton on the contract with Messrs. Usher & Co., Ltd., for the supply of coal to the electricity works.

The Finance Committee has considered letters from the various contractors to the Electricity Department, and has recommended the acceptance of the following tenders, for the 12 months commencing April 1st, in respect of the items they are willing to supply on the same terms as at present :—Liverpool Electric Cable Co., Dussek Bitumen Co., B.I. & Helsby Cables, Electrical Mfg. and Supplies Co., C. C. Wakefield & Co., Stern Sonneborn Oil Co., A. B. Gross & Co., Vacuum Oil Co., W. Wood & Co., Anti-Attrition Metal Co., L. Andrew & Co., Imeson & Finch, Docker Bros., Robert Kearsley & Co., J. H. Tucker & Co.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, February 26th. At 5 p.m. At Imperial College of Science, South Kensington. Papers on "Magnetic 'Character' Figures, Antarctic and International," by Dr. C. Chree, F.R.S.; "The Electrification of Surfaces as Affected by Heat," by Dr. P. E. Shaw; "Electromagnetic Inertia and Atomic Weight," by Prof. J. W. Nicholson.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, February 26th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. Report on "The Progress of Reform in the Engineer Branch of H.M. Navy," by Mr. D. B. Morison. Paper on "The Future of British Engineering and Shipbuilding" will also be read.

(Graduates' Association.)—Saturday, February 27th. At 7.15 p.m. Paper on "Electric Lighting and Power for Ships," by Mr. O. Holmes.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, February 27th. At 6 p.m. At Carlton Café, Queen Street, Cardiff. Paper on "Typical Breakdowns in Colliery Electrical Plant and their Prevention," by Mr. L. Foster.

Royal Society of Arts.—Monday, March 1st. At 8 p.m. At John Street, Adelphi, W.C. Fothergill Lecture (III) on "Motor Fuels," by Prof. V. B. Lewes.

Society of Engineers.—Monday, March 1st. At 7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "Running Costs of Motor Vehicles," by Lieut. R. W. A. Brewer.

Roentgen Society.—Tuesday, March 2nd. At 8.15 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "The Chemistry of the Radio Elements," by Mr. A. Fleck.

Institute of Marine Engineers.—Tuesday, March 2nd. At 8 p.m. At Tower Hill, Minories, E. Paper on "Tail Shaft Lubrication," by Mr. A. J. Lebeda.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, March 3rd. At 7.30 p.m. At the University, Edmund Street. Paper on "Electricity Applied to Mining," by Mr. C. P. Sparks.

(Newcastle Local Section).—Monday, March 1st. At 7.30 p.m. At Mining Institute. Paper as above, by Mr. Sparks.

Nottingham Society of Engineers.—Wednesday, March 3rd. At the Welbeck Hotel, Milton Street. Paper on "Town's Gas—Its Manufacture and Varied Uses," by Mr. G. Stevenson.

Greenock Electrical Society.—Thursday, March 4th. At 7.45. At 21, West Stewart Street. Paper on "The Operation of a Large Electric Supply System," by Mr. G. Macdonald.

Royal Institution of Great Britain.—Saturday, March 6th. At 3 p.m. At Albemarle Street, W. Lecture (III) on "Recent Researches on Atoms and Ions," by Sir J. J. Thomson, F.R.S.

Monday, March 1st. At 5 p.m. General Meeting.

Salford Technical and Engineering Association.—Saturday, March 6th. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "The Strength of Iron Castings," by Mr. E. L. Rhead.

NOTES.

Fatality. — An inquest was held at Oldham, on February 19th, touching the death of Harold Wood (21), electrician. —Tom Ryan, a tinsmith employed at Messrs. Asa Lees & Co.'s works, Derker Street, Oldham, said that on the previous Wednesday the electricity was off until 2 p.m., and at that time deceased went to the main switch to turn the current on and then to set the motor going. In starting, it fired in the fuse-box. Deceased knocked off the switches of the motor and got hold of a fuse, and a few seconds afterwards staggered back and collapsed on the floor.—Charles Tucker, an electrical engineer at the works, said deceased worked under him and he regarded the affair as purely accidental. He was doing work he should have done, but not in the manner in which it should have been carried out. When the wire fused in the box deceased should have gone to the main service switch and pulled it out, as he had done on a previous occasion on similar faults. Deceased had been with the firm since June, 1913.—The Coroner (Dr. Carson) said the young fellow had evidently done what he ought not to have done and without doubt the affair was an accident. A verdict of "Accidental death" was returned.

Copper.—It would be anticipated that supplies of copper should show a temporary falling-off in quantity just at the present time, but an examination of the mid-monthly statistics, as tabulated by Messrs. Merton, does not confirm this impression. The European visible supplies, at 35,567 tons on February 15th, are 442 tons higher than for the end of January. English stocks are 83 tons less than on the same date, the increase being made up on Chile and Australian shipments.

In classified supplies American shipments to Europe are, so far as can be judged from mid-monthly statistics, low, but equal to those for September and October, and higher than those for August, November or December. Spain and Portugal have sent a quantity equal to the average pre-war supply, while the supply under the heading "Other Countries" is considerably above the peace average. Chile shipments are higher than in normal times and Australian show better than for the preceding four months Total deliveries for the half month, if continued at the same rate, would give a quantity for the month considerably exceeding that for October and November, and only beaten by last month out of all the six preceding ones

Changes in the Board of Trade Returns.—Commencing with January, various changes have been made in the classification adopted in the monthly import and export returns as issued by the Board of Trade. The following are the alterations made in connection with the electrical industry. First, as regards imports: electricity meters and measuring instruments, as also switchboards, which have hitherto been included under the general heading of "Electrical Goods and Apparatus, unenumerated," are now shown separately. Similarly, the old heading of "Machinery, Electrical of all kinds," has been divided into two sections: (1) Generators and motors (except for aeroplanes, motor-cars and motor-cycles), and (2) unenumerated. On the export side the following are now given separate headings in the division relating to "Electrical Goods and Apparatus": (1) Meters and measuring instruments, (2) transformers, and (3) switchboards. The classification, "Machinery, Electrical of all kinds," has been sub-divided into three sections: (1) Railway and tramway motors, (2) other generators and motors (except for aeroplanes, motor-cars and motor-cycles), and (3) unenumerated.

Institution and Lecture Notes.—Institution of Civil Engineers.—On Tuesday last a paper was read on "The Electrolytic Action of Return Currents in Electric Tramways on Gas and Water Mains; and the Best Means of Providing against Electrical Disturbances," by Mr. H. E. Yerbury. The author reviewed and criticised the Board of Trade Rules and Regulations and their revisions, from 1894 to the present date, and dealt with the influence of a leakage current on reinforced concrete. The preventive measures proposed by British and Continental authorities in order to reduce the potential differences between tramway tracks and pipes were classified, and a description of the function of a negative booster was given in detail. The author stated that where the rails and the mass of earth were positive to pipes in the vicinity of the track, there could be no danger to pipes in that area, as they were cathodic. On the other hand, danger existed to all pipes and metallic structures (where embedded in soil) which were positive to the rails, as it was the flow of current out of the pipes that had a tendency to cause corrosion and pitting. The danger, however, was nothing like as great as would appear from the theoretical standpoint. He pointed out that as current-density and duration of current were the most important factors in connection with injurious electrolytic action on gas or water pipes, potential readings were misleading; it was well known that where a comparatively high difference of potential existed, there was, as a rule, less injurious current passing. In his opinion, the Board of Trade regulations in respect of leakage currents could easily be complied with on all tramway undertakings, and were absolutely effective in safeguarding the property of other authorities. Up to 600 volts could be allowed between overhead conductors and earth, and this increase of voltage would reduce the cost of feeders and also the heavy currents now dealt with.

Society of Engineers (Inc.).—Mr. Sherard Cowper-Coles has been elected a vice-president of the Society, to fill a vacancy.

Manchester University.—In the course of a lecture on February 18th at the Manchester University, Mr. S. L. Pearce, chief engineer to the Manchester electricity department, remarked upon the increase in the supply of electricity in this country. In 1904, he said, there were 380 undertakings, producing 450 million units of energy for lighting and power purposes. In 1914 there were 502 undertakings, producing 1.636 million units. To be added to this, according to the latest returns, there were 586 million units supplied for tramway purposes, and 253 million units for the railways. The Manchester district had fully shared in this increase; in 1904 the output was 38 million units, with a maximum demand of 17,390 KW., and in 1914 it was 154 million units with a maximum demand of 50.000 KW.

S.A. Institute of Electrical Engineers.—The report for the past year shows that the income was £697, and the expenditure £426. The net surplus for the year was £137, and the credit balance amounted to £590, as against £454 a year ago. The membership was 236, compared with 278. In view of the unsettled times through which the country has passed, due to the strikes in 1913 and 1914, and to the war and rebellion, the Council regards the present position of the Institute as very satisfactory.

Royal Irish Academy.—In a paper read at a meeting of the Academy in Dublin, on "Some Electrical Properties in Thin Layers," Mr. A. J. McClelland pointed out that thin layers of such substances as graphite or bronze powder, formed on insulating materials, exhibited remarkable electrical properties. Although when newly prepared these layers might be almost non-conductors, when subjected for an instant to a strong electric field normal to the surface, and applied through the insulator, they became conducting. The paper dealt further with the laws obeyed by the conductivity, and discussed the difference between these effects and the coherer effect.

National Association of Colliery Managers.—In a paper on "A Year's Experience with the Miner's Electric Lamp," read before the North Staffordshire Branch at Stoke-on-Trent, Mr. Caleb Johnson said that when the lamps were first installed in the collieries difficulty arose in persuading the men, especially the older ones, to take kindly to them, the objection being the additional weight. That was soon overcome, however, and he was of opinion to-day that another pound in weight, or even more, might be added without objection from the miners, thereby giving facilities to increase the illuminating power of the lamp. The introduction of a lamp with greater illuminating power, in his opinion, tended to reduce the number of cases of miners' nystagmus. During 1913, at the colliery with which he was connected, they had a number of persons afflicted with the disease, but during the year 1914 they had none. They kept several spare lamps, and when they suspected a workman of suffering from, or developing, nystagmus, they gave him an electric lamp. Now they were receiving repeated testimony from the men that they could do their work in greater comfort, and read the newspaper at home in the evening without their eyes or heads aching in doing so.

Association of Mining Electrical Engineers.—At a meeting of the West of Scotland Branch held in the Royal Technical College, Glasgow, on February 20th, a paper was read by Mr. A. Smellie, New Cumnock, on "Experiences in Handling Colliery Electrical Plant." The author stated that when a new company was formed to work the New Cumnock collieries, it made arrangements for an installation of electrical plant for the pumping, coal cutting, haulage and auxiliary ventilation below ground, and for the driving of a washer on the surface. The plant consisted of two three-phase generators driven by steam impulse turbines with condensers, each capable of developing 1,000 KW. at 3,000 R.P.M., 3,000 volts, 50 cycles. The neutral was insulated. The generators were run alternately, as one was quite sufficient for the work. A big proportion of the current was used for pumping, which was carried out mainly by means of turbine pumps driven by three-phase squirrel-cage motors. Prior to the introduction of these the water was dealt with by every conceivable kind of pump. Breakdowns were numerous, and idle time was common, but since the installation of electric pumps not a single shift had been lost due to the breakdown of the pumping plant. While electricity had many advantages as a medium for operating haulages on long roads, it was as a motive power for auxiliary or face haulage that the writer thought it showed its greatest utility. Small electric haulages which were light in themselves, and were easily shifted about, could be cheaply installed. In an experience extending over a period of 10 years with small haulages, and some of fairly large size, he had not lost a shift due to the breakdown of electric fittings. In the pits at New Cumnock they had coal cutters working on all gradients up to 1 in 2 with complete success, and he would not have the slightest hesitation in applying them to even a greater inclination than that. There was no doubt about the efficiency and economy of a central generating station where a number of pits within a given radius had to be supplied with current, but those contemplating such an installation would be well advised to have nothing but plant of the very best construction. With machinery well designed, well housed, well supervised, and with cleanliness the dominating factor, repairs should be negligible and the measure of reliability equal to that of any machinery about a colliery. Changing from steam to electricity should be gone about slowly and regularly. If one motor after another was added by degrees, the men were trained as the system developed, while, on the other hand, if a dozen motors were dumped down at a time when the men were strange to the work, little things that would ultimately be considered of no consequence were regarded as mountains of difficulty, quite sufficient to prejudice many against the system.

At the meeting of the Notts. and Derbyshire Branch at Nottingham, on Saturday, a paper on "Typical Breakdowns in Colliery Electrical Plant, and their Prevention," was read by Mr. Llewellyn Foster.

Institution of Mechanical Engineers.—The annual report of the Council shows that the membership has increased from 6,346 in 1913 to 6,400 at the end of 1914. The total revenue for the year was £16,971, and the expenditure was £15,521. After deducting items credited to capital there remained a balance of £966. The capital of the Institution, less debentures and loans, &c., amounts to £69.273. The Benevolent Fund stands at £5,467.

Institution of Electrical Engineers.—At the meeting of the Manchester Local Section on Tuesday last, a paper was read by Mr. A. P. M. Fleming on "Training for the Industrial side of Engineering," and a discussion followed.

At the meeting of the Yorkshire Local Section on Wednesday last a paper was read by Mr. C. P. Sparks on "Electricity Applied to Mining," and was followed by a discussion.

Appointments Vacant.—Mains assistant (35s.), for Radcliffe U.D.C.; switchboard attendant (30s.), for Portsmouth Corporation; sub-station attendant for Walsall electric supply department; assistant engineer, for Stafford electricity department; switchboard attendant, also wireman, for Blackpool Tower Co.; switchboard attendant (£1), for Heywood electricity works; switchboard attendant (32s.), for Borough of Bermondsey; works superintendent for West Ham Council (£250). Particulars are given in our advertisement pages.

Patents and Alien Enemies. — Letters Patent Nos. 10,859/01 and 24,439/02, granted to Goldschmidt for the Thermit process, have been avoided by the Board of Trade, on the application of Messrs. W. T. Turner and H. A. Blackwell. The hearing was reported in our issue for November 6th, 1914. In respect of Patent No. 7,995/02, granted to Jensen, Mr. G. Jones has been granted a licence.

London Electrical Workers.—The following paragraph appears in the *Herald* for February 20th:—

"Evidently the London members of the Electrical Trades' Union are not believers in the righteousness of being sweated for the sake of patriotism disguised as profit. The right to live under decent conditions and at fair rates is just as important, perhaps more so, now than in times of international peace, and London electrical workers realise this to the full. They are demanding an increase in wages to 1s. per hour and a 48-hour week from their bosses—and they will get it by force if need be."

(*Continued on page* 293.)

THE ELECTRICITY SUPPLY TO PORT GLASGOW FROM GREENOCK.

The history of the Greenock Corporation electricity department has been one continuous record of expansion, and the extension of the electricity supply into the neighbouring Burgh of Port Glasgow in November last is the logical outcome of the enlightened policy which has always distinguished this undertaking.

The department has been fortunate both in its chief engineers and in the Committees which have been entrusted with its management. They have endeavoured to maintain the price of electricity for power purposes at the lowest possible level, believing, quite rightly, that the interests of all classes of the community are better served by enabling engineers, shipbuilders and manufacturers successfully to compete for work, and so bring trade to the town, than by making large profits, which would only, at the best, take a half-penny or a penny off the rates.

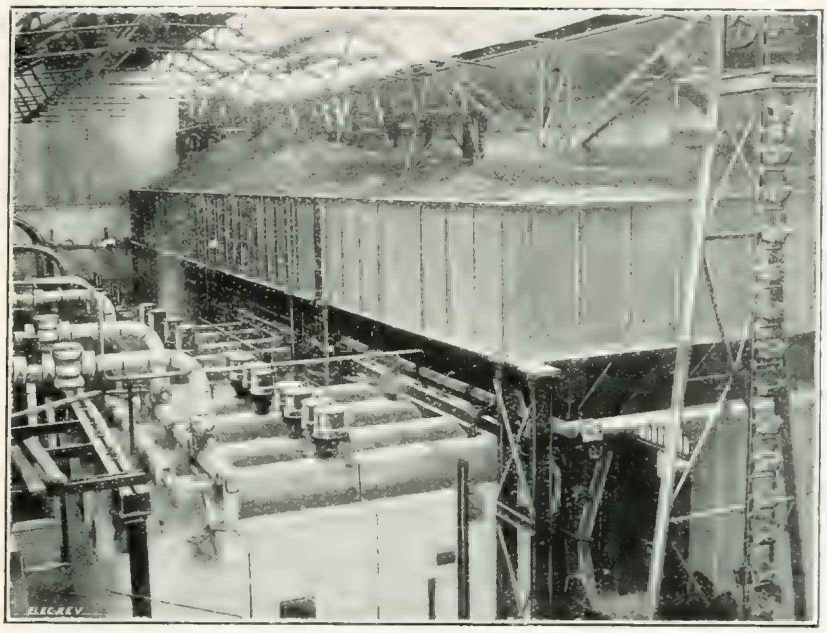


Fig. 1.—Dellingburn Power Station: Coal Bunkers and Conveyor.

The direct result has been that practically every power user in the town is a consumer, and last year the department sold 136 units per head of population, a figure exceeded by only one other undertaking in the United Kingdom.

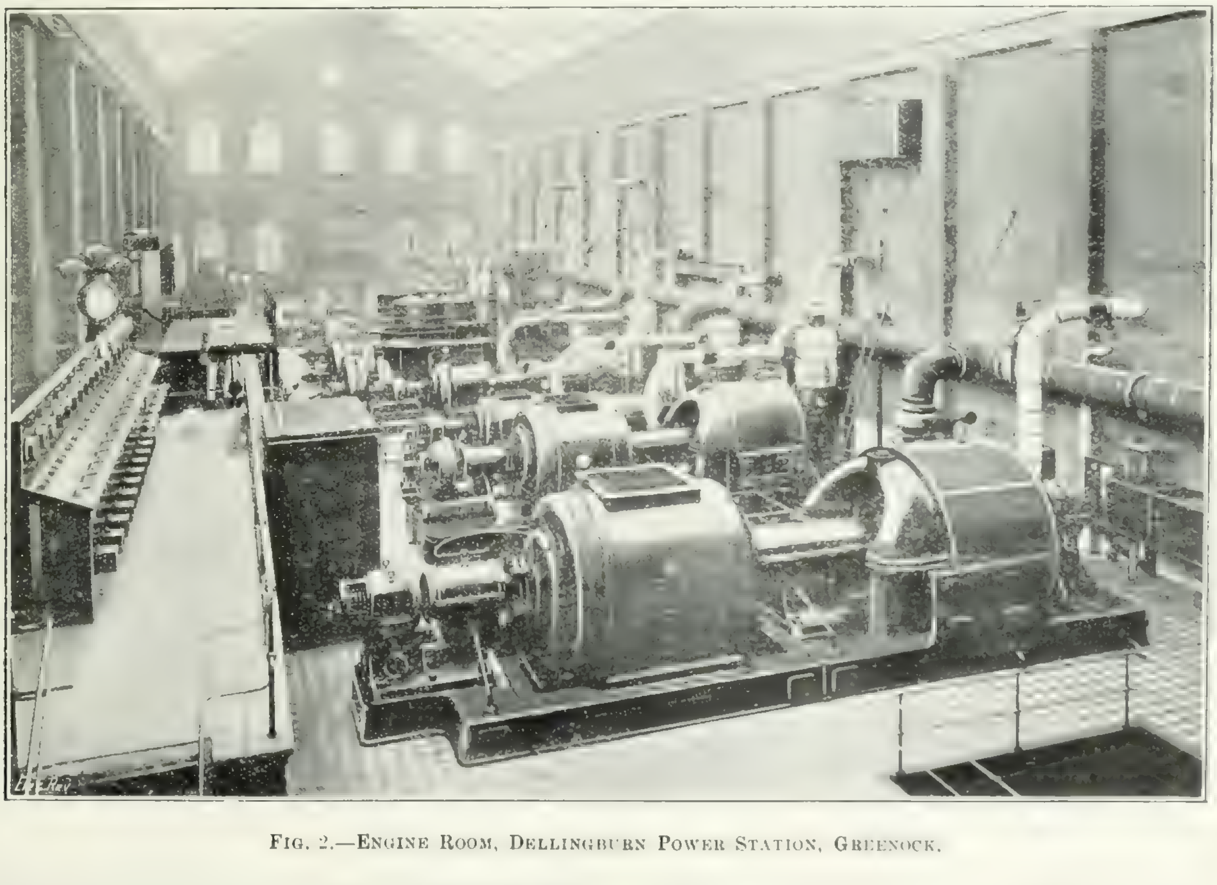


Fig. 2.—Engine Room, Dellingburn Power Station, Greenock.

The question of a supply of electricity to the Burgh of Port Glasgow had been raised several times during the last few years by the shipbuilders and engineers of that town, but their Council always put so many obstacles in the way that the project had to be dropped each time.

The cause of the disagreement between the two burghs is about a century old. In the days when the Clyde was only a shallow stream unfit for navigation, the City of Glasgow leased a tract of land on the lower reaches of the river, built harbours there, and called it Port Glasgow.

Greenock, a small fishing village three miles lower down the river, was better situated, and private enterprise under the patronage of the local Laird built larger and more commodious quays and harbours, and soon all the trade of Port Glasgow passed into the hands of its neighbour. Ever since then, the Town Council of Port Glasgow has been haunted by the fear of annexation by its larger neighbour, and all overtures from Greenock for the supply of water, gas, or electricity have been met with uncompromising obstruction.

Most of the shipbuilders in Port Glasgow had their own generating stations, but with the possibility of cheaper power being available from Greenock these had not been extended to cope with the increased demands of modern shipyard work. The boom in shipbuilding recently brought matters to a crisis; a Committee of power users was formed,

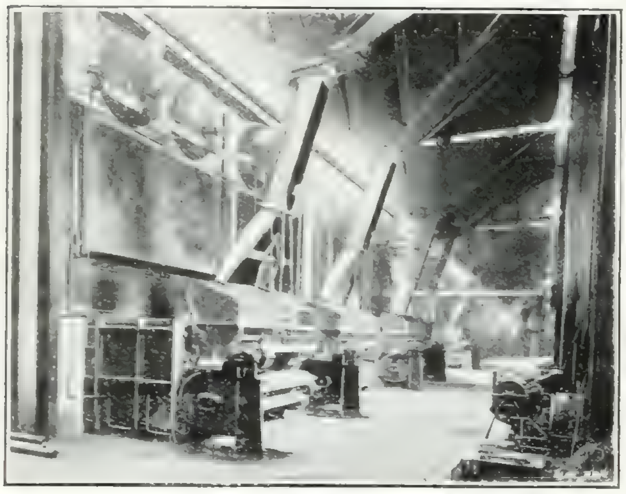


Fig. 3.—Boiler House.

and as they were the largest ratepayers in the burgh, they were able to put pressure on their Council, and so the negotiations were brought to a successful conclusion.

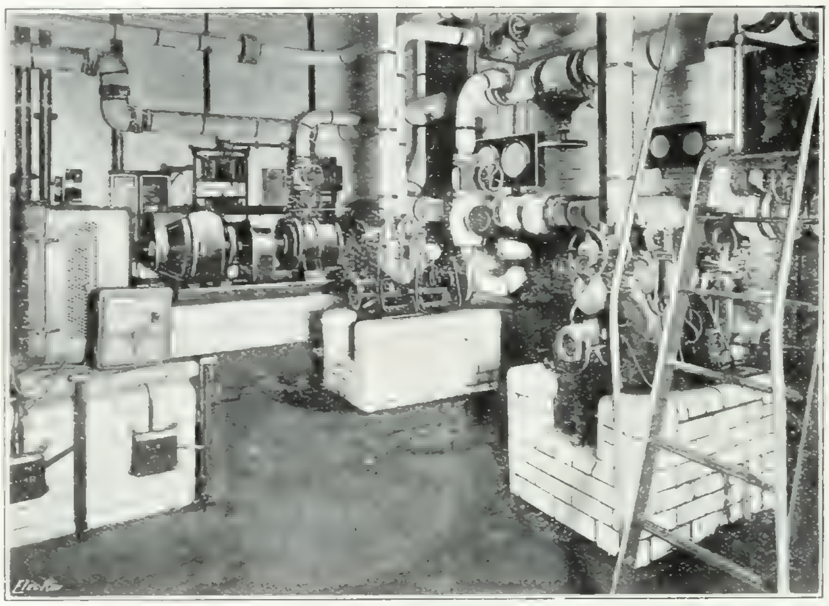


Fig. 4.—Pump House.

Greenock has now taken over the Port Glasgow electric lighting order, and will supply Port Glasgow consumers on exactly the same terms as those offered to similar consumers in Greenock. In the event of a deficit, the Greenock Corporation may not levy rates in the Port Glasgow area, but to safeguard the department, the six principal shipbuilding firms in the burgh have signed a minimum guarantee and also an agreement to take all their electricity from Greenock for the next 29 years.

The town of Port Glasgow lies along the narrow strip of land between the River Clyde and the steep hills, which rise almost immediately from the water's edge. All the principal consumers have their shipyards in a line along the sea front, so that the problem of power distribution has been very much simplified.

With one exception, all the electrical plant of the various firms is suitable for a 250-volt supply, so that three 250-volt rotary sub-stations have been erected in the burgh, one at the Greenock boundary, one in the centre of the town and one on private premises at the far boundary.

The first two are public sub-stations operated by the electricity department, and supply both the town and the shipyards and engineering works lying between. A 1 sq. in. low-pressure, two-wire concentric trunk cable connects the two stations and loops into the principal shipyards, where links are provided so that each yard can be fed from either sub-station in the event of a fault occurring anywhere in the trunk cable.

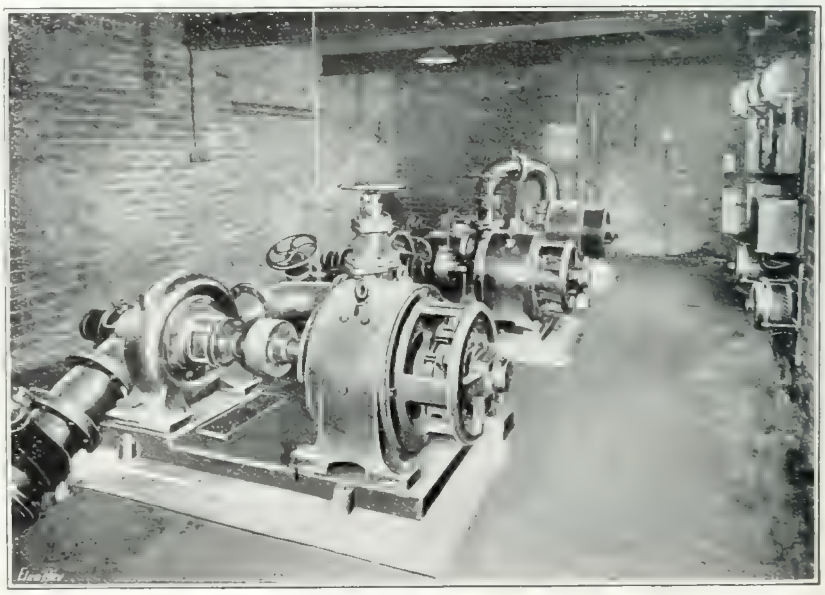


Fig. 5.—Cooling Tower Circulating Pumps.

At regular intervals along this trunk cable distributing pillars are installed, from which cables are run for the supply of smaller consumers. The system of distribution throughout Port Glasgow is two-wire.

The trunk cable between the sub-station in Bay Street (centre of town) and the sub-station in the Clyde Shipbuilding and Engineering Co.'s yard at the other boundary is 1 sq. in. up to Messrs. Ferguson Bros.' shipyard, and ·5 sq. in. thereafter. In addition to these three sub-stations there is a sub-station in Messrs. Wm. Hamilton and Co.'s yard. The reason for this separate supply is that Messrs. Hamilton's pressure for power is 420 volts.

The sub-stations are fed by two 10,500-volt E.H.T. three-core ·1 sq. in. cables which loop into alternate sub-stations, thus forming a high-tension ring main about 6½ miles long.

All the high-pressure feeders and low-pressure distributing mains for this extension were manufactured by Messrs. Callender's Cable and Construction Co., and the cables have been laid on both the solid and the draw-in systems.

The Boundary Street sub-station consists of two bays; in one are placed the switchgear and the rotaries, and the other is to be used as a battery room. The high-tension cubicles and all the switchgear in this station were provided by the British Thomson-Houston Co., Ltd., and the two 500-KW. rotary converters and transformers were supplied by the British Westinghouse Electric and Manufacturing Co., Ltd. The rotary converters are of the eight-pole compound-wound self-synchronising type, and are supplied with six-phase current at 185 volts, 50 periods. They have an overload capacity of 50 per cent. for three minutes, and the full-load efficiency for rotary and transformer is 92 per cent. The Bay Street sub-station is a duplicate of the Boundary Street sub-station as far as plant is concerned. In the Clyde Shipbuilding and Engineering Company's sub-station there is one 500-KW. rotary converter, and the high-tension cubicles and switchgear, as well as the transformer and rotary converter, are of the British Westinghouse Co.'s manufacture. In Messrs. Wm. Hamilton and Co.'s sub-station there is one 500-KW. rotary converter, which, however, is wound for 420 volts, and is of the British Westinghouse self-synchronising type. The switchgear in this station is of the British Thomson-Houston Co.'s manufacture.

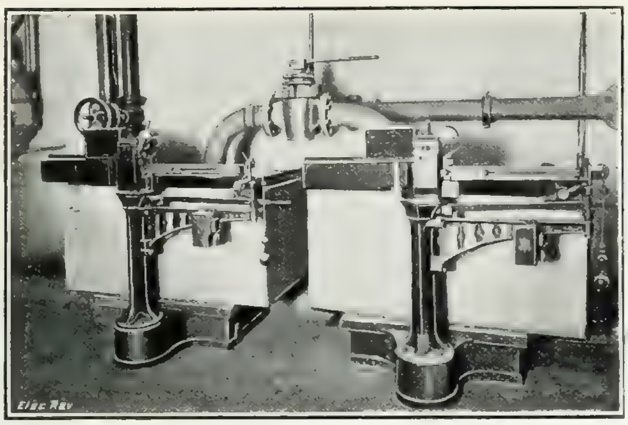


Fig. 6.—Testing Tanks.

In all four sub-stations provision has been made for doubling the capacity of the plant now installed.

An extremely interesting collection of private generating plant has been displaced by the Corporation supply.

Messrs. Dunlop, Bremner & Co. had two modern steam-driven dynamo sets; these have been taken out and a 1 sq. in. concentric feeder from the Boundary Street sub-station now provides all the necessary power.

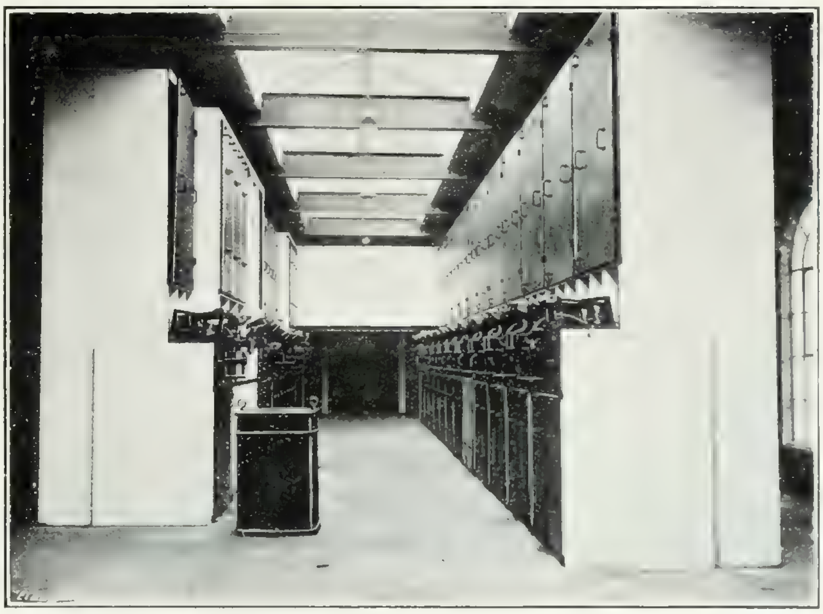


Fig. 7.—High-Pressure Switch Cubicles, Dellingburn Power Station.

Messrs. Russell & Co., shipbuilders, have two dockyards. Their Kingston Yard, which is opposite the Boundary Street sub-station, was supplied from three modern steam-driven dynamo sets; these have been sold, and the yard is fed by two 1 sq. in. concentric cables. In Messrs. Russell and Co.'s other yard, the original generating sets were two Crompton dynamos, driven by vertical gas engines. These engines gave a great deal of trouble to start, and were very often kept running on no load simply because of the difficulty of restarting. The Greenock Corporation latterly loaned the firm a large motor starter, so that the gas engine could be run up by motoring the dynamo. This yard is fed by two 1 sq. in., and one ·5 sq. in. concentric cables.

The Clyde Shipbuilding and Engineering Co. had the finest assortment of suction gas plant of any of the Port Glasgow shipbuilders. Their plant consisted of one 110-KW. compound dynamo by Messrs. J. P. Hall & Co., rope driven from a National gas engine; two 87·5-KW. compound dynamos by the British Westinghouse Co., rope driven from two Premier gas engines; and one 225-KW. compound dynamo by the British Westinghouse Co., direct driven at 160 R.P.M. by a Premier gas engine. The firm had also installed a 75-KW. dynamo by Messrs. Dick, Kerr & Co., driven by a Robey high-speed engine, so that the lighting of the works might be assured. A sub-station with a 500-KW. rotary converter has been erected on this firm's premises.

Messrs. Duncan & Co. have no generating plant of their own, but expect to take a minimum of 100 KW.

Messrs. Ferguson Bros., Ltd., shipbuilders and engineers, have two small gas engine sets which are fairly modern. Their demand also was estimated at a minimum of 100 KW., but owing to a recent fire which has completely destroyed their machine shops, they have intimated that an increased demand may be expected from them when the damage is made good.

Messrs. Wm. Hamilton & Co., shipbuilders, had a power plant consisting of a couple of two-pole low-speed sets sold out of Dickinson Street, Manchester, many years ago.

These and other superseded sets are illustrated on p. 292.

Messrs. Murdoch & Murray, shipbuilders, have also displaced a gas-engine set. They have not signed an exclusive use contract with the Corporation, but are taking energy for all power and lighting purposes at ordinary rates.

In addition to these eight shipyards and engineering works, the Kingston Investment Co., which bought up the slum area of the burgh and built model houses and shops, have displaced their own generating plant and have entered into an agreement with the department to take 50 KW.

The Caledonian Railway Co., who have just rebuilt their station at Port Glasgow, have adopted electric lighting and propose to use electricity for signal lighting also.

With all these exclusive use guarantees for 29 years, the extension of the electricity supply into Port Glasgow should prove a splendid venture for the Greenock electricity department, while it meets at the same time an undoubted need in the Port Glasgow area.

To cope with the demands of Port Glasgow, and also to meet the increasing load in Greenock, extensive alterations have recently been carried out at the generating station in Dellingburn Street. A switch annexe has been built at the end of the engine room with a complete equipment of Westinghouse cubicles and solenoid-operated remote-control switchgear to operate the high-pressure alternators and

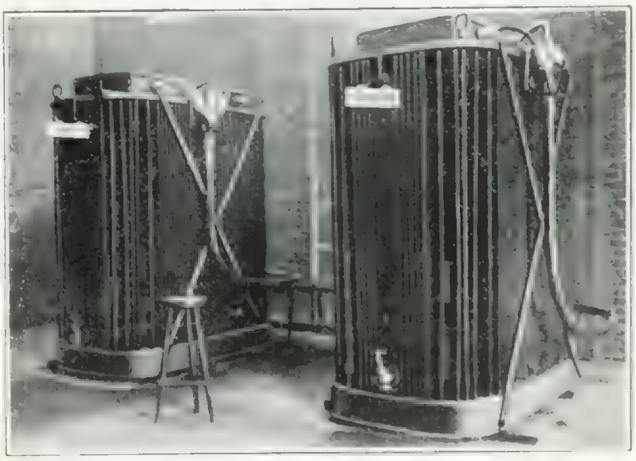


Fig. 8.—10,500-Volt Transformers.

feeders. These displace the existing high-pressure switchgear in the engine room, and their place is now occupied by a control desk.

Two 1,000-kva. Westinghouse oil-insulated self-cooling transformers, with a ratio of 3,300 to 10,500 volts, are used to step up the station voltage for the Port Glasgow supply. Under normal conditions one transformer is used on each feeder, but the switching arrangement is such that one transformer can be used on both feeders, or two transformers can be used on one feeder.

Owing to the heavy load which has already been connected in Port Glasgow, two more 1,000-kva. transformers, duplicates of the original pair, are now on order, so that two transformers in parallel may be permanently connected on to each feeder. The switches controlling these feeders are hand operated.

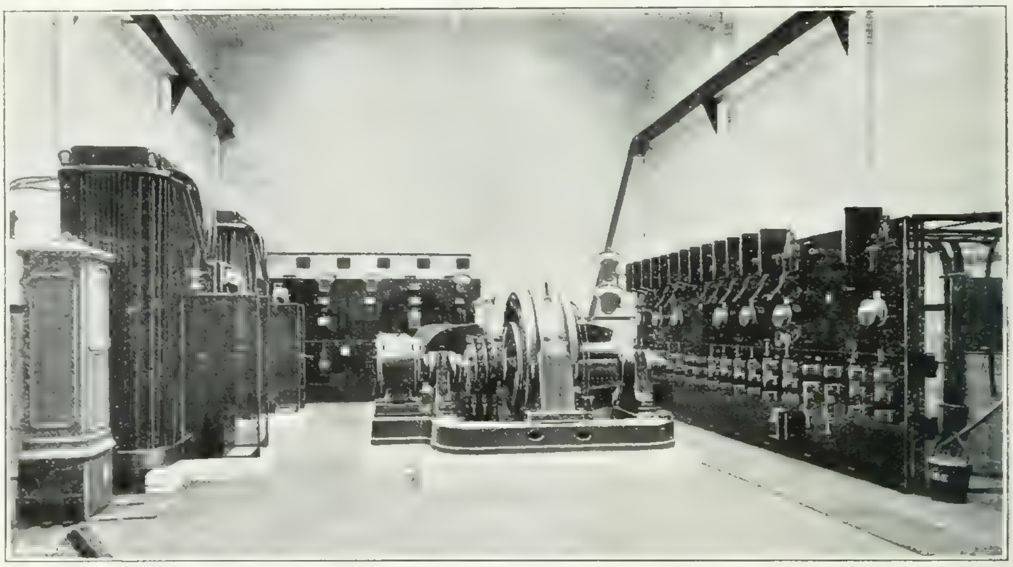
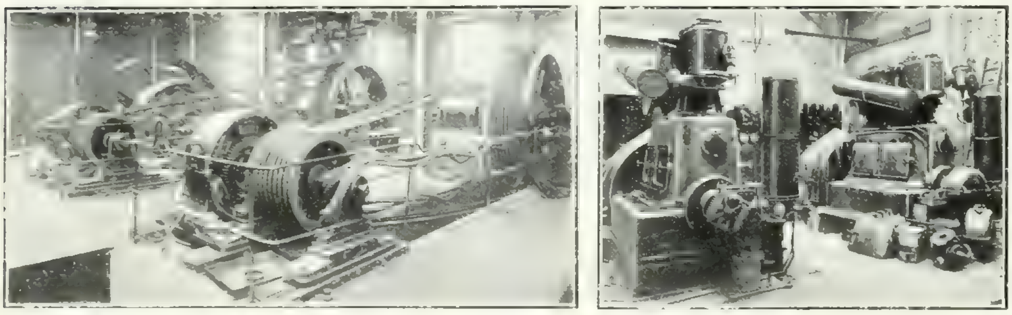


Fig. 9.—Bay Street Sub-Station, Port Glasgow.

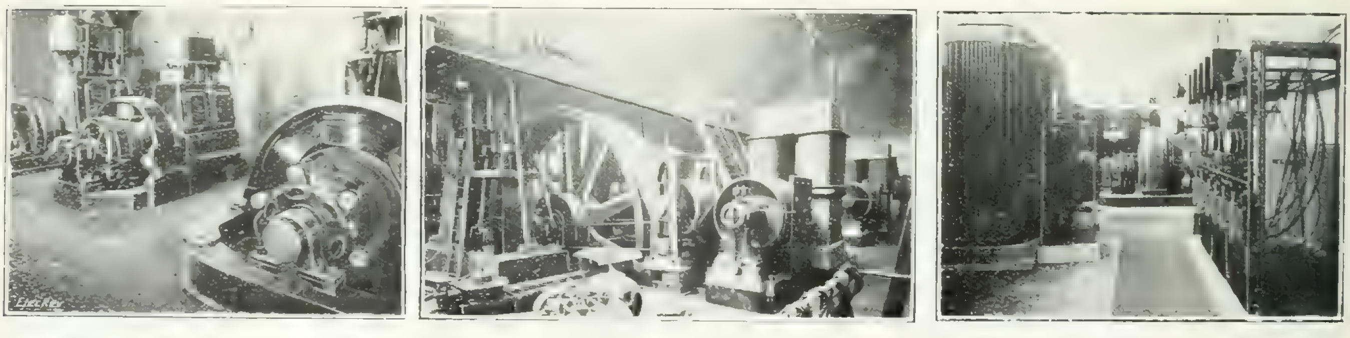
A turbo-alternator set of 5,000 kw. capacity has also been installed, thus bringing the total plant capacity of the power station up to 11,300 kw. (four turbo-alternators totalling 9,000 kw. and four reciprocating d.c. sets totalling 2,300 kw.).

This last set consists of a Westinghouse Rateau impulse turbine running at 1,500 r.p.m. and driving a 3,300-volt, 50-cycle alternator of the compensated type. A Sturtevant wet air filter is provided, and the condenser is operated by a turbine-driven air pump of the Le Blanc type.



Gas Driven Plant of the Clyde Shipbuilding and Engineering Co., Ltd.

Steam Plant of Messrs. Dunlop, Bremner and Co.



Messrs. Russell & Co.'s Plant at Kingston Yard.

Old Friends at Messrs. Wm. Hamilton & Co.'s Works.

Sub-Station at Messrs. Hamilton & Co.'s Works.

Figs. 10—14.—Some Examples of Plant Superseded by the Corporation Supply; and one of the New Sub-Stations.

Further converting plant has been provided by separating a 750-kw. motor-generator set, which consisted of two 250-volt and one 500-volt d.c. machines coupled together on the same bedplate and used as a motor balancer. Instead of the 500-volt machine, a 3,300-volt 750-kw. induction motor has been connected to the two 250-volt machines, thus providing 750 kw. of converting plant in the main power station, which can be used as a balancer; the 500-volt machine has been coupled to another 3,300-volt 750-kw. induction motor, and the set has been installed in the original Hunter Place station, which is now used entirely as a sub-station. In addition to this 750-kw. motor-generator, there are in this sub-station two 500-kw.-volt Westinghouse rotary converters and transformers.

Two 18,000-lb. Babcock & Wilcox boilers have been added, bringing the total number of boilers up to 12, including the three destructor boilers, and the overhead coal bunkers and conveyor have been extended to include these additional boilers. To make room for a large economiser to meet the requirements of the increased plant, the original pump room at the end of the boiler house has been removed and a new pump room has been erected. The pumping plant consists of one 7,000-gallon Rees Roturbo rotary pump, one 10,000-gallon and one 4,000-gallon Weir double-acting vertical pumps; one 10,000-gallon and one 7,000-gallon Weir latest type rotor feed pumps. Above the pump room is situated the Paterson oil-eliminating plant, while in the basement below the pump room are placed the two hot wells, one for turbines and one for reciprocating plant. In the basement is also located the apparatus for measuring the condensed water from any one of the generating sets in the station. Two large tanks are mounted on Avery weighing machines, and the condensed waterpipe is made to terminate above and between these tanks. A two-way cock and tee-pipe are fitted by which the water can be directed into either tank. When a generating set is to be tested, the condensed water from the set is directed by means of selector valves into the pipe connected to the tanks. When one tank is filled, the weighing machine is balanced, and the weight is then automatically stamped on a card, after which the tank is emptied by a valve in the bottom. Meanwhile, the next tank is filling, and the process is repeated continuously during the period of test. The load on the machine is kept fairly constant, and the units generated during the test are noted, and the consumption per KW.-hour at that load is thus easily obtained. The performance of each generator is checked in this manner at frequent intervals.

Two Lea recorders have been installed. One records the total boiler feed, while the other is connected in circuit with the 5,000-KW. turbo-alternator set.

A Sanders Rehders steam meter is installed to record the steam delivered from the refuse destructor boilers, and the British Thomson-Houston Co.'s steam meters are to be fitted to several of the boilers.

Although Greenock is favoured with a remarkably good power load, the possibilities of the domestic load have not been neglected. Energy for heating and cooking purposes is sold at a flat rate of ¾d. per unit if metered separately, but where this is not possible an "annual charge" tariff may be adopted by which the consumer pays a fixed sum per quarter based on the lighting maximum demand, and all units registered by meter for both lighting and heating purposes are charged at ¾d. per unit.

Over a year ago, the Corporation opened large showrooms in the main thoroughfare for the use of its hiring and publicity section. This department was inaugurated in 1904 for the hiring of lighting installations and motors, and already 383 lighting installations and 160 motors have been fitted up on this system. Lately, the scheme was extended to include cookers, &c., and of these the department has installed 56 cookers, 162 radiators, and 186 irons, kettles, &c. As showing the necessity for the Corporation's policy of providing facilities for hiring electrical appliances, it may be pointed out that out of the total of 1,650 consumers on the mains, no fewer than 453 have been introduced to the undertaking through this hire and hire-purchase department, and these represent a demand of over 1,700 KW. distributed among houses, shops, factories, and workshops.

As an indication of what can be done in developing the heating load when tariffs are favourable, it is only necessary to mention that during the three months ended December 31st, 1914, the department sent out on the hire-purchase system 58 radiators, 19 irons, and 11 kettles, making a total increase in the connections to existing services of 103 KW.

The development of the undertaking during the 15 years of its existence is shown in the following table, which gives the data for the fifth, tenth and fifteenth years of operation :—

	1903-04.	1908-09.	1913-14.
Units sold	1,413,783	3,495,852	11,451,438
Average price obtained per unit	2·00	1·45	1·04
Total cost per unit, pence ...	1·25	·825	·610

Mr. J. A. Robertson, the late engineer (now borough electrical engineer of Salford) was responsible for the Port Glasgow extension scheme, and the new engineer, Mr. Frank H. Whysall, has put the scheme into operation on the lines planned by his predecessor.

Owing to the large amount of Admiralty work carried out in Greenock, the demand for power has risen to such an extent that further extensions are urgently required. These include a new 5,000-KW. turbo-alternator set, the erection and equipment of a rotary converter sub-station in the east end of the town to relieve the overloaded feeders in that district, the installation of another 500-KW. rotary converter in Messrs. Scott's Engine Works sub-station, the laying down of a new 0·6 sq. in. feeder to the centre of the town, and the erection of large economisers and flues at the power station.

We are indebted to Mr. Frank H. Whysall, M.I.E.E., for the foregoing information regarding the undertaking, and to Mr. John H. Parker, his chief assistant, for the photographs with which this article is illustrated.

NOTES.

(*Continued from page 288.*)

Parliamentary.—*London County Council's Tramways Bill.*—The Select Committee on Standing Orders have agreed that the London County Council Tramways and Improvements Bill be allowed to proceed on condition that Tramways Nos. 3 and 3A are struck out of the Bill.

London Electric Supply (No. 2) Bill.—On the motion for private business in the House of Commons on Monday night, the Chairman of Ways and Means on the London Electric Supply Bill said :—After carefully considering the nature and scope of the powers which are sought in this Bill, I have informed the promoters that in my opinion the Bill is not one which the House ought, in the present Session, to be called upon to consider, raising, as it undoubtedly does, important questions of a public character and contentious nature. The promoters have therefore agreed that the order for the Second Reading of the Bill shall be discharged and the Bill withdrawn. The question was put and agreed to.

Second Readings.—In the House of Commons on Tuesday, the Metropolitan District Railway Bill was read a second time, as was also Rhondda U.D.C. (Tramways Extensions, &c.) Bill.

In the House of Lords, the Mersey Railway Bill, the Yorkshire Electric Power Bill, and Ormskirk Gas and Electricity Bill were read a second time.

Standing Orders.—The Standing Orders Committee having considered the Aberdare U.D.C. Tramways Bill and the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board Bill, which were reported for non-compliance with Standing Orders, have decided that the Bills may be allowed to proceed. They have also allowed the Halifax Corporation Bill to proceed on condition that Tramways Nos. 4, 5, 6, 7 and 21 are struck out.

Petitions.—In addition to the petitions deposited in the House of Commons, the following, amongst others, are lodged in respect of Bills emanating in the House of Lords :—Yorkshire Electric Power, 25 petitions including a number of local authorities and gas companies ; Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board 12 petitions, including the Lancashire Electric Power Co., Derbyshire and Cheshire County Councils, &c. ; Aberdare U.D.C. Tramways by the Great Western and Taff Vale Railway Co. ; Ormskirk Gas and Electricity by the Lathom and Burscough U.D.C.

A Letter from the Front.—The Chairman of the Epsom Urban Council (Councillor C. Cropley) has received a letter from Mr. A. C. Gilling, the electrical engineer of Epsom, who is at the Front with the Westminsters. The letter reads :—"Life out here is not quite such a holiday as Egypt or India would have been, but I would not have missed the experience for worlds. We spend about four days and four nights in the first line, and then we go into the reserve for a few days. You would not recognise me if you saw me. We wear two pairs of socks, two pairs of puttees, one ordinary uniform, a fur coat over all, and, lastly, inches of mud. I am writing this in what we call a 'bug-hutch.' It is a nice little hole dug in the ground, in which three of us live and sleep, and at the time of writing the enemy is taking pot shots at anyone who shows his head for a moment above the trench. One of our greatest amusements is considering how to devise a new way of cooking bully beef and making tea. Life is pretty strenuous. I have not had my boots or clothes off for three weeks, and I am getting quite used to sleeping on the ground—concrete floor. Our best fun is at night on guard. We wait for the flashes from the German rifles, and then fire back from where they come. The only unfortunate thing is, we don't know if we hit the mark."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Last week the Middlesbrough Electricity Committee, according to a Yorkshire paper, consented to release the borough electrical engineer, MR. H. M. TAYLOR, who intended offering his services to His Majesty's Forces.

The staff of the Stamford electricity works have presented a hall clock to MR. W. WELLS, meter inspector, on his marriage ; the gift was handed to Mr. Wells by the resident manager of the Urban Electricity Supply Co., Lieut. F. H. Brandreth.

MR. WILLIAM MAWBY, a member of the staff of the Blackburn Corporation electricity department, was married at Blackpool on Monday to Miss Mary A. Frankland, of Blackpool. Mr. Mawby's colleagues at Blackburn have presented him with a mahogany timepiece.

We are glad to hear that MR. C. CLARE ATCHISON, the Rochdale borough electrical engineer, who has undergone an operation, is improving.

MR. J. W. A. DEVOY has resigned his position as mains superintendent to the Tunbridge Wells Corporation electricity department.

Tynemouth Corporation has been recommended to increase the salaries of the following officials in the electricity department as from April 1st next :—Mr. C. Turnbull, jun., electrical engineer from £300 to £325 per annum ; Mr. J. Waller, engineer, from £3 to £3 5s. per week ; Mr. H. T. Wilkins, chief clerk, from £2 to £2 5s. per week.

Mr A. J. Seward having resigned his appointment as constructional lighting superintendent at the West Ham electricity works, Mr. J. Turtle, the assistant, has been appointed to fill the vacancy at a salary of £156 per year, plus commission. The Electricity Committee proposes to grant the following increases in the salaries of the undermentioned employés :—Mr. H. Irons, installation inspector, Mr. G. Hale, constructional assistant, Mr. W. Whitney, assistant mains engineer, from £215 to £240 per annum ; Mr. J. C. Retzbach, assistant draughtsman.

Upon consideration of a recommendation by the Electricity and Tramways Committee of the Bingley District Council that the salary of the electrical engineer should be increased by £20 per annum, the Council referred the matter back.

Mr. J. B Patterson, at present works superintendent at Lancaster electricity works, has been appointed assistant engineer while Lieut. G. C. Milner (engineer) is on active service at the Front. Councillor Heald (chairman of the Committee) said the appointment was well merited ; and he complimented one of the works employés, Mr. W. Corless, on having returned to the Colours with five sons.

Tramway Officials.—Mr. Charles Henry Hoggard, who has for 17 years been associated with the Sheffield tramways, has been appointed traffic superintendent of the Darlington municipal tramways.

Mr. R. L. McCulloch, manager of the Warwick and Leamington Tramway and Lighting Co., has been appointed general manager of the City of Carlisle Electric Tramways.

Mr. L. Johnson, manager of the tramways at Southampton, has resigned.

The Tramways Committee of the Huddersfield Town Council have granted the following increases of salary :—Mr. A. P. Quilliam, assistant tramway engineer, from £170 to £180 ; Mr. T. Hartley, traffic superintendent, from £150 to £160.

General.—Mr. T. P. Brogan has been appointed chairman of the Battersea Electricity Committee for the ensuing three months.

Mr. C. C. T. Eastgate, M.I.E.E., has been appointed Electrical Inspector to the Government of the Punjab, and sails for India on the 6th prox.

Obituary.—Mr. R. H. Claxton.—It is with much regret that we have to record the death on the 18th inst. of Mr. Robert Heywood Claxton, one of the most prominent pioneers of the telephone system in this country. Born in Liverpool in 1840, it was in Liverpool also that Mr. Claxton's telephonic activities commenced in 1879. In 1905 he retired from the position of provincial superintendent of the National Co.'s north-western province, and was elected to a local directorship, which position he continued to occupy until the taking over of the National Co.'s system by the Government at the end of 1911. It was in New Brighton, near Liverpool, that Mr. Claxton passed away. He was remarkable for a prompt recognition of the peculiarities of the Telephone Exchange business, and its combination of commercial and engineering problems. Though claiming no technical qualifications, he had exceptional judgment in the selection of his engineering advisers, the earliest of whom was Mr. Haworth, and amongst others we may recall the late Mr. Hope-Jones, Mr. France, and Mr. Gill, all of whom served under Mr. Claxton. It is perhaps for this reason that Liverpool was prompt to adopt new developments in the art. On October 18th, 1884 (Electrical Review, Vol. XV, page 312), we recorded the introduction of the multiple switchboard at Liverpool, and the first use in the United Kingdom of dry core cable was made in Mr. Claxton's district in the Mersey Tunnel. He was the first to employ lady operators, and with such success as to lead to his assistance being sought to organise a similar staff in London. His relations with his subscribers and the local authorities were of the best, and in the competitive era Liverpool was immune from competition. With his colleagues and business friends he was always cordial and courteous, and regret at his death will be general and widespread.

Lance-Corporal J. A. Donald.—We regret to learn of the death, at the age of 24 years, of Lance-Corporal J. A. Donald, of the Royal Naval Division (Engineers' Section), who died suddenly from myocarditis whilst on leave on Sunday last. He was for several years on the electricity works staff of the Blackpool Corporation, and we have it on the best authority that he gave promise of a very brilliant career. He was a most successful student at the Harris Institute, Preston, having taken the bronze medal and many certificates in electrical and mechanical engineering. He had also been a student of the Institution of Electrical Engineers since 1911. Lance-Corporal Donald, along with two other members of the Blackpool staff, joined the R.N.D. of the Institution of Electrical Engineers in September.

Mr. F. W. Farmer.—The death is announced of Mr. Frederick William Farmer, for many years engineer at the Weymouth electricity works.

Mr. J. W. Proctor.—The death has taken place, in his 55th year, of Mr. Jas. Wm. Proctor, of the firm of Jas. Proctor, Ltd., mechanical stoker makers, of Burnley.

Mr. G. Matthews.—The sudden death is announced of Mr. George Matthews, for many years manager of the carriage department of the Bristol Tramways and Carriage Co., Ltd. He was in his 73rd year.

Mr. William Long, of Thelwall Heys, Grappenhall, near Warrington, and Cleabarrow, Windermere, whose death is announced at the age of 80 years, was a director of the Windermere and District Electricity Supply Co., Ltd., and was first chairman of the company.

The death has occurred, in his 36th year, of Mr. Michael Traynor, of Bray, Co. Wicklow, chairman of the Urban District Council's Electric Lighting Committee.

NEW COMPANIES REGISTERED.

M-L. Magneto Syndicate, Ltd. (139.152).—This company was registered on January 28th, with a capital of £15,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, apparatus, machinery, instruments and fittings used in connection with the generation, distribution, supply, accumulation and employment of electricity, general electrical engineers and electricians. The subscribers (with one share each) are :—D. H. Morris, 14, Waverley Road, Kenilworth, electrical engineer ; G. A. Lister, 23, Coundon Road, Coventry, electrical engineer. Private company. The number of directors is not to be less than two or more than six ; the first are C. A. Lister, D. K. Morris, G. A. Lister and E. A. Watson. So long as R. A. Lister & Co., Ltd., hold the majority of the shares, they may appoint two other directors ; remuneration as fixed by the company. Registered office, Carlton Works, Lockhurst Lane, Coventry.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Foster Engineering Co., Ltd.—A memorandum of satisfaction to the extent of £4,000 on February 10th, 1915, of second debs., dated August 1st, 1913, securing £9,000, has been filed.

Wellingborough Electric Supply Co., Ltd.—Issue on February 12th, 1915, of £2,700 debs., part of a series of which particulars have already been filed.

Sun Electrical Co., Ltd.—A memorandum of satisfaction to the extent of £275 on February 9th, 1915, of deb. stock dated March 31st, 1911, securing £7,000, has been filed.

Sheerness and District Electric Power and Traction Co., Ltd.—Issue on February 12th, 1915, of £1,000 6 per cent. second debs., part of a series of which particulars have already been filed.

Bombay Electric Supply and Tramways Co., Ltd.—Issue on January 1st, 1915, of £10,000 debentures, part of a series of which particulars have already been filed.

Holophane, Ltd.—Capital, £200,000 in £1 shares (100,000 pref.) Return dated November 13th, 1914 ; 60,732 pref and 92,435 ord. shares taken up ; £15,207 paid ; £137,960 considered as paid. Mortgages and charges, nil.

Mond Nickel Co., Ltd.—Particulars of £500,000 6 per cent. redeemable debenture stock, created November 17th, 1914, and secured by trust deed dated February 10th, 1915, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged : The company's undertaking and property, present and future, except uncalled capital, subject to £375,000 1st mortgage deb. stock. Trustees : Rt. Hon. Earl of Selborne, K.G., G.C.M.G., and R. Armitage, M.P.

Costa Rica Electric Light and Traction Co., Ltd.—Capital, £130 000 in £1 shares. Return dated January 6th, 1915. All shares taken up. £7 paid. £129,993 considered as paid. Mortgages and charges : £286,650.

John Spencer, Ltd.—Capital, £75,000 in £5 shares (10 000 pref.)—Return dated December 8th, 1914. 10,000 pref. and 1,027 ord. shares taken up. £55,135 considered as paid. Mortgages and charges : £25,000.

Cordoba Light, Power and Traction Co., Ltd.—Capital, £1,000,000 in £1 shares (300,000 pref., 600,000 ord. and 100,000 unclassified). Return dated December 23rd, 1914. 300,000 pref. and 600,000 ord. shares taken up. £1 per share called up on 300,000 pref. and 170,100 ord. shares. £470,100 paid. £429,900 considered as paid on the remainder. Mortgages and charges : £834,000.

CITY NOTES.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

During the year 1914 the number of houses and shops connected with the system increased by 124, from 4,817 to 4941, and the energy consuming devices, calculated as represented by lamps of 30 watts consumption, by 6,528 to 488,912 (14,600 kw.). The net profit available for dividend is £14,020, plus £2,558 brought forward.

Deducting the interim dividends on the ordinary and preference shares, £7,575, there remains £9,004.

The second half-year's dividend on the first preference shares absorbs £1,500, and the dividend on the second preference shares from the 1st October to 31st December, £625. A dividend at the rate of 10 per cent. per annum for the last half-year (£5,250) making 9 per cent. for the year on the ordinary shares is recommended, carrying forward £1,629.

The renewal and reserve fund account has been increased by the transfer of £9,746, and now stands at £131,884, of which sum £93,454 is the amount expended in excess of capital received, the balance being represented by working capital, investments, and cash balances. The directors announce the resignation of Mr. R. W. Wallace, K.C., who had been a director since the formation of the company. They have elected Mr. H. W. Miller, who has been associated with the company from its commencement, to the vacancy. Mr. Miller has been appointed managing director.

Annual meeting, March 4th.

Underground Electric Railways Co. of London.

The report shows that for the year ended December, 1914, the net revenue from investments and properties (including general interest), after deducting general expenses, amounted to £673,830. The service of the 4½ per cent. bonds of 1933, required £89,349, and of the 4½ three year secured notes from 30th April to 31st December, required £21,085, leaving a surplus of £563,396. Payment under the guarantee on Central London Railway Company Assented Stocks for the year absorbs £37,031; six per cent. per annum on £1,273,000 six per cent. first cum. income debenture stock for the year, requires £76,380; six per cent. per annum plus income tax on £6,330,050 six per cent. income bonds of 1948, for the year, absorbs £411,544, leaving £38,442. The income from investments and other sources amounted to £684,626, an increase of £54,809 or 8.70 per cent.

The passenger earnings of some of the companies have been adversely affected by the conditions prevailing in London since the commencement of the war, and there has been an increase in expenses due to increased wages and cost of material. As a result, the revenue from these companies is less than that for the corresponding period in the previous year.

Before the war began the London Electric Railway and City and South London Railway Companies were well forward with their preparations for proceeding with the extensions and improvements involving large capital expenditure. As the conditions of the money market were then not favourable to capital issues by these companies, this company bought from them £463,000 and £412,000 of their respective debenture stocks, and issued £700,000 of its own 4½ per cent. three-year notes secured on these debenture stocks.

During the year this company acquired all the issued shares and debentures of the Metropolitan Steam Omnibus Co., Ltd., which subsequently sold its assets to the London General Omnibus Co., and was wound up. At the same time the Underground Co. sold to the L.G.O. Co. the assets which it had purchased in the previous year from the New Central Omnibus Co., Ltd., and this company has also been wound up.

The northern extension of the London Electric Railway, from Paddington to the Queen's Park Station of the London and North Western Railway, was opened for public traffic on January 11th, 1915, as far as Kilburn Park Station, and on February 11th, 1915, to Queen's Park station. The intermediate station at Maida Vale will not be opened until April next.

Additional omnibuses were added to the fleet of the L.G.O. Co. and new garages built in the early part of the year under review, but the total number of omnibuses in service and garages in use has been substantially reduced by the requirements of the War Office and Admiralty.

The Associated Equipment Company is making additions to its factory and equipment which will afford facilities for a much larger output.

The balance of £45,170 on revenue account on December 31st, 1913, has, in consequence of the changes in the constitution of the company, been applied in reduction of the item "Commission and discount of issue of bonds." The item of stocks and shares stands in the books at £14,520,892.

Passengers carried and passenger receipts earned by Associated Companies:—

	1912.	1913.	1914.
Metropolitan District—			
Passengers	86,003,149	89,438,332	*
Receipts	£652,670	£686,177	*
London Electric—			
Passengers	100,882,586	100,263,755	101,074,981
Receipts	£713,629	£709,872	£707,393
Central London—			
Passengers	–	37,505,424	36,702,836
Receipts	—	£250,257	£240,029
City & South London—			
Passengers	-	22,723,856	23,847,930
Receipts		£145,652	£136,128
London & General Omnibus—			
Passengers	487,201,629	580,205,335	569,343,223
Receipts	£2,684,329	£3,191,205	£3,132,259
Total—			
Passengers	674,087,364	830,136,703	*
Receipts	£4,050,628	£4,983,163	*

* Figures not available—Metropolitan District Railway, under Government control from August 4th, 1914.

Annual meeting, March 4th.

Metropolitan Railway Co.

The report submitted at yesterday's annual meeting, after referring to the Government control of the system since the war and the basis agreed upon with the companies, showed that the gross receipts in respect of the railway, etc., were £969,982, and the expenditure was £558,139, leaving £416,783, plus £181,503, miscellaneous receipts (net) from rents, interest, brought forward. Deducting interest, rentals and other fixed charges, and appropriation to renewals, £302,788, and dividends on preference stocks, £211,482, the balance available for dividend on ordinary stock is £92,274.

The dividend is £1 5s. for the year, with £11,458 carried forward, and £12,500 transferred to the general renewals fund. The dividends for 1913 was £1 12s. 6d. per cent., and £8,258 was carried forward. The dividend on the surplus lands stock is £2 15s. per cent., the same as for 1913.

The electrical sub-station at Drayton Park has been completed, and the current for working the G.N. and City section has been supplied from the company's generating station at Neasden since 24th September last with satisfactory results. In April last new stations were opened at Goldhawk Road and Uxbridge Road on the Hammersmith and City line, which have taken the place of the old Shepherd's Bush Station, now closed. Escalators have been put in at Baker Street Station at the joint expense of this company and the London Electric Company to improve the means of exchange between the Metropolitan and Bakerloo systems. Owing to the situation created by the war, delay has taken place in the commencement of the building of the hotel at Baker Street. The completion of the widening of the railway between Finchley Road and Wembley Park has been delayed mainly in consequence of the scarcity of labour arising out of the war, but it is expected that the section at present unfinished, namely, the viaduct at Kilburn, will be completed and brought into use in the course of the next few months.

The company is not promoting any Bill in the present session of Parliament.

Having regard to the large amount standing to the debit of capital account, the directors availed themselves of a favourable opportunity to issue £500,000 £5 per cent. preference stock in December last. The stock is being paid for by instalments, and a substantial proportion has been pre-paid.

Four hundred and thirty of the employés of the company have joined His Majesty's Forces, and many of them are now serving abroad.

Central London Railway Co.

Lord George Hamilton presided on February 18th at the annual meeting, held at the Westminster Palace Hotel. He said that owing to the war, the gross receipts were £10,146 less than in the previous year. The car mileage had decreased by 466,591 miles, or about 7 per cent. The passenger receipts per car mile were 9.390d., compared with 9.099d. for the corresponding period. The percentage of operating expenses to traffic receipts was 59.67, as compared with 58.47 for the preceding year. The balance available for dividends was £115,762, which was £16,716 less than for the corresponding period. This year they paid ⅜ per cent. less on the ordinary stock, and ¾ per cent. less on the deferred ordinary stock. Even with those reductions in dividend the balance which they carried forward of £15,413 was £5,465 less than the balance of the preceding year. Looking, therefore, to the future, to the almost certain increased cost of coal, and the various other charges that might be put upon the company, they thought it undesirable to further reduce the balance, and he thought, considering the uncertainty which attended the future traffic of underground railways in London, the shareholders would agree in thinking that the directors exercised a judicious discretion in thus curtailing the dividend. They had also considered it expedient to postpone embarking in new contracts, and thus certain extensions and improvements, such as the widening of the tunnels at Holborn, and the installation of escalators at Shepherds Bush, Oxford Circus and the Bank, were postponed. The Wood Lane extension, which would connect the line with Ealing, had been advanced, but owing to the war the progress had not been very rapid. As regarded the future receipts and progress of the company he wished to speak with all caution. The property was in most excellent order, and the extension which would shortly be made to Ealing would, he thought, give it additional attraction. On the other hand, it did suffer considerably from competition with the motor-'buses, for their track lay parallel with it almost throughout the whole of its route. Their experience in the past was that in fine weather passengers preferred for short journeys the motor omnibus, while for more lengthy travel they had recourse to the tube railways, and therefore every extension such as that which was about to be completed to Ealing would add to the receipts of the railway.

Earl St. Aldwyn seconded the motion, which was carried unanimously.

Metropolitan District Railway Co.

Lord George Hamilton, G.C.S.I., presided, on February 18th, over the annual meeting. He said that in common with other railways they had felt the effects of the war. The Government had taken over the control of the railways from the outbreak of hostilities, and they arranged to pay the companies the net revenue which they obtained in 1913, subject to the condition that if such receipts in the first half of 1914 proved to be less than the amount received in the corresponding period of 1913, the compensation payable to the companies should be reduced proportionately. That principle had somewhat adversely affected those companies whose receipts in the first half of 1914 were higher than those in the corresponding period. They had a balance available for dividend on the second preference stock of £43,288. Upon that stock they last year paid a dividend of 2½ per cent. for the whole year. They came to the conclusion, after careful consideration, that this year it would not be desirable to pay more than a 2 per cent. dividend for the whole year. 1½ per cent. had been paid in the half year ending 30th June, 1914, and they proposed to pay ½ per cent. for the second half year and to carry forward a balance of £13,888. They could, out of the balance, have paid another ½ per cent. dividend, but they came to the conclusion—looking at the probable rise in the price of coal and other supplies—that it would be desirable to carry forward a good balance. As regarded capital expenditure, they determined to postpone all new contracts that were not absolutely necessary or in connection with which agreements had not been entered into. Certain of the stations had been materially improved: Charing Cross was now connected by escalators with two of the underground railways, and he was glad to say that the improvements there effected were thoroughly appreciated by the public, and were bringing them a substantial increase in receipts. Structural alterations had been made at Blackfriars Station, and the flying junction works at Earls Court had been completed and opened for traffic, and additional rolling stock had been delivered and placed in operation. The capital expenditure during the year had amounted to £117,399, the main items being £12,194 expended upon the flying junction at Earl's Court, and £77,215 on rolling stock. Estimated further capital expenditure amounted to £60,000, of which £25,000 was required for miscellaneous items. Since the outbreak of war, a very considerable number of the officers and staff of all the companies who were working in connection with the Underground were summoned or enlisted for war service. He was proud to think that the Underground group supplied a large number of men in answer to this call. In reviewing the past year, there was one incident which gave special satisfaction to everybody connected with his railway. It was the honour of knighthood which was conferred upon their popular and competent managing director. Sir Albert Stanley's connection with the Metropolitan District had been one of continuous progress. He had the knack of making himself as popular with the employés under his control as with the general managers of other companies, and he thought it was universally felt that no more appropriate selection for distinction of the Sovereign could have been made from the high officials of railway management. His review of the incidents connected with this railway during the past year was necessarily bald and jejune, but he and the other directors had unabated confidence as regarded the future prosperity of the line when peace and quietude were restored, and although its development might be slow there was every indication that it would be both certain and continuous.

Sir Charles Dalrymple, Bt., seconded the motion, and the report was adopted.

London Electric Railway Co.

The annual meeting was held on February 18th at the Westminster Palace Hotel. Lord Farrer, who presided, said that the railway did not come under Government control, but during mobilization complete freedom of transport was given to soldiers and sailors. Having referred to the arrangements made to pay certain salaries to the officers and clerical staff engaged on war service, and congratulated Sir Albert Stanley on his knighthood, his lordship proceeded to refer to the progress of the various works sanctioned at previous meetings. The Charing Cross extension, opened in April, was familiar to all Londoners, and even with the abnormal conditions which had prevailed during the last six months, was showing good results. The Queen's Park extension, already under construction to link up the Charing Cross railway with Watford, was opened—as far as that company was concerned—last month, as part of their original scheme, and they hoped in normal times would develop a satisfactory traffic. These and other works were part of a well-considered plan for developing the traffic of London and could not be postponed. But on the outbreak of war the directors felt that no further expenditure should be undertaken on capital account for the moment, and therefore postponed the Hammersmith widening, the further arrangement of moving staircases, and the Euston and Camden Town extensions, which had not been begun; and they were enabled to effect some saving by the closing of one of the unnecessary surface stations at Euston, in October, which was very little used by the public. They could only hope that the situation would soon improve and allow them to proceed with the development of the undertaking. The total capital expenditure for the year was £399,997, and the estimate of further expenditure on capital account was £126,900. The estimated cost of works not yet commenced and in abeyance was £1,204,400; these works comprised the extension from Golders Green, the Hammersmith and Camden Town extensions, and the installation of escalators at Trafalgar Square, Piccadilly Circus, and Tottenham Court Road stations. Turning to the revenue, the gross receipts had amounted to £712,573, being a decrease of £2,746, or .38 per cent. compared with the receipts for the corresponding period. The total expenditure had been £345,001, an increase of £12,145, or 3.65 per cent. Rates and taxes had increased by about £2,400 and it had cost the company £889 for watching and patrolling the line. National insurance had increased by £366. The percentage of operating expenses to gross receipts was 48.6, compared with 46 76 for the corresponding period. Train mileage showed a decrease, although an increase had taken place in the shunting miles caused by the opening of the Paddington extension. The average fare per passenger was 1 69d., as compared with 1.70d. for the corresponding period: The number of season ticket holders had increased. The directors were of opinion that when all the conditions which had prevailed since the outbreak of war were taken into account the results were not unsatisfactory.

Sir Algernon West, G.C.B., seconded the motion, which was carried.

South Metropolitan Electric Light and Power Co., Ltd.

The revenue account for 1914 shows a credit balance of £43,054 plus £5,571 brought forward, making £48,625. After deducting £13,084 for interest on debenture stock paid and accrued, and for other interest, and £6,696 for interim dividends paid on the preference shares, there remains £28,845. Final dividend on the 7 per cent. cum. first pref. shares absorbs £5,004; final dividend on the 6 per cent. ditto absorbs £2,250; there is put to depreciation account £5,000; to credit of "issued expenses" £1,000; to reserve account £10,000, and £5,591 is carried forward.

Year.	Lamps (35 watt).		Consumers.	Gross Revenue.	Expenditure.	Net Revenue.
	Connected.	Increase.		£	£	£
1912	258,872	28,681	5,263	56,604	22,670	33,933
1913	289,705	30,833	5,888	65,635	24,065	41,570
1914	330,982	41,277	6,468	66,792	23,737	43,054

Notwithstanding the loss of revenue due to restricted lighting and the disturbance of the normal course of business by the war, the above table shows an increase under every heading except expenditure, which shows a decrease; and the net revenue is nearly £1,500 more than for 1913. In the circumstances, the directors consider this highly satisfactory. The sum which by the provisions of the debenture trust deed has to be set aside to special reserves before payment of any dividend on the ordinary shares, amounted during the past year to £15,874. The surplus profits after carrying £6,000 to depreciation and "issue expenses" accounts, but without making such other reserves, represent a dividend of 8 per cent. on the ordinary shares. The issue of 25,000 six per cent. cumulative second preference shares, made in March last, was over-subscribed, and during the year a further £5,630 four-and-a-half per cent. debenture stock has been allotted. The development of the West Kent Power Company is progressing satisfactorily. New business of a substantial character has been secured, and the prospects are very favourable.

"Two Bills affecting your company's interests were presented to Parliament, one by the London County Council, and the other by some of the London Electric Supply Companies. The former is not being proceeded with, and, as at present advised, your directors do not see their way to support the latter."

Annual meeting, March 1st.

County of Durham Electrical Power Distribution Co., Ltd.

The report for 1914 states:—The total connections to the company's system at the end of the year amounted to 81,887 h.p., an increase of 11,392 h.p. The profit is £23,946 plus £1,111 brought forward. Interest on loans and debenture stock, £12,508, being deducted, the available balance is £12,540. The directors recommend a dividend of 4 per cent. for the year on the preference shares, £10,000. The question of depreciation is being considered in connection with a scheme of writing down the capital.

The expenditure on capital account during the year has been £34,285, of which £32,619 is the outlay on behalf of its associated company, the County of Durham Electric Power Supply Co. The profit for the year has suffered principally through the reduction in the dividend received from the County of Durham Electric Power Supply Co., which company's revenue has been adversely affected by the war. The offer sent out by the Newcastle company to each shareholder of the company of an exchange of shares on certain terms, has been accepted almost unanimously, only four shareholders, representing a nominal capital of £400, not having sent in their acceptances.

Charing Cross, West End and City Electricity Supply Co., Ltd.

In their report for 1914, the directors say that the result, having regard to the exceptional circumstances brought about by the war, cannot be considered as unsatisfactory.

West End undertakings.—The gross earnings of these undertakings from sales of current, rent, etc., were £142,086, as compared with £151,240 for 1913. The expenses, excluding depreciation, were £69,677, as compared with £66,866 for 1913. The net earnings were £72,409, against £84,374. After including £18,000 brought from last year, paying interest on the debenture stock, and providing £22,000 for depreciation, £56,304 remains, out of which the preference dividend for the year absorbs £18,000, and the interim dividend for the half-year at the rate of 5 per cent. per annum on the ordinary shares, £10,000. A final dividend on the ordinary shares is recommended at the same rate, making 5 per cent. for the year. This requires £10,000, and after transferring to general reserve (income) account £304, £18,000 is carried forward.

The company has now connected to its city mains the total equivalent of 718,473 (30 watt) lamps. The total includes 325,436 in lighting, 55,489 in heating, and 337,548 (13,574 H.P.) in motive power.

City undertaking.—The gross earnings of this undertaking from sales of current, rents, etc., were £153,689, as compared with £149,819 for 1913. The expenses were £86,983, against £80,639, and the net earnings were £66,706, against £69,180. Including £18,000 brought forward from 1913, paying interest on the debenture stock, loans and advances, there is a balance on net revenue account of £54,367, out of which has been paid the dividend on the preference shares amounting to £18,000, leaving £36,367, as compared with £38,327 for 1913.

The directors recommend that £18,367 be transferred to general reserve (income) account, and £18,000 carried forward.

The company has now connected to its West End mains a total equivalent of 708,470 (30 watt) lamps. The total is made up as follows:—455,512 in lighting, 33,187 in heating, and 219,771 (8,838 H.P.) in motive power.

The Chief Engineer certifies that the plant and machinery at the several stations of the company have been maintained in a high state of efficiency.

The company is associated with the Brompton and Kensington, Central, Chelsea, Kensington and Knightsbridge, London Electric, Metropolitan Electric, Notting Hill, St. James's and Pall Mall, and Westminster Companies, in promoting a Bill, entitled "The London Electric Supply (No. 2) Bill."

	West End undertakings.	City undertakings.
Units generated	6,432,593	30,161,270
Units bought	9,770,753	391,945
Units sold—Public lamps	439,958	—
Other sales	11,994,327	—
Total units sold	12,434,285	25,424,940
Used on works, and transmission and distribution losses	3,769,061	5,128,275
Total accounted for	16,203,346	30,553,215
Public lamps	303	—
Total maximum supply demanded in KW.	7,024	12,775

Annual meeting, March 4th.

Compania de Electricidad de la Province de Buenos, Aires, Ltd.

Mr. S. F. Mendl (Chairman) presided on Friday at Winchester House, E.C., over the third anuual meeting of the company. He said that the year under review would not come up to their expectations. They knew of the intense depression in the Argentine and in fact it might fairly be called the crisis, which arose towards the end of 1913, and had lasted without intermission ever since, and naturally, seriously affected a company of that kind. It was true that the provision of electric light and power had become a necessity in Argentina as in other civilised countries, but they were bound to be seriously affected when industrial, financial and commercial conditions in the country were as bad as they had been during the greater portion of the period with which they were dealing. Their revenue had increased by £6,454, which compared with last year's £13,541. They could not altogether complain that the proportionate increase had not been maintained. They had, however, succeeded in effecting radical economies in administration and general charges in Buenos Aires. These charges during the year were £12,500 as against £20,000 in 1912-13, and £21,000 in 1911-12. It must also be remembered that the company did not have the full benefit of the issue of the preference shares, as they were only issued in December, and were not fully-paid until March, 1914. The working expenses ratio shown at stations was 54.72 per cent. which was higher than they anticipated last year, and this was directly due to the depression in the country to which he had referred. If the proportionate increase in revenue had been maintained, and the development of the company had continued, the station working expenses ratio would have been automatically reduced to a much lower level. Another circumstance which had affected their expenses was the sale of the Pergamino station. That was a profitable sale in itself, as they got rid of one of their least satisfactory assets at the price at which it stood in their books, but it affected the expense ratio, as they had to work on a smaller gross undertaking. At the same time, the expense ratio of the new stations they had established at Ramon Mejhia and Caseros were naturally higher than they expected they would be in the future. The Chairman referred to the loss sustained by the company in the death of Baron de Oliveira, the managing director, but said they would not fill the vacancy, in order to carry out their policy of effecting economies in the London administration. The Legislative powers of the Province of San Luis had sanctioned an extension of the control between the municipality and the company for 15 years, and in San Martin they had acquired a new concession from the municipality for 20 years. Since the outbreak of war they had to keep down all capital expenditure to the utmost limits, and the Argentine administration was fully alive to the necessity of husbanding the resources of the company with the utmost possible prudence. Referring to the non-payment of the preference dividend in November, the Chairman explained that the company had earned the dividend, but there had been difficulties in the collection of accounts, and the Board felt they must conserve their funds for the payment of the debenture interest in April. The prosperity of the company, of course, depended on the prosperity of Argentina, and with the passing of the commercial and financial depression in that country, they had every reason to believe their upward course would be resumed on the same scale as before the depression. He had commercial relations with the company, and he believed that the worst of the depression had passed, and that the general financial crisis of the world had done all it could do with regard to accentuating the crisis. Everything in Argentine depended on the crops, and they would be much more satisfactory than for some years. Inasmuch as Argentina produced what the rest of the world wanted, they might look with good hope to a speedy passing of the depression, and an electrical company should share in the return of prosperity. At the extraordinary meeting that followed there would be resolutions submitted for altering the articles of association, and for increasing the capital of the company to £1,350,000 by the creation of 12,500 ordinary shares of £4 each. The alteration of the articles simply provided for a reduction in the remuneration of the directors. There had been some letters of protest from shareholders as to the increase of capital, but his explanation would, he thought, be satisfactory. Under the agreement with the bankers who guaranteed the preference issue their commission was to be paid in ordinary shares instead of cash which was a great advantage to the company. As the Board were considering a drastic reduction in the ordinary capital of the company it was necessary that this commission should be paid now, and hence the increase in the capital. If they left the matter over until after the capital of the company was reduced, then the bankers would be able to claim 12,500 ordinary shares of £4 each, which would probably give them the larger proportion of the capital. By issuing the new shares now the bankers would share in the proposed reduction.

Mr. Guy Hannaford seconded the motion, and it was carried.

At the extraordinary meetings which followed, the resolutions outlined by the Chairman were agreed to.

Mersey Railway Co.

Mr. James Falconer, M.P., presided on Friday over the annual meeting held at Worcester House, E.C. He said that during the latter half of the year the railway had been in the hands of the Government, although it had been worked by the company's staff as usual. The total net income for the year had amounted to £58,267, compared with £58,345 in 1913. The income available for distribution included £1,350, part of a suspense account which had been created from moneys received as compensation in connection with the purchase of certain plant of which delivery was delayed, that enabled them to pay all the debenture-holders' interest in full, except the "B" stock on which they were able to pay one per cent. against the 3 per cent. to which it was entitled. They were therefore able to do better for the debenture holders last year than they had ever done before.

The Chairman, in reply to questions, said that under their Act of 1900, they were empowered to set aside each year to the renewals fund, a sum not exceeding £3,000. For some time they had been setting aside £2,000 year by year, until last year they had accumulated £20,000. They had always had it in their mind, whenever the fund reached that figure, that they would not add £2,000 to it every year, but that each year should be considered on its merits. This year they had had exceptional repairs and improvements in connection with their stokers, and therefore, although they added £2,000 to the fund, they took from it £934, the cost of renewing the stokers. As to the use of the line for its original purpose, there were proposals and Bills passed through Parliament by the Cheshire Lines Committee, authorising the construction of a connection between their station in Liverpool and the Cheshire Lines system, and there were also similar proposals with the Great Central Railway on the Birkenhead side. Had those proposals been carried out, undoubtedly, the railway would have proved a very important means of exchange of traffic on either side, but unfortunately, both schemes were dropped. The possibility, undoubtedly, was still there, and the great advantage to traders and the public was still there, but the enterprise of the other railways concerned was not so keen as it was at the time the Mersey railway was formed, and until that situation was altered, they could not do anything. At the present time particularly, financial matters were in such a condition that the raising of capital would not be considered by anybody.

The report was adopted.

Subsequently, a special meeting was held at which a resolution was agreed to approving of a Bill which the company is promoting in Parliament for an extension for five years of the period during which the payment of interest on certain of the debenture stocks is contingent on the available net revenue of the company.

Sunderland District Electric Tramways, Ltd.

The directors report that for the year ended October 31st, 1914, after providing for interest on the prior lien bonds and the first mortgage debentures, and for sinking fund instalment, and making provision for depreciation on investments, there remains a net profit of £2,17[illegible] plus £[illegible] brought forward. The payment of interest at the rate of 2½ per cent. per annum (less income tax) on the first income bonds will absorb £1,752, leaving £611 to be carried forward. During the year the provision of suitable housing accommodation for the staff has been proceeded with, and eight houses in course of erection are now approaching completion.

The traffic receipts showed an increase up to the end of July last of £2,246 over those for the corresponding period of the previous year, but owing to the outbreak of war the receipts for the remaining three months of the financial year decreased by £[illegible], leaving a net increase of £1,579 for the year.

Mr. H. R. Hogg presided on Monday at the annual meeting, held at Balfour House, E.C. He said that during the past year the undertaking had progressed particularly well, and the receipts showed a healthy increase up to the date of the war. Immediately on the outbreak of hostilities the receipts fell and instead of showing a weekly increase on the previous year's earnings, turned what had been a net gain of 10 per cent. into a weekly reduction of about the same amount. That, however, occurred for only three months of the financial year, and the accounts, therefore, showed satisfactory features. The traffic receipts amounted to £29,966 which, with sundry additions, gave them a total income of £31,729. The working expenses, in spite of increased wages to the whole of the staff, were reduced from 61.19 per cent. on the gross takings the previous year to 56.84 per cent.—a very satisfactory reduction. The number of passengers carried was 4,719,579, an increase of 228,194. Last year they provided 15 new cars, and during that and the present year 18 older ones had been completely renovated at a cost of £4,170; some badly wanted additional buildings had been completed, and the permanent way and overhead equipment had been kept in good order at a cost of £1,983. They were, therefore, well prepared for the coming summer, when their lines were most fully employed. They had written off £2,343 for depreciation of rolling stock, buildings, etc., which the auditors considered sufficient. Like all who had funds invested in high-class securities, they had suffered from the fall in prices, and had therefore retained a sum of £1,000 as a reserve to cover the difference between the cost of the investments and a valuation as at 27th July last. Something like a third of the staff having joined the colours, they had had to employ and teach new men to take their places. The Board were proceeding with the erection of houses for the men, so as to have them near their work. They had provided for the manager, and had just completed eight cottages for the men, and as soon as they were filled they intended to start with some more, the land purchased having room for 22. That would accommodate about one-third of the total men employed.

Mr. C. Eves seconded the motion, and the report was adopted.

Notting Hill Electric Lighting Co., Ltd.

Sir Wm. Crookes, presiding at the annual meeting held at Winchester House, E.C., on Tuesday, said that no new capital had been created for issue for several years. They had spent £4,128, principally, as usual, for mains, and secondly, for meters, to pick up new customers; the additional business would show a profitable return in the future. They had spent £42,768 in excess of the capital received, by employing their reserves in the business.

Considering the circumstances prevailing, the revenue account must be considered satisfactory, and it reflected credit on the whole of the staff. The expenses were nearly £300 below the previous year, and the profit worked out at £24,221 against £24,465. The revenue showed a reduction of £527, due solely to the war regulations imposed by the Government, compelling consumers to reduce their lighting. Up to the end of September their revenue each quarter showed a nice increase, but the last quarter they knew was bound to be disappointing, and they estimated that the loss in net revenue was about £2,000. They were still suffering considerably, and obviously, they must continue to do so until the Government was able to remove the restriction as to lighting. Allowance had since been made in the account for the bonus to the staff, under their co-partnership scheme, which, they would remember, was based on the amount of profit available for dividend on the ordinary shares. The staff appreciated the concession, and would receive an addition of about 8 per cent. to their wages. By the depreciation, renewal and reserve fund account, it would be seen that the total reserve to be carried forward was £45,545, which in their opinion was a very satisfactory sum. They charged against the fund last year £605 for meters which were too old for further service, and with the metal filament lamps, it was more than ever necessary that meters should be in good order, otherwise they omitted to register when a very small quantity of current was passing. The Kensington and Notting Hill Joint Debenture Stock Sinking Fund continued to increase at a very even rate, and they had contributed £17,532 to it, but the total was £66,045. The balance was made up by the amount of the Kensington company's contribution, and further by the fund being invested at compound interest, which should result in the company having a valuable asset in 1931, when the stock was redeemed.

The Chairman referred to a table prepared, showing the progress of the company from its inception. The table showed that they added the equivalent of 12,258 lamps of 8 candle-power during the year, which was more than for many years past, and it was only the restricted lighting of London that had prevented the accounts from indicating a corresponding increase in revenue. In addition to their loss of revenue, he must say that, including men from the joint works, 15 had joined His Majesty's Forces, and were being paid part wages, which amounted to over £550 a year, but they felt the shareholders would approve this patriotic way of treating those who were helping to win for them a glorious and lasting victory in this deplorable war. They had also been hit in another way by the war, as they had on order for Wood Lane a new generating set which was guaranteed to reduce the cost of production considerably, and should have been running by now. However, just as it was ready for delivery, the Government commandeered it for very important work of their own, and they would probably not get delivery of another set until the end of the year. The directors had referred in their report to the Bills which had been promoted this session on the London electric supply question. As had been explained, the Bill promoted by the L.C.C. did not receive the votes of a sufficient majority of the Council to approve it, and it had since been abandoned by the Council. The company, however, joined with nine other London electric lighting companies in promoting the London Electric Supply (No. 2) Bill, but the Government had just decided that this would not be allowed to proceed, as it came within the category of those Bills which were of a public character, and raised questions of a contentious nature. It had, therefore, been agreed to withdraw the Bill. If it had passed the first House, the directors would have called the shareholders together to obtain their approval before proceeding with it, and he had intended to give them that day certain information respecting it, and also to inform the shareholders that during the time the Bills had been in preparation, the companies had been in negotiation with the L.C.C. with a view to formulating a scheme of sale acceptable to all parties. Recent developments rendered it uncertain as to what might be done in future in the direction of an agreement with the County Council, but he would assure the shareholders that the directors were carefully guarding their interests. The Chairman expressed their great regret at the loss they had sustained by the death of their colleague, Sir Joseph Swan.

Mr. A. E. Franklin, in seconding the motion, said the Chairman had asked him to say a few words with regard to the conference of the various electric light companies They had heard that in the exceptional circumstances under which Parliament was meeting, the Bill would not proceed, but the shareholders might take it that the close association which had been existing during the whole of the negotiations would certainly have the effect of facilitating any future movement that might take place for the metropolitan interests, which might come forward hereafter. The contentious matter raised in the Bill was of two classes, and probably it would not have amounted to much, had the Bill gone into the Committee Rooms. One matter really lay between the Borough Councils and the County Council, namely—that of their respective interests in the future of electricity. That was a matter which did not concern them. The other point was one of great public interest. There was a certain school of electrical companies who advocated the concentration of the production of electricity in one spot, and who followed the schemes instituted in America, where there was such concentration, and where, obviously, the working costs were much lower, because the output was much larger. The other view to which they and other Boards strongly adhered, was that in view of the public danger which would exist in having one place for the supply of electric current to London, such a scheme, however economical, was impossible of introduction to a city like London. It was almost too dreadful to contemplate what would happen if all their power and light were concentrated in one place where a single bomb dropped from a Zeppelin or an aeroplane might put them in darkness for a long period.

The motion was carried.

The retiring directors and auditors were re-elected, and, on the motion of Mr. Horace Boot, seconded by Mr. Davies, a hearty vote of thanks was passed to the Board and staff.

Newcastle and District Electric Lighting Co., Ltd.

The directors report that during 1914, 19,271,853 units were sold, as against 16,863,440 in 1913, an increase of 14 per cent. The gross profit was £32,031 plus £10,076 brought forward. Deducting interest on debentures and loans, £16,620, and interim dividend paid last August, £4,193, the available balance is £21,294. A dividend at the rate of 3 per cent. per annum (less income tax) for the half-year ending December is to be paid (making, with the interim dividend, 3 per cent. for the year); this requires £4,044; transfer to second mortgage debenture redemption fund, £2,132; written off debenture issue expenses, £500; carry forward, £14,617. The directors have redeemed a further £2,060 of the company's 6 per cent. second mortgage debentures. Capital expenditure for plant and mains required to connect the systems of supply in Newcastle and Newburn has amounted to £31,274. The war has considerably affected the profits during the year, chiefly owing to its causing delay in the completion and consequent erection of the new plant provided for by the third mortgage debentures. During the current year the company will for the first time get the benefit of this expenditure. Impending additions at the Close works, Newcastle, will involve certain capital expenditure, and shareholders will be asked to sanction an increase of borrowing powers by £50,000. Particulars will be given at the annual meeting on March 5th.

Capt. Frank Buddle Atkinson has been elected to a seat on the Board.

Oxford Electric Co., Ltd.

The revenue account for 1914 shows a profit (including £982 brought forward) of £14,917. After providing £2,091 for debenture and other interest, and writing off £770 on account of hire-purchase installations, the balance available is £12,055. A dividend at the rate of 6½ per cent. per annum, less income tax, on the ordinary share capital (whereof 2½ per cent. was paid in September last) absorbs £6,500; five per cent. per annum on the preference shares, £2,500; there is placed to reserve and renewal of plant, £2,000, leaving to carry forward, £1,055. Reserve and renewal of plant account has been charged with the cost of plant replaced. The outbreak of war has adversely affected the costs of production and revenue charges, but notwithstanding the exceptionally unfavourable local conditions created, the sale of electricity has exceeded that of the preceding year. The supply mains of the company have been extended in Warneford Road, also in High (St. Thomas), St. Clement's and Leopold Streets.

Annual meeting, March 5th.

Scarborough Electric Supply Co., Ltd.—The annual report states that during 1914 there has been connected to the company's mains the equivalent of 8,031 (30-watt) lamps, making a total to date of 130,905. The units supplied, including the 300,000 minimum supply to the tramways, were 1,012,817. After placing £1,000 to depreciation account, there is a balance on revenue account of £3,847. The directors recommend that a dividend of 2 per cent. for the year be paid, less income-tax, absorbing £2 000, leaving £1,847 to be carried forward. The carry forward is large, but the directors state that the exceptional existing circumstances make this desirable. The directors express their great regret at the loss sustained by the company through the death of Mr. John Hall, who had filled the office of secretary to the company since its formation in 1892. They place on record their appreciation of his faithful services.

Listowel, County Kerry, Electric Light Co., Ltd.—The annual meeting was held at Listowel, Mr. J. Macauley presiding. Mr. E. L. Cantwell, manager and secretary of the company, presented the annual report, showing that the gross profits for the period were £295, plus £8 brought forward. There was placed to reserve £150, leaving available for dividend £154. It was resolved to declare a dividend of 7 per cent. for the period covered by the accounts, and to carry forward the surplus. The chairman said that they had reason to congratulate themselves on the very satisfactory position, and he referred to Mr. Cantwell's very capable conduct of the business.

Companies Struck off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

British Engineering and Fume Condensers.
British Speedometer Control Co.
British Wireless Telegraph Syndicate.
Civil Engineering Press.
Electrical Fittings Co. (1911).
Electrical Amusements.
Electrocoustics.
Insulators.
Internal Combustion Engines Cooling Agent Co.
National Electric and Motor Corporation.
Patent Tube Covering and Lining Co.
Rotary Pulsating Plunger Pumps.
Smoke Abaters.

Aberdeen Suburban Tramways Co., Ltd.—The profit earned during the half-year ended January 31st, 1915, was £1,153, making, with the sum brought forward from last half-year's accounts, a balance of £2,445 at the credit of the profit and loss account. The directors report that they have been approached by the Corporation of Aberdeen with a view to the purchase by the Corporation of the company's undertaking. Negotiations are, meantime, pending, and if terms are proposed by the Corporation which the directors feel justified in submitting for the approval of the shareholders, a meeting with the shareholders will be called for the purpose of considering them.

Jarrow and District Electric Traction Co., Ltd.—The report for 1914 states that the total revenue amounted to £7,870, an increase of £137 as compared with 1913. After deducting all expenses chargeable to revenue, including interest on debentures and loans, and making a provision of £800 for renewals, there remains a surplus of £2,647, plus £1,028 brought forward. There is to be placed to reserve £900, dividend on the ordinary shares at the rate of 3½ per cent. for the year absorbs £1,748, and £1,026 is to be carried forward. Passengers carried: 1913, 1,531,434; 1914, 1,571,546. Receipts per passenger: 1913, 1·19d.; 1914, 1·18d.

Annual meeting March 1st.

Chelsea Electricity Supply Co., Ltd.—The directors recommend a dividend for the last half of 1914 at the rate of 6 per cent. per annum on the ordinary capital, making 5 per cent. for the year, after paying debenture interest and placing £14,320 to depreciation fund, £704 to debenture premium redemption fund, writing off £1,089 from the cost of extinction of founders' shares, and £1,429 off cost of investments; carrying forward about £3,196. The dividend is the same as for 1913.

Blackpool and Fleetwood Tramroad Co., Ltd.—The annual meeting was held on February 19th, at Manchester, Mr. John Greenwood presiding. The chairman said the available balance was down by £3,843 compared with 12 months ago. With regard to the future they were faced with a claim by the Urban District Council for a contribution towards the making of a new road. The road itself would be contiguous to the tramline, but it might as well be a mile away so far as it could benefit their own concern. Out of their staff of 125 men, 25 had joined the Forces of the Crown, two of their drivers, he was sorry to say, having been killed in action. The directors proposed to deal with the dependents who were left. He added that it was possible in the near future that they would have to expend a considerable sum on the relaying of the lines in Fleetwood. The report was adopted.

Compagnie Générale d'Electricité.—This French company, which has an ordinary share capital of £1,000,000 and a reserve fund of an equal amount, reports a very favourable increase in the turnover in 1914, and in particular the central stations at Amiens, Marseilles, and four other towns experienced a growth of almost 25 per cent. in the receipts. The net profits amounted to £148,000, and rose to £223,000 on the addition of the sum brought forward from 1913, this surplus comparing with £146,000 in the preceding year, when a dividend of 10 per cent., or £2 per share, was paid. The state of war, however, has induced the company to postpone for the present any distribution of profits for 1914.

Fife Tramway, Light and Power Co., Ltd.—The profits for the year (together with the balance carried forward), after paying loan interest and interest on debenture stock and providing instalment for debenture stock redemption, amount to £19,271. Out of this £4,205 was paid as interim dividend on the preference shares. The directors recommend a dividend on the preference shares for the half-year at the rate of 6 per cent. per annum, £5,998; 3½ per cent. dividend on the ordinary shares, £3,263; £3,000 to reserve stock, and £2,803 carried forward.—*Financier.*

County of London Electric Supply Co., Ltd.—The directors recommend payment of final dividends upon the preference shares at the rate of 6 per cent. per annum for the half-year to December 31st, less income-tax, and on the ordinary shares at the rate of 9 per cent. per annum, less income-tax, for the half-year to December 31st, making 7 per cent. for the year on the ordinary shares. £40,000 has been placed to reserve for depreciation, leaving £10,000 to carry forward.

W. T. Glover & Co., Ltd.—The directors recommend a dividend for the year ended December 31st, 1914, of 5 per cent. on the ordinary shares. After allocating £6,500 to debenture redemption funds, transferring £5,000 to reserve fund, and writing down certain quoted investments to their estimated values as at December 31st, 1914, a balance of nearly £8,000 remains to carry forward.—*Financial Times.*

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be quoted in the Official List:—

Interborough Rapid Transit Co.—$5,000,000 additional first and refunding mortgage 5 per cent. gold bonds for $1,000 each Nos 93,659 to 98,658.

Waygood Otis, Ltd.—Further issue of 15,000 ordinary shares of £1 each, fully paid; and 15,000 6 per cent. cumulative preference shares of £1 each, fully paid.

Vulcan Boiler and General Insurance Co., Ltd.—The net profit for 1914 is reported at £56,736 plus £9,320 brought forward. The dividend and bonus for the year amount to 25 per cent., £7,500 is placed to current risk and reserve fund, £1,200 to superannuation and benefit fund, and £10,481 is carried forward.

Mirrlees Watson & Co., Ltd.—We read in a financial daily that the accounts for the year 1914 show a loss of £12,649, from which falls to be deducted the credit balance of £5,504 brought forward, leaving £7,145 at the debit of profit and loss account to be carried forward.

Tramways, Light and Power Co., Ltd.—The receipts for 1914, including £1,126 brought forward, amount to £29,174, and after providing for administration, loan and debenture interest, the profit amounts to £18,329. The directors propose (says a financial daily) to pay the dividend on the preference shares, and to carry forward £1,712.

London Electric Wire Co. and Smiths, Ltd.—According to the *Financier* the directors recommend a dividend of 7½ per cent. (7s. 6d. per share), less income-tax, on the ordinary shares for the last half of 1914, making 10 per cent. for the year, placing £40,000 to reserve (making £110,000) and carrying £25 952 forward.

Mexico Tramways Co.—It is stated that the directors are deferring the payment of the half-yearly coupon due on March 1st on the general consolidated first mortgage 50 year 5 per cent. gold bonds.

Bournemouth and Poole Electricity Supply Co., Ltd.—We are informed that the recent issue to shareholders of 2,500 cumulative 6 per cent. second preference shares was largely over-subscribed. Letters of allotment were posted on 18th inst.

STOCKS AND SHARES.

Tuesday Evening.

THE tendency in Stock Exchange markets at the present time is disposed to heaviness. Everybody and everything seem to be waiting. The progress of the war is necessarily slow and the main excitement lies in the Eastern zone of operations, where Russian and German armies drive each other backwards and forwards with a violence and over a length of country difficult to realise by us on this side. Every day one meets in the City, men home on leave from the French trenches who agree in their reports of the stale-mate character of the present fighting; and their personal experiences coincide with the official *communiqués* to show that until weather conditions change, no great alteration is likely in the existing order of affairs.

The much-advertised blockade rouses little more than passing interest in the City—in illustration of which the financial eye-witness cites the steadiness of shipping securities. A theory that finds increasing support amongst the prophets is that Germany is deliberately endeavouring to array the world against her, in order that she may be able to excuse defeat by the declaration that she cannot fight the universe, although she could boast of her vaunted ability to beat the powers at present opposed to her—which, by the way, would be at least a claim in perfect keeping with many of the other absurdities preferred by this ever-truthful nation.

The electric lighting companies are doing pretty well, having regard to the circumstances under which they have worked during the last five months of 1914 and the difficulties with which they are faced now. The London Electric Supply Corporation has actually increased its dividend, paying 4 per cent. against 3 per cent. a year ago, and so repeating a performance which it has not equalled since 1906. In 1907, the dividend dipped to 2½ per cent.; in 1908 and 1913 it was 3 per cent.; in 1909 and 1910 the directors paid 2 per cent. The reserves now stand at £136,000; and the price of the shares has risen to 30s.

The Chelsea Company announces a dividend making 5 per cent. for 1914, the same as that for 1913. At 4¾ the yield on Chelseas comes to £5 11s. 1d. per cent. on the money.

The feature of the St. James's report is the small decrease in profits, considering war conditions. For 1913, 12 per cent. was distributed; but the current dividend of 10 per cent. is a repetition of the rate paid from 1906 to 1912 inclusive. Since the company was incorporated, the sum of £280,000 has been written off in depreciation. There is a capital reserve fund of £66,500, and an emergency fund of £20,000.

The Notting Hill Company's net profit of £24,324 was the bagatelle of £141 less than that for 1913, and the 5s. dividend for the year maintains the rate paid since 1912. Its appropriations amount to £45,500, and the capital expenditure up to December 31st last came to £252,000.

The South Metropolitan has paid no dividend on its ordinary capital since 1908, but its net profit for 1914 shows an improvement of £1,500. In addition to the usual £5,000 to depreciation account, twice that sum is carried to reserve, thereby doubling it and bringing it up to £20,000

Market changes on the week are unimportant. A fair line of South Londons changed hands on the basis of 3 to 3$\frac{1}{16}$, and the exceptional bargain at 56s. marked at the end of last week was probably in respect of shares sold *ex* the dividend of 4s. County of London Preference are easier at 11. Metropolitan 3½ per cent. Debenture stock advanced to 80, bringing it to a level with the similar security of the St. James' Company. The yield at this price is £4 7s. 6d. per cent. on the money invested.

The following tables show rises and falls on the week, in representative securities:—

HOME ELECTRICITY COMPANIES.

	Mean price. July 27.	Feb. 23, 1915.	Rise or fall this week.
Brompton Ordinary	9⅛	8⅞	—
do. 7 per cent. Pref.	8⅝	8⅜	—
Charing Cross Ordinary	5¼	4¾	—
do. do. do. 4½ Pref.	4¾	4½	—
do. do. City Pref.	4¾	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅝	4¾	—
do. 4½ Deb.	96½	92	—
City of London	16	14¼	—
do. do. 6 per cent. Pref.	13½	12¾	—
do. do. 5 Deb.	116½	112	—
do. do. 4½ Deb.	100¼	98	—
County of London	12	11	—
do. do. 6 per cent. Pref.	12	11	— ⅛
do. do. 1st Deb.	102½	99	—
do. do. 2nd Deb.	101½	97	—
Kensington Ordinary	7½	7¼	—
London Electric	1$\frac{7}{16}$	1½	+ ¼
do. do. 6 per cent. Pref.	5$\frac{1}{16}$	5⅛	—
do. do. 4 Deb.	92½	87	—
Metropolitan	3½	3⅛	—
do. 4½ per cent. Pref.	4$\frac{1}{16}$	4	—
do. 4½ Deb.	97½	95	—
do. 3½ Deb.	83	80	+2
St. James' and Pall Mall	9⅜	9	—
do. do. do. 7 per cent. Pref.	7	6⅛	—
do. do. do. 3½ Deb.	81½	80	—
South London	3$\frac{1}{16}$	3	—
South Metropolitan Pref.	1¼	1⅛	—
Westminster Ordinary	8⅝	8¼	—
do. 4½ Pref.	5⅛	4⅞	—

HOME RAILS.

	Mean price. July 27.	Feb. 23, 1915.	Rise or fall this week.
Central London, Ord. Assented	83	77	—
Metropolitan	37½	29	—1
do. District	21¾	17½	— ½
Underground Electric Ordinary	2½	1¾	—
do. "A"	7/6	6/-	—
do. Income	88	83	— ½

TELEGRAPHS AND TELEPHONES.

	Mean price. July 27.	Feb. 23, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108½	104 xd	—1
do. Def.	23	21¾ xd	— ¼
Chile Telephone	7⅜	6¾	— ⅜
Constantinople Tel.	4½	3½	—
Cuba Sub. Ord.	8½	8½	—
do. Pf.	16½	12½	—
Eastern Extension	12¾	12¾	—
do. 4 Deb.	97½	92 xd	—
Eastern Tel. Ord.	130½	127	—1
do. 3½ Pf.	77½	72	—
do. 4 Deb.	96½	94	—
Globe Tel. and T. Ord.	11½	10¾	+ ¼
do. Pf.	12⅝	11¾	—
Gt. Northern Tel.	32½	28	+1
Indo-European	59	55	—
Marconi	1$\frac{15}{16}$	1⅝	—
New York Tel. 4½	101	97	—
Oriental Telephone Ord.	2$\frac{5}{32}$	2	—
do. Pf.	1$\frac{1}{32}$	1$\frac{3}{16}$	—
Tel. Egypt Deb.	98	83½	—
United R. Plate Tel.	6⅜	6	—
do. Pf.	5½	5	—
West India and Pan.	1¼	1$\frac{5}{16}$	—
Western Telegraph	13⅜	13	—
do. 4 Deb.	96½	95½	—

FOREIGN TRAMS, &C.

	Mean price. July 27.	Feb. 23, 1915.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅞	4⅛	—⅛
do. 2nd Pf.	4¼	4	—
do. 4 Deb.	91	84	—
do. 4½ Deb.	98½	93	—
do. 5 Deb.	96	88	—
Brazil Tractions	66	49½	—2½
Bombay Electric Pf.	11⅜	10⅜ xd	—
do. 4½ Deb.	96	91	—
Mexico Trams	70	85	—
do. 5 per cent. Bonds	84	[illegible]	—
do. 6 per cent. Bonds	76	50	—
Adelaide Sup. 6 per cent. Pf.	5¼	5$\frac{3}{16}$	+ $\frac{1}{16}$
do. 5 Deb.	104	102	+ ½

MANUFACTURING COMPANIES.

	Mean price. July 27.	Feb. 23, 1915.	Rise or fall this week.
British Westinghouse Pref.	1¾	1$\frac{15}{16}$	+ $\frac{1}{16}$
do. 4 Deb.	74½	72	+2
do. 6 p. lien	102½	98½	—
Callenders	11⅛	11¾	+ ¼
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2½	3¼	—
Edison & Swan, £3 pd.	$\frac{3}{32}$	11/6	—
do. do. fully paid	1¼	2	—
do. do. 4 Deb.	59	60	—
do. do. 2 Deb.	63½	60	—
Electric Construction	$\frac{17}{32}$	13/-	—6d.
do. do. Pf.	$\frac{1}{16}$	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	14	+ ½
do. 4½ Pref.	5	5	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	8½	—
Telegraph Con.	38½	37	+ ½

Brazil Tractions have been flat, another fall of 2½ points lowering them to 49½. The market professes to be puzzled to account for the drop, and can only put forth the excuse—as lame as it is trite—of there being more sellers than buyers. Rio exchange is better to-day at 12⅝d., but Brazil Tractions continue to crumble. Singapore Electric trams weakened to 3s., on rumours that one of the native regiments had run amok, though the trouble is said to have been composed by now. This report is a variation of that which declared the town to have been bombarded by the *Kronprinz Wilhelm.* Adelaide Supply Preference improved to 5$\frac{3}{16}$, but, on the other hand, Anglo-Argentine 1st Preference lost ⅛. The Mexican issues are quiet.

Telegraph stocks and shares present a front rather less bold than they have lately displayed. The Eastern group is dull, Eastern Telegraph Ordinary being on offer at 127: probably a cheaper bid would dislodge stock. The Anglo-American Telegraph division is also a little easier, and it is suggested that the would-be German blockade may have aroused some desire on the part of timid cable stock holders to realise their holdings. Personal experience, however, has failed to confirm this in any way. Great Northern are £1 better. Chili Telephones relapsed. Marconis are quiet and steady. There is not much doing in the market as a whole.

Henleys at 14 and Telegraph Constructions at 37 are both 10s. higher on the week. British Westinghouse issues are good, the Preference and 4 per cent. Debenture both showing rises. Electric Constructions again went back a trifle.

In the rubber market the principal feature is the steady strengthening of the market for the raw material. Rubber creeps up a farthing per lb. at a time, and holds on a steady upward course. The share market has scarcely responded to the firmness of that in the product. Amongst armaments there is not much going on. A good deal of strength is shown by the popular descriptions—Vickers and Armstrongs more particularly. Certain of the iron companies are rather out of favour, and a little desultory selling from the North of England has led to reactions in some of the best-known shares.

Para Electric Railways and Lighting Co., Ltd.—The directors recommend a dividend of 6 per cent., less income-tax on the ordinary shares for 1914, carrying forward £20,030.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JANUARY, 1915.

The returns of electrical exports and imports for the first month of the year show a decided improvement in the case of the former, while the latter exhibit a considerable decrease in value.

Thus the exports from this country reached a total value of £364,562, as compared with £290,069 in December last, while the imports for January were valued at £239,127 as against £261,303, and the re-exports at £12,455 compare badly with the £25,510 recorded for December.

A glance at the export figures shows that while our output of machinery and goods and apparatus has fallen off, this has been more than made up in improved business in other directions, principally in cable, telegraph and telephonic exports.

Machinery imports were somewhat heavier than in December, but a considerable falling off occurred in the importation of cables, telegraphic and telephonic apparatus and lamps. The feature of the imports is the great increase in U.S.A. business, which reached £198,596 in value during January, an increase of over £30,000 on December last.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	6,024	2,055	435	221	...	903	2,046	23	530	100	367	6,108	18 812
Germany	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies ...	103	3,178	291	...	412	213	2,351	148	100	...	17	1,593	8,406
Belgian Congo	17	...	...	...	...	...	...	...	...	...	...	...	17
France	1,274	1,000	903	226	380	...	855	63	713	43	5,176	4,807	15,440
Portugal	30	1.282	...	70	2	...	176	1,025	22	2	127	285	3,021
Spain, Canary Isles and Spanish N. Africa...	139	213	246	96	...	19	948	201	...	13	...	...	1,875
Switzerland and Italy	212	55	249	...	37	971	3,293	...	15	375	16	14,642	19,865
Greece, Roumania and Bulgaria	...	...	56	...	85	...	600	...	143	...	2,270	...	3,154
Channel Isles, Gibraltar, Malta and Cyprus...	157	97	72	80	...	16	50	...	390	...	10	...	872
U.S.A., Philippines and Cuba	328	...	842	34	...	19	97	...	11	...	...	...	1,331
Canada and Newfoundland	1,554	85	255	714	...	1,738	2,965	...	348	22	...	6 374	14,055
British West Indies and British Guiana ...	168	26	202	31	...	94	64	...	113	...	12	64	774
Mexico and Central America	104	90	96	94	...	74	55	...	...	...	...	...	513
Peru and Uruguay	32	152	60	71	...	...	83	208	54	...	218	5.731	6 609
Chile	97	122	10	249	...	...	1,183	...	12	104	...	3 347	5,124
Brazil	31	625	606	181	...	87	759	814	331	9	...	279	3,722
Argentina	569	9,226	1,230	119	...	429	4,036	1,543	391	22	535	958	19,058
Colombia, Venezuela, Ecuador and Bolivia...	...	89	...	80	...	10	705	...	...	...	62	...	946
Egypt, Tunis and Morocco	201	285	89	13	...	175	187	7	196	55	280	1.740	3,228
British West Africa	12	136	7	15	...	...	779	...	30	...	94	2.472	3 545
Rhodesia, O.R.C. and Transvaal	128	490	776	195	...	51	1 694	12	48	26	25	23	3,468
Cape of Good Hope	178	3.022	139	470	...	36	1 589	1,150	99	...	177	360	7,220
Natal	100	1,903	188	113	...	26	3,860	...	...	86	...	135	6 411
Zanzibar, Brit. E. Africa, Mauritius & Aden	79	88	44	304	...	128	203	153	22	...	4	20,368	21.393
Azores, Madeira and Portuguese Africa ...	22	213	42	135	...	71	1,339	...	...	...	24	65	1,911
French African Colonies and Madagascar...	...	...	...	...	...	...	...	...	...	...	...	...	...
China and Siam	942	691	972	109	109	684	985	858	498	...	11	12,805	18 664
Japan and Korea	533	...	15	...	...	376	3 079	...	674	18	...	391	5.086
India	2,602	12.907	1,926	1,842	23	1,869	15,380	2,759	1,963	228	4,090	1,219	46 808
Ceylon	42	32	153	90	...	...	44	...	273	...	199	216	1,049
Straits Settlements, Fed. Malay States and Sarawak	464	667	226	69	...	88	11,447	86	304	89	77	2,769	16,280
Hong Kong	319	112	344	...	...	...	70	...	1,208	...	200	...	2,253
West Australia	127	347	139	56	36	2 615	1,867	92	150	...	50	103	5,582
South Australia	89	1,185	419	113	47	176	2 421	...	58	3	896	...	5 407
Victoria	2,158	8.457	1.848	393	166	2 891	3.018	2 070	501	...	3 293	...	34.795
New South Wales	243	6,320	2,283	1.207	47	1,188	4.738	7,647	11.942	...	2,626	2,103	40,344
Queensland	317	48	117	618	...	27	1,326	15	735	...	770	99	4,072
Tasmania	...	58	...	...	...	...	...	...	33	...	25	20	136
New Zealand and Fiji Islands	527	1,699	1,226	480	51	1,506	4,961	32	371	57	712	1.664	13,316
Total, £	19 922	66 955	16,506	8,488	1,395	16,480	79,253	18 960	22,278	1,252	22,393	90,740	364,562

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	73	...	758	27	812	149	2,076	614	450	2,717	4,270		11,946
Germany	...	...	...	...	...	...	...	...	...	...	...		...
Holland...	495	70	23	3.567	1,861	...	166	68	681	...	1,674		8,605
Belgium	88	...	...	...	...	...	...	...	...	...	...		88
France	225	14	844	39	1,077	394	9	...	125	1,146	1,490		5,363
Switzerland	147	...	68	119	...	1,332	1,501	...	...	1,336	...		7 503
Italy	266	4,168	31	...	...	...	263	...	10	...	...		4,738
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...		...
United States	3,796	1,169	2 937	337	4.016	674	29,022	145,161	8 071	2 821	592		198 596
Total, £	5,090	5,421	4,661	4,089	7,766	2.549	36,037	145,843	9 337	8,020	8,026		206 839

Additional Imports: Spain, carbons, £1,995; Canada, fittings, £20, machinery, £263, batteries, £10.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above... ...	794	255	3,974	204	...	122	3.209	...	78	249	3,570		12 455

Total Exports: £364,562 Total Re-Exports: £12,455 Total Imports: £239,127

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

POLYPHASE COMMUTATOR MACHINES AND THEIR APPLICATION.

By N. SHUTTLEWORTH, M.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, February 10th*, 1915.)

(*Concluded from page* 245.)

The angle θ between the counter-voltage of rotation and the impressed voltage on the machine can only be obtained by proper adjustment of the phase of a field flux and exciting voltage. It is determined by the phase of the exciting voltage derived from the secondary (3) of the transformer, which as previously intimated may be regulated by a turning movement.

It might be possible to employ a motor of the kind for fan driving where there is an opportunity of varying the power factor (namely, varying the angle θ) after each change in load.

The one essential for successful operation and good characteristics is that θ should vary in direct proportion with the load current. Under this condition the current would remain in phase with the voltage at unity power factor under all loads, and the speed would be appreciably constant.

Whether M. Latour embodies features such as this in the actual machine it is impossible to say, but from the success that he claims it would seem probable.

Whatever the methods employed by M. Latour, to obtain a successful motor on these principles, especially for a frequency as high as 50 cycles, it is quite certain that there is considerable auxiliary apparatus in addition to the motor itself, and this tends to make the equipment very costly. However, machines of this type are stated to be in commercial operation.

For small sizes the speed range is considerable, and becomes greater the smaller the machine (50 per cent. above and below synchronism at 25-h.p., 50 cycles; 23 per cent. at 200-h.p.). For large sizes the speed range is very limited, and is not sufficient for the usual practical requirements.

Another example of a variable-speed motor with shunt characteristics is the Eichberg 3-phase commutator motor, represented by fig. 8. The motor is simply an armature fitted with a compensating winding, and exciting voltages are impressed from the auxiliary auto-transformer, which is permanently connected in star to the supply system, and is provided with tappings, each of which may in turn be connected to the brushes of the motor. It will be observed that by varying the ratio of the two arms in each phase of the auto-transformer there is a different ratio between the armature and compensating-winding voltages on the motor, and this, as previously seen, implies variable armature speed.

The very fact that the armature and compensating winding have an equal number of turns and are wound in opposite directions prevents energy being transferred from stator to rotor, or vice versa, by induction. An auto-transformer connected in parallel cannot therefore act as a power transformer, and it carries only the wattless exciting current required by the motor. Speed regulation by the means described is a comparatively simple matter.

Unfortunately, if good operation is to be maintained, this simple motor cannot be constructed with a sufficiently large number of turns in the armature to suit normal supply voltages. It is quite imperative in practical machines that the number of armature turns be considerably reduced. This being so, the auto-transformer at once becomes a power transformer, and delivers a portion of the total input of the motor direct to its armature at comparatively low voltage and heavy current. The effect of the change is considerably to increase the capacity of the transformer, and it entails also a massive controller to deal with the heavy currents between the transformer and the brush-gear.

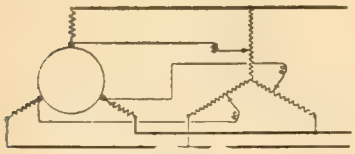


Fig. 8.

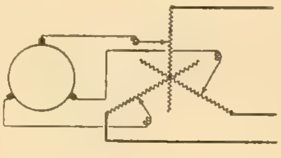


Fig. 9.

The necessity for a transformer, however, vanishes when the stator and rotor turns are no longer equal, as it becomes possible for power to pass from stator to rotor by induction, and the functions of a transformer may be embodied directly in the motor in addition to its previous duties. The modified machine is shown in fig. 9, where it will be seen that the existence of a field in the motor is made positive by closing the star point of the stator winding, and tappings are brought out from it to which the brush studs of the armature are connected by means of the controller.

The latest type is represented by fig. 10; the star point of the stator winding in this case is closed through a polygon, and the intention is evidently to impress on the armature a voltage which is slightly dephased from the true star voltage of the supply system. A phase displacement of this nature brings about an improvement in the power factor.

To be strictly accurate the angle of the phase shift must vary with each speed, but as this is impracticable the improved power factor is obtained at a few speeds only. The stator winding is continued and is provided with tappings below the star point so that speed regulation may be obtained below synchronous speed as well as above.

The possible speed variation with this type of motor approximates to that given for the Latour motor, but the output limits are considerably smaller. No proper provision can be made for commutation, which is effected solely by the resistance of the brush contact. It is very doubtful if a 200-h.p. machine could be built at all, except for very low speeds.

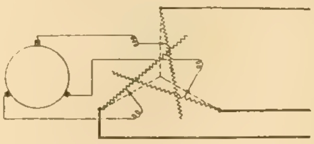


Fig. 10.

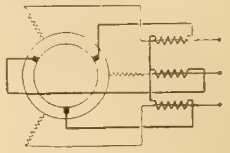


Fig. 11.

Altogether, the machine is very expensive and requires a large controller, and it is very unlikely that this type will be able to meet competition either in quality or in price.

The alternating-current series commutator motor is destined to play a not inconsiderable part in practice. In construction the stator is exactly similar to that of an ordinary induction motor; the armature is similar to that of a continuous-current motor. It is now usual, instead of connecting the stator winding directly in series with the armature, to introduce a transformer which reduces the voltage impressed on the armature; this is necessary to improve the commutating conditions, but it incidentally isolates the armature and commutator from the supply system, and therefore allows the stator winding to be designed suitable for a high-tension system.

The characteristics of this motor are much more comprehensive and varied than that of the continuous-current series motor. An a.c. series motor can exert any required torque over a considerable speed range, and this is rendered possible by the simple movement of the brushes round the commutator relative to the stator. At any one brush position the speed-torque characteristic resembles that of a continuous-current motor in many respects; over the working speed range an increase of torque is accompanied by a decrease in speed, and vice versa. At starting and at low speeds the current in a continuous-current motor is limited only by its internal resistance, whereas in an alternating-current motor it is limited by fluxes which produce an inductive drop. The alternating-current motor possesses the advantage that without series resistance it may possess a high starting torque and also give high running torque at top speed; any starting torque from the very lowest value to several times full-load torque may be obtained by merely shifting the brushes. With the brushes in such a position as to obtain low starting torque the standstill current is very small, hence it immediately becomes evident that under such conditions the machine may be connected directly to the supply system without the introduction of any starting devices. Any initial torque such as is required to start the load may be obtained by moving the brushes from the position of rest, and, in general, full-load torque is exerted with half full-load current, and other torques in proportion. The motor is quite unsuited for maintaining a constant speed under a variable load torque, unless the changes are very gradual and allow of a change in the brush position in the meantime, but for loads with torques which remain practically constant at all speeds, or torques which vary only with the speed, the motor is eminently suited.

Centrifugal pumps, blowers, and ventilating fans, and also reciprocating pumps and Roots blowers may be cited as examples. The torque varies approximately as the square of the speed in the first three drives, and for the others is practically constant over a wide range of speed. In the former cases the series commutator motor is capable of producing speed variation from standstill to the maximum value in a perfectly smooth and gradual manner. Instead of the inherent torque of the motor commencing to fall immediately the armature has started from rest, it gradually rises to a certain maximum which is slightly higher than the starting torque; then it begins to fall away in the usual manner as the speed increases further, until the torque falls to a value equal to that required by the load.

Generally speaking, a speed range of 3:1 under constant torque is the utmost limit for a series commutator motor. For all supply pressures above 200 volts it becomes necessary to interpose a transformer between the stator and rotor so as to reduce the armature voltage, but the capacity of the transformer is a fraction only of the capacity of the motor, and does not therefore add very seriously to the cost. Fig. 11 shows diagrammatically the arrangement which is employed.

Other applications to which this motor may be put are the driving of calendering machines and calico printing-presses. To a certain extent series motors are used for cranes and hoists, but as those required are usually of small capacity, these services are better provided for by the single-phase commutator motor.

The motor has an advantage over the ordinary induction motor in being able to operate at unity power factor at full load and full speed; at low speeds under the same torque the power factor is slightly reduced, but still remains high; at lower speeds and torques the power factor falls off rapidly due to the great reduction in load, but it does not become worse than that of an induction motor of equal power at the same input.

Machines for low frequencies such as 25 cycles per second are easier to build, and may be made in slightly larger sizes than 50-cycle motors; the size of the commutator is almost proportional to the frequency, so that high-frequency motors are slightly more expensive. The upper limit of capacity of 50-cycle motors is in the neighbourhood of 100 H.P., and of 25-cycle motors 150 H.P.

The simplicity of construction of the series commutator motor, the ease with which starting and speed regulation are effected, the high efficiency at all speeds, and the good power factor over a wide range, are properties which are likely to make it of great service in many applications.

Another important application of the polyphase commutator motor is that of cascade connection with an induction motor.

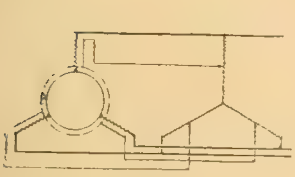


FIG. 12.

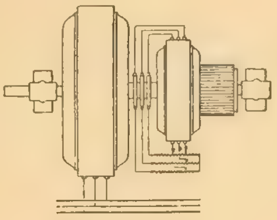


FIG. 13.

The machine may be either of the shunt or series type, but, unlike those previously discussed, must be capable of working satisfactorily over a wide range of frequency.

A commutator machine is the only one in which a gradual change in frequency does not necessitate a change in speed, and this is sufficient to explain its use in this connection.

A shunt commutator motor suitable for cascade connection embodies a compensating winding in series with the armature, and a separate shunt exciting winding which derives its excitation from the source of supply, preferably through an auto-transformer, so that the excitation may be varied at will and the phase of the voltage fixed in relation to that impressed on the motor terminals. A diagrammatic representation is shown in fig. 12.

For any one ratio of the exciting voltage to the terminal voltage there is one frequency only at which the machine will operate. This frequency may be altered conveniently by varying the ratio of the exciting voltage to the terminal voltage, and whatever the terminal voltage these relations hold good. By connecting such a machine in cascade with an induction motor, the slip-ring voltage as determined by the design of the motor is taken up by the shunt commutator motor, and the latter enforces a slip frequency only, according to the setting of its excitation. It will be evident that it becomes possible with an arrangement of this kind by varying the excitation of the commutator motor to impose a wide range of frequencies on the external circuit, which is the secondary of the induction motor, and, as previously shown, each frequency corresponds to a definite speed of the induction motor. Speed regulation becomes, therefore, almost as simple as with continuous-current machines.

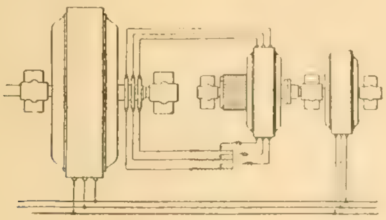


FIG. 14.

The commutator motor has to deal with the full secondary current, and a voltage which is fixed by the maximum slip frequency employed; a cascade motor, therefore, capable of producing x per cent. slip in the main induction motor must be designed for x per cent. of the latter's ratings.

Two methods of utilising the torque exerted by the commutator motor are in practical use. One suggested by Krämer is to couple the shaft of the commutator motor direct to that of the main motor, or to drive the auxiliary by a belt or gearing. This combination is illustrated in fig. 13.

The other method is due to Dr. Scherbius. The commutator motor is direct coupled to a squirrel-cage induction generator, which in turn is electrically connected to the supply system. Electrical energy given to the commutator motor at variable frequency is converted to mechanical work available on the shaft, and this is re-converted to electrical energy in the induction generator, and returned to the supply system. This arrangement allows a convenient speed to be adopted, which is practically constant under all conditions. It is illustrated in fig. 14.

By suitable design the main motor may be magnetized altogether by the commutator motor, and no wattless current will be taken from the supply system even on no load; or the main motor may be made to draw leading wattless current on all loads in a similar manner to a synchronous motor.

The power-factor characteristic curve, 1 in fig. 15, is typical of those obtained at many speeds during tests on a 500-H.P. 440-volt 40-cycle 12-pole induction motor, in conjunction with a shunt-excited commutator motor manufactured by the British Thomson-Houston Company. A few speed characteristics (Curves A) also bear out the conclusion arrived at from theoretical considerations.

The possibility of further improvement along these lines has been proved by following the suggestions of Milch. He proposed to employ the commutator motor as a commutator generator, and to run the induction motor above synchronous speed as well as below.

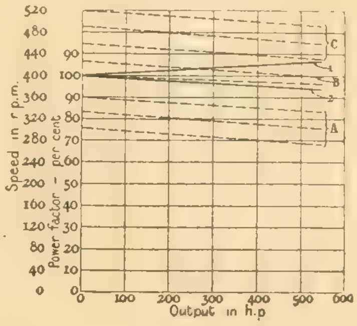


FIG. 15.

In order to pass the synchronous point it is necessary to obtain exciting current of proper frequency and phase from a source of constant magnitude, and independent of the actual value of the frequency. This may be suitably accomplished by the use of a small frequency converter.

This converter exciter, positively driven from the main motor, is connected to the field winding of the shunt commutator machine, and the voltage impressed naturally sets up a current in the armature of the commutator machine and the rotor of the main motor, the phase being such as to produce a torque and cause the machine to accelerate in speed.

The speed of the induction motor remains appreciably constant under load, and the characteristic obtained on test is shown in fig. 15, Curve B.

As it is unnecessary to continue separate excitation when there is a voltage present at the terminals of the commutator generator, it is replaced by self-excitation, the exciting winding being connected to its exciting transformer. Regulation of the speed of the main motor is carried on from this point by adjustment of the excitation of the commutator machine exactly as in the case for speeds below synchronism.

The arrangement of the B.T.H.-Milch system is shown in fig. 16.

Under load the commutator generator maintains practically constant frequency, any variation which takes place being due to the internal losses, and as is to be expected the speed of the main motor drops slightly with load. Speed characteristics obtained during the same tests as the foregoing are shown in Curves C of fig. 15. The power factor of the main motor for all these speed characteristics is shown in curve 2 of the same figure.

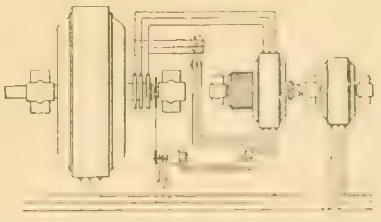


FIG. 16.

The type of motor with a control system as described is only of practical service for large outputs. In small units it is much too expensive, but for large powers it becomes cheaper than a continuous-current motor and apparatus converting from alternating current to continuous current.

The limit of slip frequency is approximately 15 cycles per second, so that except for 25- and 40-cycle supply systems the amount of speed regulation is perhaps not so wide as would be desirable for some applications, and this may limit its possible field to some extent. Its use lies principally for unidirectional rolling-mill drives, and for this purpose it is admirably adapted. The speed characteristics shown in Curves A, B, and C of fig. 15 may be made to droop to any desired extent as load is applied by the simple superposition of series excitation on the shunt excitation of the commutator machine. A considerable drop of speed between no load and full load is usually necessary for rolling-mill service in order to utilise energy stored in the flywheel.

The variability in the power factor of a brush-shifting series commutator motor precludes it from successful use in cascade with an induction motor. The machine which will be discussed has fixed brush position, and if run at constant speed has a fixed power factor under all loads and frequencies. Furthermore, the system of control has been made as simple as brush shifting.

The commutator machine must generate a voltage strictly proportional to the current passing through it and also at some predetermined phase angle to the current; this is accomplished by series excitation.

The commutator machine in part acts like a resistance, producing a slip proportional to the load. There are two essential differences between this and a resistance speed-regulation; one is that the energy input to the commutator machine, represented by the voltage at its terminals and the current passing through it, is converted to mechanical work, which may be utilised as desired, and secondly the current is not in phase with the voltage, which means that a wattless component is present. Naturally this component is used to advantage by making it of such a strength as to act as magnetizing current for the main motor, and thus to improve its power factor. In its simple form the series commutator motor, or slip regulator as it is termed, is a combined phase advancer and slip producer, the slip being proportional to the load.

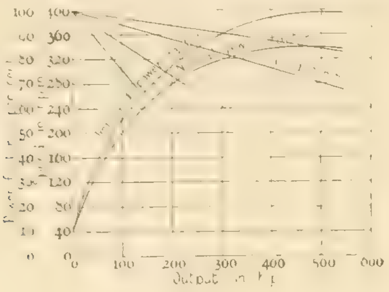


FIG. 17.

To extend its sphere of usefulness it is desirable to be able to adjust the slip-producing properties so that any required slip for a given load may be obtained, and at the same time to retain the phase-advancer properties under all conditions.

For this purpose the stator of the commutator motor is fitted with a special 3-phase winding placed with a certain angular space relation to the armature with fixed brushes and connected in series therewith.

By a suitable arrangement of shunt to the stator winding or parts of it, a portion of the total current may be deviated from the stator, the shunted current bearing a fixed angle to the total current. It becomes possible by this means to vary the excitation, and therefore the flux and voltage of the commutator machine through any desired amount for any current. The shunt possesses principally reactance, and has a limited resistance; accordingly it takes a solenoid form with an iron core, and its variability is produced by movement of the latter. This simple operation, which is the only regulation necessary, causes the commutator machine to take up a wide range of characteristics. The limits are approximately those of the shunt commutator motor, the maximum slip frequency being approximately 15 cycles per second; with a 50-cycle induction motor this allows a slip of 30 per cent. between no load and maximum load.

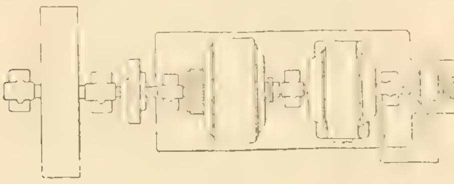


FIG. 18.

The characteristics shown in fig. 17 were obtained in the testing department of the British Thomson-Houston Company. The improved power factor at light load is not quite so good as can be obtained with a pure phase advancer, because saturation in the commutator machine cannot be allowed, but the improvement at full load, which really matters so far as the generating plant is concerned, is very considerable; the power factor also remains independent of the amount of speed regulation.

The slip regulator possesses a fairly large field of application. There are in existence at the present time a large number of induction motors which are controlled by resistance in the secondary circuit. In particular is this the case with motors driving rolling mills, and with flywheel motor-generator sets. The losses involved are often of considerable magnitude, and would represent a large saving if recoverable, but hitherto this has not been possible. The slip regulator converts not only 90 per cent. of the energy previously wasted into useful work, but at the same time improves the power factor of the induction motor with which it is used.

The application to a flywheel motor-generator set is represented by fig. 18. The commutator motor is mounted on the end of the shaft after the manner of an exciter, and its terminals are connected directly to the slip-rings of the main induction motor. As load comes on the motor the secondary current flows through the commutator motor, causing it to generate a counter electro-motive force of rotation which simultaneously causes the induction motor to slip. The electrical energy passing into the commutator motor is converted to mechanical form and given to the shaft of the set, thus serving a useful purpose; the amount of slip between no load and full load may be adjusted by simply moving the core of the solenoids which shunt the stator winding.

Another service is the regulation of an induction motor driving a ventilating fan, the torque of which is definite at each speed.

This type of equipment may be built for any output.

The Schrage type of motor combines an induction motor and cascade-connected shunt commutator motor in one.

Assume that the 3-phase primary winding of an induction motor is closed on itself, as would be the case in a continuous winding of the lap type; the tappings at which voltage would be impressed are 120° apart. The secondary winding on the rotor is shown as three separate phases by AA_1, BB_1, CC_1, in fig. 19.

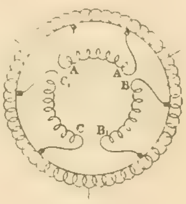


FIG. 19

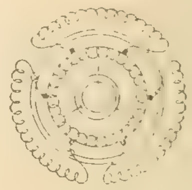


FIG. 20.

It has already been shown that to maintain a rotor speed lower than synchronism, there must be a counter electromotive force supplied to the rotor phases of the same frequency and opposite in sense to the voltage induced in them by the slip of the rotor relative to the primary field. There is a very simple and effective method of accomplishing this without an auxiliary machine, as will be clear from the following:—

Let a stationary commutator be fitted to the stator winding, the junctions of the coils being connected to the segments. Any pair of brushes pressing on the commutator will have a voltage between them the value of which depends on the angular separation or spacing. The frequency of the voltage depends on the speed of rotation of the main field relative to the brushes, and if the latter are stationary it will be the full primary frequency. If the brushes rotate with the same spacing in the same direction in space as the main field, the frequency obtained will be smaller, but the voltage will remain constant. Obviously then if the brushes are fixed relative to the rotor, and rotate with it, there will always be the same frequency between them as is induced in the rotor phases, and the voltage may be varied at will according to the spacing. By ensuring that the voltage obtained in this manner between the pair of brushes is opposite in sense to that induced in one of the rotor phases by rocking the brushes bodily relative to the rotor and so altering the phase, the desired counter voltage for each phase is obtained.

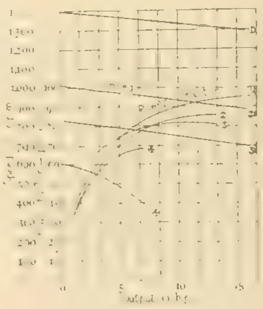


FIG 21.

When the brushes of each pair are moved together so as to coincide there is no voltage between them, hence there can be no speed regulation, but incidentally the rotor phases are short-circuited, and the machine may therefore run as a simple induction motor with short-circuited secondary. Separating the brushes produces a voltage and sets up a current which forces down the speed of the rotor until it is opposed by the slip voltage induced in the rotor. For each angle of separation of the brushes there is a definite speed. The machine has the ability to take load with very slight speed drop in precisely the same manner as an induction motor. A load torque retards the rotor, and the increased voltage induced exceeding the counter voltage between the brushes sets up a secondary current which provides the necessary torque.

It will be observed that the secondary current flows in the same sense as the rotor voltage; the rotor is therefore giving up energy by conduction to the primary, to which there will be occasion to refer again. Reversing the position of the brushes is a natural extension of the operation, and the results produced are of fundamental importance. The voltage present between a pair of brushes is fixed by primary considerations, and is unalterable and uninfluenced by secondary voltages. By reversing the position of the brushes, and therefore reversing the sense of the voltage between them, the secondary voltage in the rotor phase is compelled to follow suit, and this necessitates that the rotor commence to rotate at a speed higher than synchronism. Under these conditions the torque-producing current in the secondary is in the same sense as the primary voltage derived from the brushes. Energy is therefore conducted from the primary to the secondary and converted to mechanical work.

It will be observed that the functions of the primary winding are two-fold; first it induces voltage and transfers energy through the medium of the main field to the secondary, after the manner of an ordinary induction motor; secondly, it acts as an auto-transformer and frequency transformer, and thus transforms and returns power (which is delivered to it by the secondary) to the system when the motor runs below synchronous speed, and transforms and conducts additional power to the secondary when the motor runs above synchronous speed. The power dealt with by the commutator and through the brushes is only due to the slip energy analogous to the power dealt with by a separate auxiliary shunt commutator motor.

To sum up the action, it may be said that the power induced in the secondary on the induction-motor principle corresponds to the mechanical output at synchronous speed under the torque considered, and if the speed be less than synchronous the secondary power is in excess of that used up in the mechanical form, and the difference is conducted back to the primary, where it is transformed and returned to the system. At speeds above synchronism the power induced in the secondary is less than the mechanical output, and the deficiency is made good by power conducted directly from the primary to the secondary. The electrical input therefore corresponds to the mechanical output, and the machine is highly efficient at all speeds.

The amount of speed regulation above and below synchronism is limited only by the power factor of the secondary circuit. This must be kept high, otherwise the torque for a given current will suffer. The power factor depends solely on the ratio of resistance to reactance; and the reactance is low so long as the frequency is low. On a 50-cycle circuit a slip frequency of 25 cycles above and below synchronism gives speed limits in the ratio of 50+25 : 50—25, namely 3 to 1, and for circuits with a lower frequency than 50 cycles per second the speed range is increased.

Reference has hitherto been made to a purely hypothetical machine since it is quite impossible practically to alter the spacing of brushes which are rotating in space. To utilise the idea, the primary and secondary must be inverted, the primary with its commutator must be wound on the rotating element, and the supply fed to fixed points on the winding through slip-rings, and the secondary must be wound on the stator as three separate phases after the manner of an induction motor, the terminals being connected to brush studs on two rockers movable in opposite directions as shown in fig. 20.

A still further modification is necessary in a practical machine. A straightforward primary winding after the manner of a rotary converter armature would have considerably too high a voltage per segment for satisfactory operation with a normal supply voltage. Two distinct windings are therefore used in transformer relation, the one connected to the commutator having few turns and carrying correspondingly higher current, whilst the other may be star or delta wound and connected to the slip-rings.

The practical limit of capacity for machines of this kind is in the neighbourhood of 70 H.P., and within this limit in the author's opinion it is the cheapest, simplest, and best variable-speed alternating-current motor with a shunt characteristic yet evolved.

The characteristics shown in fig. 21 are reproduced from the E.T.Z., four speed curves being given from the many obtainable within the complete speed range. The machine is essentially one which gives an output proportional to the speed, as may be readily deduced from its action above and below synchronism.

The motor is specially suited for driving machine tools, pumps, fans, blowers, paper-making machinery, and printing presses.

Discussion.

Dr. G. Kapp said the author had earned the thanks of the Institution for having brought a subject before it which had been neglected too long. To persons conversant with vector diagrams those given by the author were quite intelligible; and if they were dealing with asynchronous machinery no more would be required, for they had grown accustomed to read into the vector diagram the physical meanings represented by the different lines and angles. This physical meaning was however not so obvious in the diagrams representing commutator machines; he had found it useful for the understanding of treatises on commutator machinery to supplement the ordinary vector, or time, diagram by what was known as a space diagram. The distinction was that in a time diagram the vectors retained their lengths, but altered their positions, whilst in the space diagram the vectors retained their angular positions but altered their signs and lengths. The conventions he suggested were as follows, assuming all machines to be of the two-pole form:—

Sense of progression in the winding.—Stator and rotor are supposed to be wound in such way that a current passing in at one end and out at the other terminal (or brush) will produce a flux across the diameter in the same sense. In other words the exit terminal becomes a N pole. The flux produced is represented by a line parallel to the diameter of the winding. The length of the line represents the crest value of the flux. The direction of the flux is represented by an open arrow head. A little circle is to be placed at the other end of the line to show that it is a flux vector. The angular position of each flux vector does not vary, but where two or more fluxes are combined the angular position of the resultant flux vector changes. In other words the resultant flux vector rotates also in a space diagram.

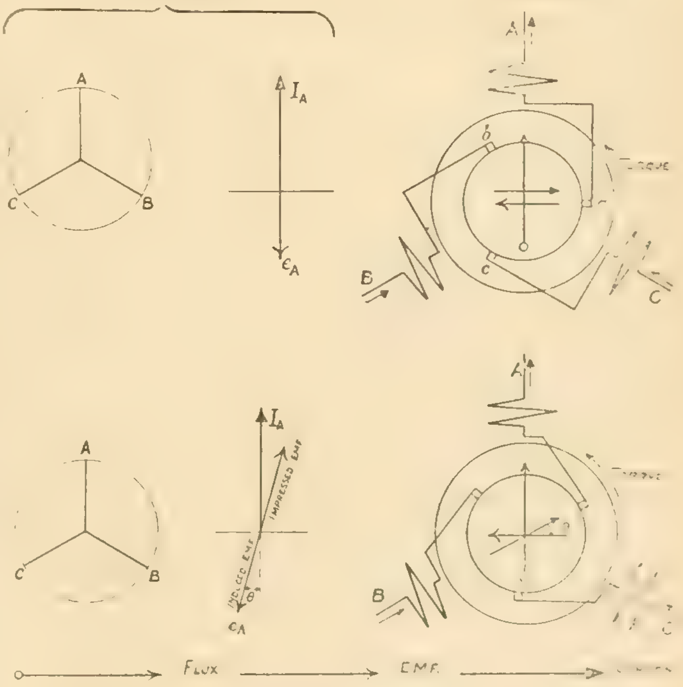
Sense of rotation.—The time vectors rotate counter-clockwise. To make the resultant flux vector also rotate counter-clockwise in the space diagram the marking of the stator poles must be in a clockwise sequence.

Direction of EMF.—The direction of the EMF. induced in the rotor is obtained by revolving the flux vector through 90 degrees. The EMF. vector is represented by a line with open arrow head.

Current vector.—This is represented by a line with a closed arrow head. Its direction is given by the terminal diameter, its length and sign (whether to one side or the opposite side) are read off the time diagram.

Direction of torque.—Consider the current vector as a lever, pivoted at its tail and weighted at its head with the field flux, then the direction in which the lever turns is the direction in which torque is exerted.

TIME DIAGRAMS. SPACE DIAGRAMS.



The application of these conventional rules is shown in the figures. The motor is supposed to be provided with a compensating winding so that no flux is produced by the armature current and the only flux vector appearing in the space diagram on the right is that due to the stator coils A B C. The figure on the left shows the phase position. It is chosen for the moment that the current in A has positive crest value. The direction of current in the space diagram is shown by the arrows placed to the field coils A B C and the resultant flux is shown across the armature by the vertical flux arrow. The brushes are placed at right angles to the coil axes and the resultant current through the armature is represented by the horizontal vector passing across the flux vector at right angles. This produces torque as shown by the curved arrow. The motion resulting from this torque produces the induced EMF. the space vector of which is also drawn at right angles across the flux vector, but with the arrow head on the left. Since an arrow head on the right of the current vector means a positive value (the current having positive crest value at the time) the space vector of the EMF. must be considered to be negative and in the time diagram the EMF. vector must be drawn in line with the current vector, but in the opposite direction. There is thus obtained for the A phase the very simple time diagram shown to the left of the space diagram. It consists of the current vector 1A and the vector of induced EMF. eA in exact opposition, which is the condition for the working of the machine as a motor. To supply the motor with current we must impress an EMF.

which has one component equal but opposite to eA; further a co-phasal component to cover losses and finally a component leading by 90 degrees to balance EMF. of self-induction. A motor with the brushes exactly at right angles to the respective field axes can therefore not work with unity power factor.

Assuming the brushes to be shifted forward by an angle θ as shown in the lower figure, the flux and EMF. vectors remain in the space diagram as they were, for these quantities depend on the position of the stator coils and these have not been altered. The only thing that has been altered is the direction of the current vector. It crosses the flux line at an angle which is by θ smaller than the previous right angle. There is this phase difference between current and induced EMF., and that is shown in the time diagram by the two vectors being no longer in line but enclosing the angle 180 θ. The torque has been decreased in the ratio of 1 to cos θ, but a leading component eA sin has now been introduced and can be made to balance the EMF. of self-induction. The latter depends on the current and is independent of the speed; the leading component eA sin θ depends on strength of flux (therefore current) brush position and speed. It will thus be seen that only above a certain speed and load can the motor work with unity power factor and that by suitable choice of load, brush angle and speed the machine, whilst taking power from the line, can at the same time inject a leading current into the line so as to make up for the bad power factor of some other motor connected to the same line. If the brush angle be increased to 90 degrees the torque vanishes and the machine must be driven by external power. It then acts in the same way as a static condenser.

Dr. M. L. **Kahn**, whilst agreeing that the Latour motor might not be quite so good as some later machines, said that it was nevertheless a much better machine than the author stated. The first patent ever taken out on this type of machine was applied for in this country by one named Wilson, and consequently the machine was an English invention.

Mr. W. J. **Larke** stated that the commutator difficulty was not the bogey that people imagined. The ordinary objection was inherited from experiences with D.C. machines and not experienced in practice with A.C. commutator machines. He also emphasized the advantages obtained from slip regulation.

Dr. A. H. **Railing** remarked on the commercial advantages of three-phase commutator machines, and pointed out that when this type of machine reached a higher state of perfection the competition from the D.C. machines would disappear.

[On p. 245, through an accident whilst in the press, figs. 3 and 4 were inverted both in order and in position.—Eds.]

WORKERS' EARNINGS AND THE WAR.

By "COMMERCIAL."

If any proof were needed, the recent debate in the House of Commons indicated plainly that since the war began the prices of the necessaries of life have gone up considerably. As to the question of the temporary or permanent nature of such increases, for at any rate the period of the war, we are invited to wait and see. One can only trust that the waiting part of the arrangement will not be unduly prolonged, if only for the sake of the unfortunates upon whom high prices act most harshly, and that the seeing part of it will be as satisfactory as may be. We have had some experience of the consequences attendant upon a shortage of coal. From the industrial point of view dear coal, or no coal at all, may mean a measure of equal disaster. For domestic supplies it is indispensable to some, and nearly so to most people, but the approach of warmer weather will, if nothing else does, perhaps tend to lower prices. Food is, however, quite a different proposition, and we await with much interest the further investigation and discussion of this question, and the resultant Government action or inaction in the matter. We do know certainly that prices reached an artificial figure at the coming of the war, and people who were foolish enough, paid in some cases fancy prices for such an article as flour. Amid the confused array of arguments brought forward at the present time, bearing upon the increased cost of food, one cannot be dogmatic either in one direction or the other. It may be well to ponder rather on the question that concerns our power to buy food at the present prices. Will our wages, or salaries as workers, be able to stand the strain if present conditions remain, or perhaps grow worse? There are one or two indications about of some more or less ill-defined unrest, and, with no desire to be pessimistic, the evils of dear food might well cause such unrest to manifest itself in a most serious manner. In certain quarters industry booms, and work is better than has ever been known. The trades so affected are too well known to reiterate here, but labourers draw the wages of skilled artisans, and the latter twice the amount of their usual earnings, if not more. Electrical firms are sharing in this happy state of plentiful orders, doing day and night and Sunday work. Government orders are largely responsible for this, but the absence of the usual German supplies is another factor in the situation. Orders are pouring into this country from the neutral European nations, which cannot in some instances be filled for some time. It is not merely that Norway or Holland is ordering more than in other years. They are ordering material which is rarely, or never, in the normal run, obtained from anywhere save Germany. Beyond this, as can be seen from the pages of the Electrical Review, the Colonies are doing their share, and signs are not wanting that they will maintain it after the war.

Outside the ranks of those firms who are thus fully employed there seems to be no serious slackness, and the absence of the hundreds of thousands of Kitchener's soldiers has doubtless relieved the labour market, where such slackness may have occurred. In some places, notably at our great ports, labour is very scarce, and presumably is worth more money to-day than usual. All this is to the good, but so far it only concerns those who are paid by the piece or the hour. Salaried workers are not having such a satisfactory time in some cases. In the first case certain firms took steps, immediately upon the outbreak of war, to reduce their staff wages. The reductions so made varied upon a sliding scale arrangement from 10 per cent. for the lowest, to 33⅓ per cent. for the highest paid of their employés. We make no remark upon the advisability or justice of such an arrangement, but merely mention the fact. These employés are now under the necessity of paying more for the maintenance of themselves and their dependents, if they have any, upon a seriously lessened income. It is not difficult to imagine the consequences of a 20 per cent. less income having to face a 25 per cent. rise in the cost of life's necessaries. At the best, salaries in the electrical world are, for several excellent reasons, generally no better than in other spheres of industrial activity, and in some departments of electrical work, to judge from certain evidence, they are occasionally worse. Some there are who predict that a slump will follow in the wake of the war. That is at least possible, if not probable. Now that slump will be the rainy day towards which the present boom ought to contribute something in the shape of a reserve. If, therefore, prices are to keep up their tendency, the staff wage should go up now. The worker receiving double money can pay 25 per cent. more for food and still save something, but the salaried man at a fixed, or reduced, rate is, as the Americans say, up against it. He has to accept the rush and overtime, which are at least partly occasioned by the needs of his country's Government for war materials; he has to pay the extra prices which prevail, but he has nothing extra as a set-off or recompense for either of these. The welfare of the staff workers is at least of equal importance to that of the other workmen, and yet just at the moment this seems to be accorded less recognition than it might receive.

As outlined above, this is the position of affairs with regard to the pay of the various workers at the moment. Generally speaking, the situation may be said to be quite as good as might have been anticipated under the abnormal circumstances which have prevailed since August last. Things are undoubtedly looking better for electrical people generally than they were twelve months ago. Further than that we cannot go, and the only course possible for a month or two seems to be to adopt the waiting and seeing arrangement to which reference has already been made.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Modern Wiring.

May I correct a reference on page 267 of your current issue? It is in the abstract of my paper on wiring and was due to the omission of a line in my typewritten copy. The sentence refers to the new system of concentrated cab-tire cable and, should read as follows:—

"On a concentric conductor having a core of 3/22 S.W.G. and an external conductor of 36/30 S.W.G., the insulation resistance between the two wires was 1,700 megohms per mile, and the insulation resistance between the external wire and earth was 52 megohms per mile. This latter was the insulation resistance given by the impregnated tape plus the cab-tire sheathing."

As mentioned in my paper the cab-tire is not designed to give high insulation. Its good points are that it maintains well its initial degree of insulation. It gives, by its damp-resisting quality, more permanent value to any supplementary insulation beneath it; and it is a most excellent chemical protection to the whole cable. It is the latter qualities alone that are emphased by the makers of the cable. Yet, considered as a conduit, it has the inestimable advantage that no rush of current or even harmful leakage to earth can occur throughout its length. It is for these reasons that in its concentric form, it may be recommended, in combination with proofed tape or other light insulation beneath it, for use where the external conductor thus protected is normally at approximately earth potential. These conditions obtain where the external conductor is connected to the earthed mid-wire of a three-wire supply. Even in a two-wire system one side may be often usefully permitted to remain with only a moderate degree of insulation and difference from earth potential. In such a case the cab-tire sheathing with its underlying reinforcement suffices to reduce stray currents to negligible dimensions.

Donald Smeaton Munro.

Edinburgh, *February 20th*, 1915.

[That there was an omission was obvious in the proofs, when going to press, but having no means of remedying it, we printed the matter exactly as received.—Eds. Elec. Rev.]

A.C. and D.C. for Lighting.

I must thank Mr. Fowler for the detailed manner in which he has replied to the points raised in my letter of recent date.

I am afraid that Mr. Fowler has misunderstood me in several cases, as shown for instance, by his remarks with regard to three-phase and direct current distribution boxes. For a given number of points, whatever the system of supply adopted, I cannot see that, allowing one fuse per point, the number of fuses, and hence, presumably the size of the box, will vary.

Again, it is surely not often that a three-phase distribution panel is used for lighting circuits? Is it not the best way to use a three-pole main switch with three single phase double-wound transformers, if the size of the installation warrants the use of more than single-phase distribution?

I regret that the wording of my letter with regard to "earth return" also conveyed a wrong impression—granted an *earthed* return, electrolytic action due to leakage current is still more likely to occur on D.C. than on A.C. circuits.

Mr. Fowler has overlooked the word "branch" when reading my remarks with regard to cables. By branch cables, I intended to imply the cables leading out of the distribution box, and not the main cables. It is usual to place the transformer close to the distribution box, in order to take care of this point.

I still maintain that Mr. Fowler is mistaken in his remarks about the diameter of the filament in wire lamps. If he will follow out the reasoning as follows, he will, I am sure, agree with me that his statement was made in error. The total candle-power given out by any lamp is the product of the "intrinsic brilliancy" and the area of the filament. Assuming that the diameter of the wire remains constant, the length of wire for a given candle-power, at a standard intrinsic brilliancy, must be a fixed value.

As the low-voltage lamp must obviously have a lower resistance than the high voltage lamp, the above conditions are not fulfilled as, in order to give the standard intrinsic brilliancy for a reduced voltage, either the length of wire must be decreased, or the diameter increased. The first alternative gives a lower total candle-power, the second (within certain limits) giving the correct result.

Perhaps Mr. Fowler has been told that the diameter of say a "40-watt" filament for a 250 volts supply is the same as for a 220 volts supply. This is, I believe correct, but it does not extend to such a wide range as that mentioned by Mr. Fowler.

In conclusion, I would like to say that my remarks were primarily concerned with indoor lighting, and not with "temporary work," and that by "general handiness," I endeavoured to express my opinion that A.C. supply was more adaptable than D.C. to varying conditions and requirements as they occur in lighting practice.

C. A. Hall.

Monkseaton, *February 18th*, 1915.

High and Low Voltage Metal-Filament Lamps.

Referring to the letter of Mr. Henry Fowler, electrician-in-charge, Liverpool, in your issue of the 12th February, in reference to A.C. versus D.C. for lighting, it seems very strange that a man who occupies a position of electrician-in-charge should be led into making such mistaken statements as he does on the question of the filament diameters of high and low volt lamps. He appears to be doubtful whether there is any difference between the filament diameter of a 110-volt lamp and that of a 220-volt lamp.

It would seem as if the simple application of the well-known electrical laws of resistance would indicate to him at once that the filament of a given candle-power lamp in 220 volts must be considerably smaller—a proportion of about one-half of the diameter of the same candle-power lamp in 110 volts. He ought to further understand that candle-power is not a matter of thickness of filament, but a matter of filament surface for any given material and temperature (or efficiency) at which it operates.

Nela.

Consulting "Engineers."

In reply to "Delta," I should prefer a consulting "engineer" who knows he knows nothing, shuts his mouth, and leaves himself in the hands of a few good firms, to one who apparently has never heard of apparatus which has been in general use for many years, and which is actually installed in his jobs (directly after the term of maintenance is passed) by the man who does not want commission so much as rest at night.

We still have installed 20 voltmeters in parallel on the same bus bar, lead-covered cables behind switchboards, and networks which are linked up solid, switches on every lamp-post and distributors on one side only of busy streets, insufficient and badly arranged plant and no provision for extension, together with all the little drawbacks so well known and inseparable from the standard specification made to suit every job.

How many consulting "engineers" could run and manage the jobs which they cause to be installed?

The fact of the matter is that no man should be allowed to practise as a consulting engineer unless he has passed through the proper training and quite stiff examinations, and the parasites referred to above would then be got rid of.

Alpha.

Half-Watt Lamp Fittings.

We were very interested in the article on Half-Watt Lamp Fittings by "Research" in your issue for February 12th. The question of the proper use of half-watt lamps is a very important one. The publication of the article referred to should be very useful to users of these lamps. We have had instances brought to our attention where the use of half-watt lamps in badly designed fittings has resulted in cracking the globes of the fitting and general unsatisfactory working. It must be appreciated that the very best results can only be obtained from half-watt lamps if they are properly installed in well ventilated fittings. It is not sufficient to put them into any type of lantern, the only ventilation of which is a hole in the bottom of the glass globe. The heat from the half-watt lamps necessitates considerably more efficient ventilation than this, and lamp users are urged to select only fittings made by those manufacturers who have a full appreciation of the necessities of the case

"Research" is correct when he states that probably the best results obtained with half-watt lamps are obtainable with the indirect lighting system. This company's indirect lighting fittings have been used in a number of cases, and the resultant illumination is wonderfully agreeable, attractive and effective.

In the last paragraph of the article your contributor mentions the need for an adjustable lamp-holder. It may interest him and your readers to know that such an adjustable lamp-holder for half-watt lamps is illustrated and described in our price list of weatherproof fittings, etc., for half-watt lamps.

The British Thomson-Houston Co., Ltd.

London, E.C., *February 16th*, 1915.

Trouble with Oil.

A 1,000-kw. set, D.C., driven by a Belliss & Morcom engine, is giving considerable trouble throwing oil. An oil baffle is fitted on the tail bearing, making a tight job so that no oil can possibly get through the commutating end of the machine, and while the shaft is quite dry, oil is found in considerable quantities inside the commutator, and thrown up through the armature windings. The conclusion come to is that the oil is carried in in the form of vapour from the engine, and condensed inside the machine. Have any of your readers had trouble of this sort? and what steps have been taken to get over it?

Enquirer.

Electrical Patents owned by Alien Enemies.

In the list under the above heading on page 271 of your issue of to-day's date, I notice that patent No. 18786 of H. Bremer, Neheim/Rhine, electric lamps, is included. This patent is not owned by an alien enemy but the British Westinghouse Electric and Manufacturing Co., Ltd., of this address, having been assigned to them in the year 1906.

It is somewhat astonishing to find such a glaring error in a list of this nature as the patent in question is one of some notoriety, having been the subject of two actions of infringement in which the British Westinghouse Company were the successful plaintiffs. These actions attracted at the time a considerable amount of attention in the electrical world.

The Westinghouse Patent Bureau.

(A. S Cachemaille, *Joint Manager.*)

London, W.C., *February 19th*, 1915.

In the list of British patents originally owned by residents in enemy countries which appeared in your issue of 19th February, we inadvertently omitted to point out that subsequent assignments, recorded or otherwise, of the patent rights may have been effected, and that the official register should be consulted.

Mr. A. S. Cachemaille, C.P.A., informs us that the patent of Bremer No. 18786 of 1902 has been assigned to Messrs. The British Westinghouse Electric and Manufacturing Co., Ltd., and requests us to make this known, which we have much pleasure in doing.

W. P. Thompson & Co.

London, W.C., *February 22nd*, 1915.

A Quarter-Turn Coupling.

In your issue of February 19th of the Electrical Review, on page 278 you describe a quarter-turn rod coupling "invented" by a Chicago engineer to replace a noisy bevel gear drive on a pump.

It may interest you to know that there is in the engineering department of the University of Leeds a small model of this coupling. This model was there when I entered the University over five years ago, and consequently the arrangement cannot be considered new.

Arthur Rawling.

London, E., *February 20th*, 1915.

Salaries of Junior Engineers.

In reply to "Driver" regarding the salaries and knowledge of some of these engineers, it is simply preposterous that a great number of these wasters, who, as "Driver" says, know nothing, get the chief post. I entirely agree with all that "Driver" says, by my own experience, which is long and varied. For instance, a year ago I went to a place where there were two large suction gas engines, and electrical plant on an elaborate system. At this place the engineer in charge happened to be no more than a common labourer. The whole installation had to be remodelled. I never saw such a state of affairs; everything had been abused to the utmost; in fact, it was in such a state that I refused to do the repairs till experts had seen it. The firm came that put it down, next came two more good men, and the architect, and they all agreed with me that the man was not efficient, yet the firm who put the plant down, supplied this "chief engineer," at a good salary. I was asked to put the whole thing into good working order, which took five months. The job had only been put down two years, yet it ran into hundreds of pounds to repair the damage done by an incompetent engineer, or shall I say a novice? I hope I never have another job like it; the damage done, if I were to describe it, would fill a small book. After the job was finished I left it to the satisfaction of all parties concerned, and I believe that the "engineer" had the order to quit, and time too. I myself was pushed out of a job to let the waster in.

Old Reader.

In reply to your correspondent "Driver," might one inquire how many years ago the cases he quotes took place? For we all know central stations were in a very slack condition 15 years ago. Also we may presume from "Driver's" description of the station, that the engineer-in-charge was receiving the magnificent salary of 25s. per week, and had probably come straight from a technical college, so the officials who engaged him, undoubtedly deserved the results, and then "Driver" asks: what kind of engineers-in-charge do you call these? "Duds," and we frankly admit it, for they lack experience; but there are "duds" in all grades of the station from the volt boy to the chief, including "drivers." I quite agree with "Driver" when he says that all these troubles could have been prevented if they had had an experienced engineer, but can you expect an experienced engineer for the paltry salaries we see advertised in the Electrical Review's situation vacant columns for engineers-in-charge? Last, but not least, I really cannot imagine the average driver, or stoker, working out indicator diagrams, CO_2 and water recorder charts, boiler and coal tests, etc., or even the volt boy's daily load curve; they are usually more efficient at calculating the correct weight for a mile handicap or how much there is to come from a "tanner" each way on a six to four on chance. Not that I wish to cast a slur on drivers or stokers, for I have always found them very good men at their jobs, so if you have got on in the world, "Driver," my advice is, don't let your brains run away with your pen.

Honi soit qui mal y pense.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

1,973. "Electro-optical cells." C. Stille. February 8th. (Convention date, February 6th, 1914. Germany.) (Complete.)

1,995. "Means for setting selecting-devices by electric current impulses." O. Imray. 8th February. (Siemens & Halske Akt. Ges., Germany.) (Complete.)

1,997. "Telegraph machines." L. M. Potts. February 8th. (Complete.)

2,004. "Lamps for use with gas, electric, or other lights." J. A. Chell. February 8th.

2,008. "Magnetic case for bomb." W. J. Deusbury. February 8th.

2,012. "Electrically-heated bodies." T. Kirkland & T. J. R. Kiernan. February 8th.

2,014. "Electric control apparatus." A. H. Curtis & Igranic Electric Co., Ltd. February 8th.

2,020. "Manufacture of neon vacuum tubes." G. Claude. February 8th. (Convention date, February 12th, 1914. France.) (Complete.)

2,036. "Portable dry-battery electric torches." M. H. Goldstone. February 9th.

2,045. "Electric accumulators." J. P. Haworth. February 9th.

2,057. "Electrical transmitter diaphragms." B. A. Pilkington. February 9th.

2,060. "Means for and methods of changing the frequency of alternating electric currents." A. M. Taylor. February 9th. (Divided application on 15,729/13. February 9th, 1914.) (Complete.)

2,076. "Wireless aerial elevator." C. Tuckfield & W. G. de Forges Garland. February 9th.

2,078. "Coin-freed electric illuminating-apparatus." H. E. Stiles, known as L. Stiles, and A. H. F. Perl. February 9th.

2,093. "Amplifiers of electrical energy." Western Electric Co., Ltd. (Western Electric Co., United States.) February 9th. (Addition to 275/15.) (Complete.)

2,130. "Gas and electric light protector." G. Hobbins, trading as V.C. Lighting Co., & W. Hunt. February 10th.

2,132. "Automatic electrical fuse-replacer." M. Terry. February 10th.

2,144. "Process for the manufacture of metallic strips and ribbons by electrolytic means." S. O. Cowper-Coles. February 10th.

2,145. "Electro-deposition of alloys." S. O. Cowper-Coles. February 10th.

2,148. "Telephone apparatus." W. Martin. February 10th. (Kelly M. Turner, Jamaica.) (Complete.)

2,163. "System of telegraphy." E. C. R. Marks. February 10th. (Delany Foreign Co. United States.) (Complete.)

2,164. "Telegraphic apparatus." E. C. R. Marks. February 10th. (Delany Foreign Co. United States.) (Complete.)

2,180. "Switch panels." Igranic Electric Co., Ltd. February 10th. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

2,224. "Incandescent electric lamps." W. Huggett. February 11th.

2,236. "Electric pedal switches." R. Bosch (Firm of). February 11th. (Convention date, July 29th, 1914. Germany.) (Complete.)

2,248. "Electric welding." E. I. Heinsohn. February 11th. (Convention date, February 21st, 1914. United States.) (Complete.)

2,250. "Convertible electric fire." E. A. Welch. February 12th.

2,259. "Means for and method of increasing the current-carrying capacity of cables carrying alternating or direct currents." A. M. Taylor. February 12th.

2,289. "Means for gripping electric cables and the like." W. T. Henley's Telegraph Works Co., Ltd., & H. Savage. February 12th.

2,312. "Electrical heating-apparatus." A. F. Berry. February 12th.

2,324. "Electric ceiling-roses and the like fittings." M. J. Railing & T. Taylor. February 13th.

2,328. "Electric switches or devices for making or breaking electric contacts." F. H. Humphreys, B. A. Quint, & E. J. Felt. February 13th.

2,329. "Controlling polyphase electric motors." B. G. Lamme. February 13th. (Convention date, February 25th. United States.) (Complete.)

2,337. "Insulation testing devices for electric lighting and power installations." R. H. Gould. February 13th.

2,341. "Generation of electrical energy." G. C. Pillinger. February 13th.

2,343. "Telegraph or like systems and apparatus therefor." Automatic Telephone Manufacturing Co., Ltd., & S. R. Smith. February 13th.

2,344. "Bonding connector for bonding the armouring of cables." C. J. Beaver & E. A. Claremont. February 13th.

2,349. "Method of establishing a voltaic arc between electrodes not in contact." F. C. Ucar. February 13th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

8,361. Changeable Signs. G. E. Wertheimer & Orograph Process and Radiant Sign Co. November 10th. (November 10th, 1913.)

19,875. Apparatus for Recording the Control and Working of Machines by their Operatives and the like. W. C. Johnson. September 2nd.

26,082. Controlling-apparatus for Motor-cars. Lancia & Co. November 13th. (July 5th, 1913.)

26,855. Electrically-controlled Railway Block Signalling and Apparatus therefor. P. Browne. November 22nd.

26,897. Propulsion of Aerial or Water Vehicles. J. Macinante. November 22nd.

27,174. Proportional Flow Meter. W. J. Mellersh-Jackson (Cutler Hammer Manufacturing Co.). November 25th.

28,421. Holders for Electric Incandescent Lamps. R. Doi. December 9th.

29,756. Electric Cables. J. F. Watson, & Callenders Cable & Construction Co. December 24th. (Cognate applications, 1850/14 and 8828/14.)

29,757. Manufacture of Electric Cables. J. F. Watson, & Callenders Cable & Construction Co. December 24th. (Cognate application, 1851/14.)

29,759. Electric Railway Systems. K. E. Stuart. December 24th.

1914.

1,613. Pumping and Spraying Apparatus for Cleaning a variety of Articles. W. Routledge. January 21st.

1,759. Railway Signalling. C. M. Jacobs. January 22nd. (Cognate application, 3966/14.)

1,776. Indicators or Alarums for Denoting the Water Levels in Steam and other Boilers. F. A. Young. January 22nd.

1,877. Alternating Current Electrical Instruments of the Moving Coil Type. R. D. Gifford, & Nalder Brothers & Thompson, Ltd. January 23rd.

1,970. Telephone Systems. Automatic Telephone Manufacturing Co., and A. B. Sperry. January 24th.

2,063. Electric Battery Lamps. F. J. Turquand. January 26th.

2,528. Vehicular Electric Lighting Systems. L. Renault. January 30th. (February 15th, 1913.)

2,679. Methods of Controlling Distant Apparatus by Hertzian Waves. J. H. Hammond, Junr. February 2nd. (Addition to 13,310/13.)

2,713. Globe Holders for Electric, Gas, and other Lamps. J. A. Shaw. February 2nd.

2,740. Method of Producing Electric Impulsive Discharges. R. C. Galletti. February 2nd.

2,746. Expediting and Safeguarding Railway Traffic. H. A. Thompson. February 2nd.

2,827. Electric Train Lighting, Ventilating, and Heating Systems and the like. J. Stone & Co., & A. H. Darker. February 3rd.

3,359. Machine Telephone-switching Systems. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). February 9th.

7,241. Signalling Apparatus, more especially for use in Collieries. John Davis & Son (Derby), Ltd., & W. H. Davis. March 23rd.

8,204. Means or Apparatus for Testing Eggs. W. Walker. April 1st.

8,407. Tune Indicators for Automatic Pianos and like Instruments. S. G. Smith. April 3rd.

9,093. Alternating Current Electromagnets. Waygood-Otis, Ltd., H. P. Amphlett, & H. C. Walker. April 9th.

15,380. Sparking Plug. Soc. Carpentier, Bal., et Cie. June 26th. (January 22nd, 1914.)

18,829. Electrical Starting-mechanism for Internal-combustion Engines. F. H. Royce & Rolls-Royce, Ltd. August 19th.

20,796. Electric Switches. F. B. Holt & H. Smith. October 9th. (Divided application on 25,833/13. May 11th, 1914.)

20,958. Automatic Electric Fuse. O. Johnson. October 14th.

23,894. Controlling-system for Electric Motors. G. R. Radley. December 10th. (Divided application on 1975/14. January 26th.)

THE
ELECTRICAL REVIEW.

VOL. LXXVI. MARCH 5, 1915. No. 1,945.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: March 5th, 1915. [No. 1,945.

Page
The Education of the Engineering Worker 309
Lead 310
The I.M.E.A. 310
Will the Ignition Magneto be Superseded? by C. J. Webb ... 311
Improved Method of Making Joints in Gutta-Percha-Covered Core, by J. Rymer-Jones 312
Indian Notes 313
Our Legal Query Column 313
Legal... 314
Business Notes 316
Notes 321
The Electric Vehicle (*illus.*) 325
City Notes 329
Stocks and Shares 335
Market Quotations 336
Metal Market—Fluctuations in February 337
Training for the Industrial Side of Engineering, by A. P. M. Fleming 337
The Electrical Equipment of a Country House, by F. H. Taylor 339
Electricity Applied to Mining, by C. P. Sparks 340
War Items 341
Correspondence—
  The Government and Foreign Trade 342
  Consulting "Engineers" 343
  Batteries for Electric Vehicles 343
  Trouble with Oil 344
  Electric Light Switching 344
  Writers' Cramp 344
Foreign and Colonial Tariffs on Electrical Goods 344
New Patents Applied for, 1915 344
Abstracts of Published Specifications 344
Contractors' Column ... ... Advertisement page xxii

THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos: Holborn 933; Central 4425 (Editorial only)

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:
ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.
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MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto I 307.
SYDNEY: The Mining & Engineering Review, 278, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132 Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

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THE EDUCATION OF THE ENGINEERING WORKER.

OUR own columns, as well as those of contemporaries and the proceedings of scientific societies, testify to the perennial interest which is excited by the subject of the training of engineers. The kindred topic, that of training for the industrial side of engineering, has not hitherto received the same amount of attention.

There are several reasons for this. Possibly the one which is most responsible is that those who consider the subject, and express views upon it, are themselves engineers, and not artisans. This is very likely a subconscious reason, but it is certainly true that many men first begin to think on the subject after this style:—"How could I have been better trained to do the work I have been called upon to do since I left college? What course would I adopt if I had to do it all over again, knowing what I now know of the conditions obtaining in real business?" Then the man who went to college first thinks he might have learnt discipline and application if he had only had a year in the works first; on the other hand, the man who went to the works first thinks he would have known a great deal more of the working of machines, of the nature of processes, and of what goes on generally in the shops, if he had had some technical training first.

A paper read before the Manchester Local Section of the Institution of Electrical Engineers, on Tuesday, February 23rd, by Mr. A. P. M. Fleming, represents, we believe, the first attempt to bring this matter before our Institution as a body. We give elsewhere an abstract of this paper, which, ably compiled and presented to the meeting in an attractive manner, evoked an interesting and, we think, an important discussion.

Two further possible reasons for the neglect of the subject of the training of those who will work at the bench all their lives were brought out in the discussion: one, that there are so many more to deal with, and they have, as a general rule, less money and less time available for spending upon their education; the other, that undoubtedly skilled direction is the first essential, because it can frequently get good results even out of imperfectly-trained men, though not at the highest rate of efficiency.

Like everyone else who has handled the problem, Mr. Fleming finds that boys leave school in a very incompletely educated state. The necessity for imparting general instruction, as outlined in his paper, and as revealed in the apprenticeship rules of large firms of engineers and shipbuilders, and railway companies, should not exist. It is only of recent years that teaching, or to use the inharmonious title which has been bestowed upon it by those in authority, pedagogy, has itself become a subject of University rank. We believe that elementary subjects, or, as Mr. Peck would say, fundamental principles, are nowadays put before children in a far more attractive manner than was formerly the case. Children of school age are at the most impressionable period of their lives, and they can, and do, remember those things which attract their interest and appeal to their imagination.

The use of the scientific imagination may lead us into strange errors at times, but it is only by its aid that we are redeemed from being unable to see the wood for the trees. The imagination must be cultivated, and in this connection we may refer our readers to a recent issue of the *General Electric Review*, containing an article describing the apprentice system at the works of the General Electric Co. of America, at West Lynn, Massachusetts. The demands of theory upon the imagination are found to be best brought home to the mind of the young man by concrete representation of the different truths which are taught him.

The absence of proper co-ordination between employers and educational authorities is another thing of which every one who is interested in this subject cannot fail to become unpleasantly cognisant. Mr. Eustace Thomas thinks that the very fact of having schools at works at all is evidence that practical men distrust technical teaching; and his does not seem to be an entirely isolated opinion. Mr. Fleming argued in his reply—which will, we understand, be amplified in the *Journal*—that the works was the proper place to have the school, because by having it there it was possible to get to know the boy himself. As a rule, of course, the teacher never works, and the worker never teaches. Mr. Thomas is himself a notable exception, for he has had years of teaching experience, and now engages in manufacture. Prof. Miles Walker is another, for he was for many years connected with the British Westinghouse Co., and now teaches.

It will already have occurred to the reader that not every works can run an apprentices' school. We are certain, however, that it could be done in more cases than those which now exist, only then we come up against the attitude of "we can't take the risk" of spending—or rather, investing—the capital, to which notice has recently been drawn in another connection.

Even where manufacturing concerns are very small, much might be done by co-operation. Mr. Fleming draws attention to what has been done by Dr. Kirschensteiner at Munich, and to quote:—"In this centre, around which there are a number of comparatively small industrial works, separate classes are arranged for the youths of each trade, and in these classes, apart from the continuation of general education, both practical and theoretical instruction is given in the trade by skilled workmen and special instructors." This system could surely be applied among the numerous metal workers of Birmingham and the Midlands, and the small cutlers and silversmiths of Sheffield, to take only two examples. Co-operation would lead in time to nationalisation, the desirability of which was alluded to by Prof. Walker.

We must not conclude without mentioning the noteworthy fact that financial restrictions are almost entirely removed at the British Westinghouse works. Many promising youths who would otherwise be precluded from obtaining proper training can now improve themselves and make progress, and the benefit is mutual between them and their employers. The apprentice should not be looked upon as part of the machinery, and to obtain the best results employers should remember the important psychological facts that the growing and developing youth needs to be self-supporting—hence he should have a wage better than an unskilled labourer's; to be properly fed—hence not to go too long between meals; and to get proper rest—hence not to be pushed on to overtime as if he were full-grown and well skilled. The recently-published report of the L.C.C. psychologist, Mr. Cyril Burt, is a document which should be studied by those who hope to advance our national well-being in this direction.

Lead.

There was recently a sharp fall in the price of lead, but it proved to be but transient, and with a renewal of buying upon a moderate scale, and a less defined desire to liquidate metal, the market experienced a good rally, and to-day the level of prices is once more above the £20 level. The weakness which was noticed about a month ago had its origin to a great extent in the tactics of leading dealers, who apparently apprehensive of the United States forcing metal upon the London market to the detriment of the general situation, seized what they regarded as their opportunity and forced down the price. This effectually stopped the offers of American lead, and with a capital demand springing up at the cheaper range of prices then established, there was a steady and sustained upward movement. The fundamental position is sound so far as can be ascertained, the stocks in the United States being very moderate, the returns just available showing that at the end of December the accumulation of foreign lead in American bonded warehouses was only 6,800 tons, or about the same as a month previously, while elsewhere there is no excess of metal apparent. Here there are such difficulties experienced in regard to the discharging of steamers reaching here from Australia and elsewhere that it is sometimes rather hard to get hold of lead out of vessels, and this now and again causes a certain amount of trouble to the trade. The excessive cost of freight is an additional factor contributing to maintain a firm tendency about the market, for it makes it a costly matter to ship lead. There has been a considerable quantity of the metal in Spain awaiting disposal, and it had been feared that this must have a sobering effect upon prices, if the time came for it to be realised, but it now appears that the bulk of this has been sold to France, which country is still a consumer of lead upon an enormous scale, as, too, are all the warring nations, in connection with their military needs. Russian buying has been a matter of great importance for a long time: Russia has been actually taking lead for shipment from America to Vladivostock, and there is still a demand reported for material for prompt dispatch. There is not much chance of this demand persisting so far as the United States is concerned, for the time is getting near when it will be possible again to ship material to Russia by way of Archangel, and the opening up of the Dardanelles is bound to make an enormous difference to the entire course of the campaign in Europe. When the seas are swept clear of the baby-killers and their atrocity-friends the Turks, a very definite forward step will have been taken for bringing the "War Lord" to his knees. The general trade demand for lead is poor taking things all round, and the requirements for military purposes constitute the most important branch of consumption. Sellers are less disposed to operate, and the continuance of a pretty firm condition is generally expected. Of course, an improvement in the shipping facilities would mean a good deal to importers, and the more expeditious handling of goods at the Docks would assist to bring down prices of all commodities, but it is probably too much to look for any material relaxation of the difficult attitude of labour, which is partly responsible for the congestion and undue raising of prices.

The I.M.E.A.

In our "Notes" columns we are able to-day to publish some exceptionally interesting information regarding the work of the Incorporated Municipal Electrical Association. We have on previous occasions referred to the strong position which this Society has attained in the electrical world, where its active policy contrasts with the passive attitude of certain other organisations, and it will be observed that the Development Committee, which, with members co-opted from all branches of the industry, is a very substantial and representative body, is about to commence operations in several directions where progress is urgently needed. The constitution of the Committee reflects the liberal views of the Association, and we may be assured that no pedantic or academic scruples regarding commercial matters will hamper its proceedings.

In effect, the Development Committee takes the place that might have been occupied by the Industrial Committee of the I.E.E., and also will discharge the functions of the Society for Electrical Development of the U.S.A., to which we have frequently referred in these pages, and which is officially represented on the Committee. It will be noted, too, that the Sub-Committees themselves are empowered to co-opt persons whose help may be of value, a procedure which is of the greatest service, and ought to be practised in all departments of the State, from the highest to the lowest, but nevertheless is rarely adopted.

The decision of the Council of the I.M.E.A. to dispense with the customary Convention this year will receive general approval; business meetings, however, will be held, and it is significant that the principal features of these will be the presentation of reports by two active and energetic bodies which, like the Development Committee, have sprung from the I.M.E.A.

The Association is "going strong," and we heartily wish it success in all its undertakings.

WILL THE IGNITION MAGNETO BE SUPERSEDED?

By CHAS. J. WEBB, A.I.A.E.

The European war, although it has only been in progress seven months, has already wrought various unexpected changes, and has brought about many entirely unanticipated positions, some of which are in connection with the motor-car movement. Among those of interest, from an electrical point of view as well as to motorists, is that relating to the question of ignition. Up to the time of the outbreak of hostilities the makers of a certain magneto had built up such a strong position that, so far as the United Kingdom—one might say the whole of Europe—was concerned, practically every make of car was fitted with one or other models of the magneto in question. True, there were other types of magneto on the market, both at home and abroad, but they received such little encouragement, that their manufacture was only conducted on a relatively small scale, and it is probably from this cause that their construction was not brought to the same high standard of perfection as the German-made article.

There was, of course, a large stock of the latter in this country at the time war was declared, which will, doubtless, enable car manufacturers to carry on for some time, and, in the meantime, a number of magnetos which have hitherto not had their chance of "making good," and others emanating from new, but none the less experienced, firms are making their appearance on the market, so that, with the idea definitely removed that a car is useless unless fitted with the "one and only" type, it is probable that the magneto supply problem will not prove so serious as it appeared to be at the outbreak of the war.

In some quarters, however, the opinion is gaining ground that the outlook for magneto manufacturers is none too bright—that, ere long, the ignition machine they are manufacturing will be superseded. In other words, there is a growing feeling that, since electric lighting installations—practically all of which include a battery of accumulators—have become *de rigeur* on motor cars, there is no longer any need, seeing that a supply of the current needful for the spark is already available, for the additional complication of a magneto.

The Development of the Ignition Problem.

In the early days of the motor movement, as a few of the older motorists have good reason to remember, they having passed through experiences the modern car-owner can hardly imagine, the ignition of the explosive charge in the combustion chamber of the engine was effected by means of a costly platinum tube kept in a state of incandescence by means of a lamp or burner. This was duly superseded by ignition by means of accumulators and coil, which was eventually brought to a relatively high degree of perfection. The main difficulty which could not be overcome, and which in due course led to the introduction, or rather adoption, of the magneto, was that the battery in a short time became exhausted and required recharging. Sometimes, despite all the care that might be taken, the accumulators ran down unexpectedly, most probably as a result of short-circuiting, with the usual result of leaving the motorist stranded "miles from anywhere."

At first the ignition magneto was not the perfect and reliable article it is to-day, and it had a "long, long way" to go ere it won the entire confidence of motorists, dual ignition—accumulators and magneto—being for some years a leading item of the specification of all the principal cars. Gradually, as we all know, the magneto proved itself reliable, so that, finally, it came to be entirely and exclusively relied upon to furnish the vital spark. Yet, there are those who do not regard the magneto as the final form of ignition, especially in view of its one disadvantage that at low engine speeds it will frequently not fire the explosive charge in the cylinders, especially if the points of the sparking plug are dirty, or the mixture is not correct, it being in some quarters held that it was the difficulties experienced in this direction that led to the introduction of engine-starting devices.

The Doom of the Magneto Predicted.

The question as to whether the magneto will be superseded is not entirely a new one. It was first mooted some two or three years ago, when it was predicted that sooner or later it would have to fight for its position. The prediction was of course based on the increased popularity of electric lighting for cars. The need of a generator to supply the current for electric lighting, a battery of accumulators for equalising it, and the opportunity for employing the same medium for the starting of the engine were considered an irresistible combination compelling the use of the same equipment to furnish the ignition current, and, consequently, rendering the magneto superfluous. That the dynamo or generator could keep the battery constantly charged was considered as affording a further guarantee that the change would come about as predicted.

The matter is one that, owing to the greater, or perhaps, we should say, earlier popularity of electric lighting and engine starting installations, has received more attention in the United States than in this country, but the fact that the announcements relating to 1915 models made in America show a decrease of, approximately, 30 per cent. in the number of makes of cars fitted with magnetos seems to indicate that the time has arrived when magneto manufacturers in this country should turn their attention to the problem of evolving a combined system of lighting and ignition, and, possibly, engine starting, since they form the class which, obviously, has had the greatest experience of electrical apparatus as applied to motor vehicles. Since the lighting dynamo has been almost universally adopted, it has been possible to design a system of lighting and ignition that has all the advantages of accumulator ignition for starting, and the magneto for running, without any of the disadvantages of either system, and in which there is a large amount of current available at all times; in other words, the amount of current that would run down the batteries formerly used for ignition purposes will not be missed from the accumulators used for engine starting and car lighting, as the dynamo keeps them fully charged.

Early experiments appeared to indicate that an ignition system depending on the same source of energy as an engine-starting motor would not give reliable results, because of the weakening of the spark due to voltage drop when working the starter under adverse conditions. Engine-starting systems have, however, been greatly improved, with the result that specialists in America are now claiming that a point has been reached when no such fears need be entertained.

The New Generator-Battery Ignition System.

The generator-battery system, as the modern method is called, introduces nothing new, but, rather, is claimed to eliminate one piece of apparatus about a car, and utilises the equipment already on most vehicles. On starting, the ignition current is taken directly from the accumulators, the latter being what is termed floating on the line. When the engine is in full operation the dynamo starts to supply the current at the proper rate to the battery, and in sufficient quantity not only to supply current for lighting and ignition, but also to keep the battery fully charged.

There is nothing radically new in the components of a combination lighting, starting, and ignition system; there is no connection between them, except that they draw the necessary current from the same ultimate source—the generator. The wiring circuits are entirely independent, that connected with the ignition conducting the low-tension current from the battery to a non-trembler induction coil, the high-tension current from the latter passing through a mechanical circuit-breaker and distributor of practically the same design and construction as used in a magneto. It is claimed for the combination system that since a "fat" spark is obtained at low as well as high motor speeds, the carburetter may be set to work with a weaker mixture than usual, and that, consequently, the petrol consumption is reduced. Furthermore, there is no logical reason why equal engine speeds should not be obtained with the generator-battery system as with the magneto, while the engines may be throttled down to a lower degree than is possible with the magneto. Among other advantages claimed for the system are that the current is of a constant intensity, since it does not depend on the speed of the engine, while, as there are no tremblers on the coil, perfect synchronism is obtained in the distribution. We do not overlook the fact that the element of security may not be so great in the case of an installation that is serving a triple purpose, but, after all, this is a question not only of choosing a well-tried system but also of seeing that it is carefully installed, a good deal depending on the way the wiring is carried out.

Some Claims for the New System.

One of the most ardent advocates in this country of the doing away with the magneto is, of course, Mr. F. S. Bennett, of the Cadillac Motor Co., who, in a recent communication, stated that: "Frankly, I believe the magneto was doomed from the day that the combined unit system—lighting, starting, and ignition—was produced, and, fortunately, there is no need to lament its departure in the form it has been generally known, as an equally good ignition system, with the enormous advantage of a perfect form of lighting and self-starting, has arrived to take its place, and, I am convinced, will inevitably do so." Mr. Bennett, after three years' experience of the combination set employed on the car with which he is connected, states that he is to-day "more than ever convinced that the magneto, perfect as it is, is bound to be displaced in Europe, as it has been in America, by some such system. The power is absolutely the same on either generator or magneto ignition, and if there is any preference it lies with the newer system, as the engine will run slower without stopping, and has a wider range of control."

While, perhaps, it is too early for us to express a definite opinion on the new-comer in the field of ignition, yet the fact that it is making great progress on the other side of the Atlantic suggests that the time has arrived when serious consideration should be given to the subject in this country, for whenever a start is made in substituting the new generator-battery ignition for the magneto on British-built cars, past experience has shown that it will have to go through a period of development and trial until it attains the same degree of reliability at the hands of motorists as that of the present-day magneto.

Finally, although the question whether the war may have the effect of quickening the disappearance of the magneto in favour of the newer system may be an open one, it is sincerely to be hoped that the lesson which the war has taught us in connection with magnetos will be taken to heart, and that never again will anything like a monopoly in connection with any part of the automobile be allowed to establish itself within our borders.

IMPROVED METHOD OF MAKING JOINTS IN GUTTA-PERCHA-COVERED CORE.

By J. RYMER-JONES.

It is not an uncommon experience that joints in the gutta-percha core of picked-up cable, and sometimes even in new core, do not always remain as sound electrically as when first made. The cause of weakness is generally traceable to imperfect cohesion between the insulating coverings, due to one or other of the following:—

(*a*) Want of cleanliness when handling the joint.

(*b*) Moisture left between the coverings owing to insufficient lamping.

(*c*) Surface oxidation preventing intimate union between the coverings.

(*d*) Deterioration of the gutta due to stock cable not being continuously under water.

(*e*) Unequal shrinkage between the gutta of the core and the gutta coverings of the joint, especially at the ends, when subjected to a considerable and sudden change of temperature.

(*f*) Overheating with a too hot tooling iron, &c.

Remedies.—(*a*) The jointer's hands should be washed with coal tar naphtha to remove *ingrained* dirt, and then with wood naphtha, prior to washing with soap and water, and rinsing well.

The surface of both ends of the core should be washed with clean white linen steeped in wood naphtha, and also all the parts to be handled, otherwise the jointer's hands are likely to become dirty again.

(*b*) Exclusion of moisture is most effectually secured by using *no water*, and on no account should saliva be used to moisten the fingers or tools. While closing a seam and manipulating the gutta-percha coverings the fingers should be dipped in wood naphtha, or methylated spirit, preferably the former, which by evaporation makes the hand cool and less likely to perspire in hot climates. The trimming knife, scissors, and cutting pliers, should also be dipped in wood naphtha instead of in water as has hitherto been customary.

(*c*) Want of perfect cohesion between the gutta-percha coverings is generally due to oxidation, and, in the case of even *new* gutta-percha sheet, to the fact that the gutta surface has been in contact with the calender, while rolled into sheet, or exposed to the air. Even after washing the surface of two pieces of gutta-percha sheet with soap and water, rinsing well and drying, it is difficult to make them adhere tightly when lamped and pressed together. Compound greatly improves the cohesion, but it is not always as tenacious as it should be or evenly applied. The remedy is to renew the surface either *mechanically, e.g.*, with a fine but stiff steel wire brush applied all over the gutta sheet; or, preferably, by breaking and mixing the *surface* with a suitably hot tooling iron. As an alternative and much better expedient the surface of the gutta-percha sheet is renewed *chemically* by rubbing it with chloroform, or benzole, using a small flat pig's bristle brush for the purpose. These act as solvents, and if the surfaces of two pieces of gutta-percha sheet, so prepared, be lamped and pressed together the adhesion is very tight.

After moistening with chloroform, or benzole, the surfaces may be smeared with a thin film of gutta-percha chloroform or gutta-percha benzole *solution*; but the cohesion is very good without this solution.

Renewing the surfaces chemically or mechanically secures practically perfect cohesion between the gutta-percha coverings. In fact, cleaning the conductor with chloroform, coating with gutta-percha chloroform solution and lamping well, to evaporate excess of spirit, is also a preferable substitute for the *compound* usually employed; and, moreover, secures the electrical advantage of making the core more homogeneous.

(*d*) If the core surface be oxidised, as is frequently the case with *old picked-up cable*, it should be pared with a sharp trimming knife before commencing to draw down the lamped ends, otherwise a deteriorated surface will lose still more of its freshness by lamping and become porous. The new gutta-percha sheet will consequently not mix so well with the old core even when the latter is treated with the solvent or solution, and the joint will probably soon develop electrical weakness by leakage between the old and the new surfaces.

If the thickness of the old gutta-percha covering is very small, there is little chance of making a durable joint, and the old core had better be stripped and its value realised.

(*e*) The more intimate the union brought about between the gutta-percha coverings by chemically preparing their surfaces, the less likely is the joint to develop weakness under trying changes from wet to dry, to which a cable is sometimes subjected in storage tanks; or under unequal contraction and expansion between the core and gutta-percha sheet brought about by great and sudden changes of temperature.

Experimental Joints Made in Gutta-Percha Core.

Ends cleaned with wood naphtha or methylated spirit and thin film pared off with trimming before lamping and drawing down. Wood naphtha (*), or methylated spirit (†) used to moisten fingers and tools.

First Set of Joints.—**Picked up core** $\frac{\text{70 lb. cond.}}{\text{75 lb. G.P.}}$ **reinforced with extra 55 lb. G.P.:—Core** $\frac{\text{70 cond.}}{\text{75 + 55 G.P.}}$

Joint.		Clark's accumulation test:— Charge during 2nd min.	4th min.	420 volts Jan. 11th, 1915.
No. 32	Chatterton compound on strand and between G.-P. covering, as usual*	3½	2	After soaking continuously for 187 days.
„ 33	Chatterton compound on strand and between G.-P. covering, as usual†	2½	1¼	
„ 35	G.-P. benzole solution on strand (φ); 1st and 2nd coats washed with benzole, then coated with film of G.-P. benzole solution and well lamped*	3½	2¾	
„ 39	G.-P. chloroform solution on strand (φ); 1st and 2nd coats washed with chloroform, then coated with film of G. P. chloroform solution, and well lamped† ...	4¼	3	
„ 42	Same as No. 39, except that *no* G.P. chloroform solution used between G.-P. coats*	2½	1¾	
	§ Core used as standard of comparison ...	3	2¼	

Second Set of Joints.—Unused core (from stock) $\frac{130 \text{ lb. cond.}}{130 \text{ lb. G P.}}$ ‡

Joint.		2nd min.	4th min.	420 volts Jan. 11th, 1915.
No. 32	Chatterton compound on strand and between G.-P. covering, as usual*	2½	1¾	After soaking continuously for 139 days.
„ 33	Chatterton compound on strand and between G.-P. covering, as usual†	5	4	
„ 36	G.-P. chloroform solution on strand (φ); 1st and 2nd coats washed with chloroform, then coated with film of G.-P chloroform solution, and well lamped* ...	3½	2¼	
„ 36A	G.-P. chloroform solution on strand (φ); 1st and 2nd coats washed with chloroform, then coated with film of G.-P. chloroform solution, and well lamped† ...	9	7	
„ 38	G.-P. benzole solution on strand (φ); 1st and 2nd coats washed with benzole, then coated with film of G.-P. benzole solution and well lamped†	6½	4¼	
„ 42	G.-P. chloroform solution on strand (φ); 1st and 2nd coats washed with chloroform, but *no* G-P. chloroform solution or compound used between G.-P. coverings*	2¼	1¼	
„ 42A	G.-P. chloroform solution on strand (φ); 1st and 2nd coats washed with chloroform, but *no* G.-P. chloroform solution or compound used between G P. coverings†	2	1¼	
„ 43	G.-P. benzole solution on strand (φ); 1st and 2nd coats washed with benzole, but *no* G.-P. benzole solution or compound between G.-P. coverings†	3	2	
	‡ Core used as standard of comparison	4½	3½	

Note.—Testing current on for four minutes, plug short-circuiting condenser during first and third minutes, and removed during second and fourth minutes.

φ No Chatterton compound used for this joint.

INDIAN NOTES.

[From our Special Correspondent.]

Calcutta Port Trust.—Before the war there was much congestion at the Calcutta jetties owing to the enormous increase in import shipping, and it was decided to increase unloading facilities and extend the docks. Accordingly orders were placed with Messrs. Pyne, Hughman & Co., after severe competition, for 13 two-ton electric goods lifts in 1913. Last month a repeat order was placed with the same firm for 17 electric goods lifts. This they claim to be the largest lift order ever placed in India with one firm.

Tata Hydro-Electric Scheme, Bombay.—This large enterprise is now nearing completion. The Lonavla dam is almost completed and the Walhwan dam should be ready by March next. Four generators and turbines with their auxiliary plant are completed, and the transmission line is in its last stages. With average luck energy should be available in the Bombay mills by the end of March to the extent of 40,000 horse-power.

The Times of India writes as follows of the undertaking:—"The scheme is going to banish smoke from Bombay. It is going to provide our industries with the most efficient motive power, so much smoother in its action than steam that it greatly increases the efficiency of machinery. It is going to stimulate industry by furnishing power far more cheaply than steam engines and boilers can be installed. It is going to provide a basis for fresh industries all along the country traversed by the transmission line and perhaps to facilitate the electrification of the suburban railways and Ghat sections of the Great Indian Peninsula Railway. Once cheap and abundant electrical energy is introduced into an industrial centre no one can place a limit on its usefulness. The present plans provide for about one hundred thousand horse-power, but the Ghats can supply such further quantity as may be necessary to meet the demands of the city."

I.E.E., Calcutta.—The local Centre of the I.E.E. held its opening meeting in Calcutta recently, and in the unavoidable absence of the Chairman (Professor Everett), Mr. A. K. Taylor read his opening address to a small but appreciative audience.

Delhi.—Mr. J. S. Pitkeathly, C.V.O., has returned from six months' leave in England, and has taken up his duties as electrical engineer, New Province, Delhi. During his absence Mr. F. W. Symes, his assistant, officiated in his stead and carried out his trying duties in a very able manner.

Karachi.—At the opening ceremony of the new City Electric Lighting Works recently, what is described in the newspapers as an epoch-making event in the civic history of Karachi, happened. In inviting the Commissioner to close the main switch to start the town supply, the Chairman of the Electric Corporation, the Hon. Mr. M. de P. Webb, incidentally referred to the war, remarking, "I am one of those who deplore the use of that stupid phrase 'business as usual,' because it reveals the boasting and bragging and pretending frame of mind which will assuredly be the ruin of Germany. Business is not as usual, and never can be until the war is ended." The Commissioner, in reply, denied that the adoption of the motto connoted boasting or bragging. Something more imperial than that, he went on to say, was implied. "Business as usual" was a plain announcement that despite all the terrors of war, without regard to the suffering of mind, body and estate that must inevitably result, every man and woman in the Empire would tackle the job that came to hand and would do his or her duty. The manner in which the Empire has lived up to its war-derived motto is sufficient indication that there was neither boasting nor bragging in its "business as usual." This pointed rebuke is considered by many to be not unmerited.

Metal Filament Lamps.—The price of most things, including electrical material, has gone up in India since the war began, except the rates for metal lamps. Due to the insane cutting of prices among Indian contractors, it is possible to buy 225-volt metal lamps in India in gross quantities at 14 annas, or one shilling and twopence each!

OUR LEGAL QUERY COLUMN.

"Enquirer" writes:—"I shall be glad if you will kindly give me information on the following circumstances:—

"A consumer in the municipal supply has several electric motors which have been in use for some years; supply is given at low pressure (100 volts). He has recently asked for the supply to another motor, and is informed that he will receive supply at a higher pressure (200 volts), and for this it will be necessary to lay a new cable [illegible] to his premises, and he is asked to give a guarantee that he will pay a minimum of 20 per cent. on the outlay in laying this new main.

"He has not been asked for a similar guarantee for his previous motors, and this one is simply an extension of his installation. He pays the ordinary advertised rates for his current.

"Can the Corporation demand this guarantee?

"The consumer would be quite content to receive supply at the old pressure, but the Corporation explain that it would overload the main, and probably affect the lighting in the neighbourhood."

*** S. 27 (1) of the Schedule to the Electric Lighting (Clauses) Act, 1899, provides that "The undertakers shall, upon being required to do so by the owner or occupier of any premises situate within fifty yards from any distributing main of the undertakers . . . . give and continue to give a supply of energy . . . . subject to the following conditions. The cost . . . . of so much of any such electric lines as it may be necessary to lay for a greater distance than 60 ft. from any distributing main of the undertakers . . . . shall if the undertakers so require be defrayed by that owner or occupier."

Sub-section (2) of the same Section provides that: "Every owner or occupier of premises requiring a supply of energy shall (b), If required by the undertakers, enter into a written contract with them to continue to receive and pay for a supply of energy for a period of at least two years of such an amount that the payment to be made for the supply, at the rate of charge for the time being charged by the undertakers for a supply of energy to ordinary consumers within the area of supply, shall not be less than 20 per cent. per annum on the outlay incurred by the undertakers in providing any electric lines required under this Section to be provided by them for the purposes of the supply, and if required by the undertakers give to them security for the payment to them of all moneys which may become due to them by the owner or occupier in respect of any electric lines to be supplied by them." The foregoing provisions make it plain that in the circumstances mentioned by "Enquirer" the guarantee can be demanded. The undertakers are not *bound* to demand it; but if they do the demand must be met.

LEGAL.

Prepayment Meter Prosecution Dismissed.

At Wednesbury Police Court on Friday in last week, Florence Williams, Wednesbury, was charged with stealing electricity, the property of the Corporation.

The Town Clerk (Mr. T. Jones) prosecuted, and stated that on January 9th an employé of the Corporation went to defendant's house in order to change a shilling-in the-slot meter for one taking pennies. The money in the meter was counted out, there being 7s. In addition there were two washers and a farthing. The indicator registered 8s., which showed that the farthing and the small washer had not used any electricity, but that the larger washer had. When the employé told defendant she was liable to be punished, she made reply that if she had had more washers she would have put more in the meter, as she had not had sufficient light for her money. The Town Clerk added that he did not press for a heavy penalty, but the practice could not be tolerated.

Evidence was given bearing out the above statement, and William Hunt, the employé, in examination, denied that he ever told defendant she could put in washers if she had not got a shilling.

Defendant, on oath, declared that the employé did tell her she could place a washer in the meter if she had not got a shilling, and make it right when the "state" was taken.

The Bench decided to dismiss the case.

Auto-Roto Syndicate, Ltd., *v.* Paul & Callard.

In the City of London Court, on Friday, before his Honour Judge Rentoul, K.C., plaintiffs, who are advertising contractors, of 32, Fenchurch Street, E.C., sued Messrs. Paul & Callard, High Street, Streatham, for £6, for 12 months' advertisements affixed to an electrically-propelled machine, at 10s. a month.

Mr. Louis Green appeared for the plaintiffs, and Mr. S. Duncan for the defendants.

There were three other cases against traders in Streatham, and it was agreed that the decision in the first case should determine the other cases.

Mr Green stated that the plaintiffs made a contract with the defendants on June 29th, by which they agreed to let defendants an advertisement for 12 months from its first showing on the plaintiffs' auto-roto machine, which was electrically propelled, and was affixed at the junction of Mitcham Lane and Streatham High Road to the side wall. Defendants were to supply suitable advertising matter, and it was to be subject to the approval of the plaintiffs. The money was payable in advance. The machine revolved with the advertisements upon it. A poster or sketch was prepared containing matter advertising defendants' business. Defendants approved of it, and although the machine was started in July the defendants were not charged until September. On August 28th defendants wrote and said that in accordance with the contract they gave notice that they required the immediate removal of their advertisement from the machine. That repudiation was ineffective. On September 2nd plaintiffs wrote and said the advertisement had started, and that having regard to the expense of preparing the poster they could not accept the repudiation of the order unless they paid for the first 12 months' rent. On September 3rd defendants replied that any legal claim did not affect their right to withdraw the advertisement of which they disapproved, or lessen their liability to carry out the instructions. They also said the machine was not placed in accordance with representations made as to the position, and that the sketch was bad. They further alleged that the machine was defective in working. There was no doubt that it raced because it was electrically driven. It did not work accurately. Sometime before September 1st plaintiffs' electrician got it into working order and controlled it. When the defects had been remedied and the machine got into working order, plaintiffs gave defendants notice that payment would begin. Therefore the defendants had had some of the advertisements for nothing.

Mr. Duncan said the permission of the Wandsworth Borough Council was not obtained by the plaintiffs before putting up the machine, and when it had been erected the Council told the plaintiffs to take it down or to put it in a different place. Where the machine was to have been placed the advertisement could be seen from the approaches in four roads, but where it had been placed it could only be seen in one road.

Mr. Green replied that there was no implied authority that the plaintiffs were to get the consent of the Borough Council. The machine was still up, and the advertisement was still running.

After hearing evidence the Court gave judgment for the defendants, with costs in each of the four cases.

Telephone Installation Case.

Sheriff Armour Hannay, Kirkcaldy, has heard parties in the preliminary pleas in an action at the instance of the Caledonian Telephone (New System) Co., Ltd., Glasgow, against Tullis, Russell & Co., Ltd., paper manufacturers, Auchmuty, Markinch. Pursuers asked the Court to ordain defenders to pay a sum of £137 19s., with expenses. They aver that on March 17th and 24th, 1914, defenders entered into two contracts with them for the installation of certain telephone instruments at a certain rental and under certain conditions. In terms of the contracts pursuers erected an installation in defenders' premises, the annual rental being £14 12s. Defenders aver that the contracts were signed only by their secretary, whereas in order to be binding on defenders they required under their articles of association to be sealed with the company's seal and subscribed on behalf of the company by two directors or by one director and the secretary. They maintained the contracts had been signed by their secretary under essential error, and that the error was induced by the pursuers or their representative, who was aware of this at the time. They aver that pursuers' representative assured their secretary that the quarterly or annual rent entirely covered the erection and capital cost of the installation. They repudiated liability for a period of 21 years or any other number of years. To save further trouble and expense they had already made a tender of £140. They aver that the contracts are not binding beyond the obligation to pay the annual rent so long as they retain and use the installation. His Lordship made avizandum.

Barcelona Traction, Light and Power Co.: Mackenzie *v* The Company.

On February 25th, in the Chancery Division, Mr. Justice Eve heard a motion in this matter.

Mr. Gore Brown, K.C., who appeared on behalf of Mrs. Byrne, one of the parties in the action, said his motion was that Mr. Whinney should be appointed Receiver of the company in the place of Mr. McAuliffe, the gentleman already appointed as Receiver. No suggestion was made against Mr. McAuliffe, but it was thought by Mrs. Byrne and her supporters that the interests of the bondholders would be better served if Mr. Whinney was appointed. The company was registered in September, 1911, and was formed under the laws of the Dominion of Canada, and its head office was at Toronto. It was formed for the purpose of developing water power and electric traction and tramways in Spain, and was, without doubt, a very large business. According to the balance-sheet of December 31st, 1913, which was the last one issued, there was outstanding capital of 27 millions of dollars in ordinary stock and 8 millions of dollars in preference stock. There was also an issue of 8 million pounds' worth of bonds, and it was with regard to this issue that the Receiver had been appointed, and the present application was made.

Mr. Justice Eve: These were bonds to bearer?

Counsel: Yes. Mr. Gore Brown added that Mrs. Byrne and others interested with her held a substantial number of the bonds, while the plaintiff, Mr. Mackenzie, held £20,000 worth and had received support from people holding altogether four millions.

Asked what were the grounds for his application, Mr Gore Brown said the action was commenced by Mr. Mackenzie really at the suggestion of the directors of the company, and while he was not suggesting any improper motive or dishonest conduct on the part of any of the gentlemen concerned, when they were dealing with the affairs of a company of this kind they wanted to be assured that the Receiver had an absolute independence of action. There was reason to believe that the Receiver worked with the directors to a certain extent, and received instructions from them, and when there was a working together in that way there could not be the strictest and independent investigation which the matter demanded. Mr. McAuliffe was once a directer of the company, and was one of its auditors.

His Lordship said he understood that there was to be a scheme prepared, and when that came before the Court he would see that all the parties interested were protected.

Mr. Gore Brown said that would serve his purpose, and eventually the motion was adjourned and no order was made.

A.E.G. Electric Co. *v.* Semple.

At the Westminster County Court last week, the plaintiffs, of Oxford Street, London, sued defendant, a Battersea Park butcher, for £2 13s. 5d., the price of an ammeter supplied to him. Defendant said that when he ordered the instrument he thought that the plaintiffs were an English company, but he subsequently discovered that the company was composed of Germans, and that all the shares (£150,000), with the exception of seven, were held by Germans. He had also returned the instrument as defective, but they sent it back and he refused to take it in, and for some months it was in the possession of the L. & N.W. R. parcels delivery office. Plaintiffs said that the instrument was not defective. Defendant said that he refused to pay any money whatever so as to protect himself from being charged under the Defence of the Realm Act.

The Judge said that the defendant had now made his protest, but that was not to the point. He adjourned the case for defendant to call the man who fitted the instrument.

Ruthenberg *v.* British Abrasive Wheel Co.

Mr. Marcus Ruthenberg, the inventor of an electric furnace, was, on Monday, March 1st, plaintiff in an action before Mr. Pollock, High Courts Referee, against the defendants, of Victoria Street, Westminster, in which he sought to recover £976, balance of account for goods sold and delivered and for work done.

Mr. Tyler appeared for the plaintiff, and Mr. Clavel Salter, K.C., with Mr. Maddox, for the defendants.

According to the plaintiff's case, he was employed by the defendant company, whose business is to make abrasives, which are of intense hardness, for the purpose of making grinding wheels, to supply them with one of his electric furnaces at a cost of £1,100. To this was added £215 for additional gear and other matters, bringing up the total indebtedness to £1,376 16s., including £33 16s. paid by the plaintiff, on behalf of the defendants, to the Union Electric Co., Ltd. The defendants had paid two cheques of £200 each, reducing the balance to the amount claimed.

The defence was a general denial of indebtedness, and a counterclaim for £1,600, including the £400 paid on account, on the ground that the whole thing was worthless. The agreement between the parties was contained in the correspondence which passed, and a large number of letters were put in evidence, and it was said that by those letters, and partly verbally, the plaintiff agreed to supply an electric furnace of such construction that it could be worked in a satisfactory manner and smelt bauxite or alumina, pure or impure, into a fluid mass and make a product in every way the same as that made at Niagara Falls. The defendants said that there was an implied warranty, and that the furnace was defective and did not do its work properly. A portion of the plaintiff's claim was in respect of an amperemeter for each electrode reading to the maximum demands, and a voltmeter also reading to the maximum demands for the circuit, mounted on a slate panel. The plaintiff admitted the agreement, but denied that the transformer, or anything else, was defective as alleged, but alternatively said that if it was defective the transformer was rendered so by reason of the defendants having allowed the insulation to absorb moisture, and by reason of tests to which it was subjected by the defendants or their agents. He denied that he had committed any breach of the agreement, or that his work was defective, unless defects had been created by the furnace having been erected without proper skill by the defendants, and by working it in an improper manner.

(To be continued.)

Tungsten Drawn Wire.—Petition for Licence.

In the Chancery Division on Monday, March 1st, Mr. Justice Warrington commenced the hearing of a petition by the Robin Electric Lamp Co., Ltd., for a licence to make, use and vend tungsten wire in accordance with the inventions covered by the Tungsten Lamp Association patents, or any of them, upon payment of "such royalties as shall in the circumstances be deemed reasonable."

The petition was opposed by the British Thomson-Houston Co., Ltd., and Messrs. Siemens Bros. & Co., Ltd.

Mr. Bousfield, K.C., Mr. Cave, K.C., M.P., and Mr. R. Frost appeared for the petitioners; Mr. Walter, K.C., Mr. J. H. Gray and Mr. E. Lunge for the Thomson-Houston Co., and Mr. Colefax, K.C., and Mr. Hume for the Siemens Co.

Mr. Bousfield said the petitioners were a company formed to work a patent of Mr. Joseph Theodore Robin for a lamp which had two filaments instead of one. By such a lamp one secured this, that if one filament broke, a person could by giving a turn to an attachment to the lamp bring in another filament, so that the lamp started with a new lease of life. Since the day of the squirted lamp, the drawn-wire lamp had come in, and it was better as regarded both efficiency and durability. One's lamp bill might approach to something of the dimensions of the electricity bill; a little more durability in the lamp therefore made a great deal of difference, and 90 per cent. roughly of the lamps sold to-day were drawn-wire lamps. The petition recited the nine patents under which the petitioners asked for a licence. The patents were referred to as the Association patents. The B.T.H. owned a group of patents of American origin, and Siemens Bros. owned a group of patents of German origin. These two companies, together with the Osram Lamp Co. who owned another group of patents, pooled their patents. The total number of them was something like 150. They pooled their lamp patents and jointly granted licences to anybody who came into the Association, the main condition being that the member of the Association should sell to the retailer at a certain list price. The petitioners had taken out from the list the only nine patents that referred to the manufacture of the drawn wire. If they got a supply of drawn wire they would be content without the licence, because the sale of the wire carried the licence to use it: but not being able to get it they asked to have a compulsory licence. The petitioners had applied to the patentees and their various licensees for the supply of drawn tungsten wire covered by the Association patents, and had in each case been met with a refusal to supply wire or to grant a licence except in the case of the British Thomson-Houston Co., who, when applied to, offered to sell to the petitioners wire at 125s. per 1,000 ft. for lamps for 25 watts up to 100 watts at 100 volts. That price was wholly unreasonable and prohibitive, for with wire at that price the petitioners would not be able to place their lamp on the market with any reasonable prospect of success. The petitioners could obtain wire similar to that used by the patentees and their licensees in lamps sold under the protection of the Association patents from various sources abroad at a price of about 40s.

Counsel, commenting on the price proposed to be charged for the wire—125s. per 1,000 ft.—said the cost of manufacturing the lamp was 4d., and the price of the wire for a single-filament lamp would be 5d., and for a double-filament lamp 10d. A great deal would turn on what was a fair price. As members of the public the petitioners were entitled to be supplied with wire without questions being asked. But the patentees were holding up the price of wire on unreasonable terms in order to suit the purpose of a combination which was formed to keep up the price of electric lamps. A drawn-wire filament lamp which was sold here at 2s. 6d. could be purchased abroad for about 10d. The cost of the lamp was something under 4d. The filament cost ½d. As one group of patents was American and the other German, in the natural order of things they would have had two sets of manufacturers competing with each other and the price would have been kept down; but directly these two combined there were no competitors, and the combination fixed the price and said: "Unless you sell your lamps at this price we shall not supply you." There was obviously a fear in the mind of the Association that if the petitioners were to sell a double-life lamp at 2s. 9d., the public would not pay 2s. 6d. for a single-life. So the Association said:—"You must put 1s. on the price, or give us 1s. for the wire." The price of the lamp in Germany, where the German patents were running, was 1s. 9d., and in Holland, where the patent did not run, the price was 10d. A charge to the public of 3d. for two filaments would be quite reasonable, but they were asked to put on 1s. Counsel went on to say that competition had been artificially interfered with in this case by the two groups, and the combination was not entitled to ask for a royalty on the basis of that artificial condition of things, which was created by joining the groups together, so as to get rid of competition. This wire could be bought in the open market in Switzerland at a price which worked out at ½d. a metre.

(To be continued.)

Tramway Accident Claim.

The trial concluded in a Scottish Court of Session, on Friday, of the action in which a Johnstone doctor sued the Paisley District Tramways Co., for £500 damages for personal injuries and for damage to his motor car. The case arose over a collision between a tramcar and the doctor's motor. Defenders denied fault and pleaded contributory negligence. The jury returned a verdict for pursuer and assessed the damages at £400.

Fallon *v.* Middleton Electric Traction Co., Ltd.

At the Manchester Assizes, on February 24th, before Mr. Justice Sankey and a jury, the wife and two daughters of James Fallon, greengrocer and fishmonger, of Rochdale, who died as the result of an accident at Castleton, claimed damages, under Lord Campbell's Act, from the Middleton Electric Traction Co., Ltd. It was alleged that Fallon's death was due to the negligent driving of the defendant company's tramcar, which ran into the back of the cart that Fallon was driving. In the result, the widow was awarded £300 and the two daughters £25 each.

Osram *v.* Pope's Electric Lamp Co., Ltd.

In the Chancery Division on Tuesday, before Mr. Justice Eve, an application was made by Mr. C. Terrell for the postponement of the trial of this action. He said the ground was the convenience of counsel. The hearing was fixed for the 15th inst., but counsel (Mr. Russell Clark) was engaged on a great public duty, and he could not be ready before the 25th inst.

Mr. A. J. Walter, K.C., said that would only leave four working days for the hearing, and as it was an extremely heavy patent action it could not be finished before the Courts rose. He suggested that it should be fixed for the 22nd. If that was not suitable there were two judges who were looking for work, and it might possibly come before them.

His Lordship said he would mention it to Mr. Justice Warrington if the parties wished.

Eventually his Lordship fixed the hearing for not before the 22nd inst., to be mentioned 10 days before that date.

British Insulated and Helsby Cables, Ltd., *v.* Crittall Manufacturing Co., Ltd.

On Monday, in the Official Referee's Court, Mr. Muir Mackenzie commenced the hearing of this action for the recovery of £544, the price of an electric welding machine, &c. The hearing was adjourned. We shall report the case next week.

Hamilton *v.* Marconi's Wireless Telegraph Co, Ltd.

This case was to come on in the King's Bench Division on Wednesday.

BUSINESS NOTES.

Competing with the Enemy.—The staff and heads of departments of the Efandem Co., Ltd., Fallings Park, Wolverhampton, dined together at the Victoria Hotel last Friday evening, under the presidency of Mr. W. J. Fahn (director), who, in replying to a toast, referred to some of the effects of the War upon the business of the company as electrical and mechanical engineers and manufacturers. He explained how in 1911, from a small experimental business in Birmingham, they decided to erect works in Wolverhampton, and carried on the manufacture of goods which were never before made in this country. They had to compete with Continental firms, and were fairly successful from the start. Orders from the first were in excess of the output, and for three years the history of the company was one of rapid development. In 1912 they had nearly doubled their buildings and plant, and in 1914 they had a capacity for production which was more important than that possessed by any other single manufacturer in the world; that was to say in two particular lines—for portable electricity and electric car-lighting sets and motor self-starters. Then the War broke out. A great deal of their raw material came from abroad, and material obtained from our present greatest enemies could not be obtained. They were consequently faced by a terrible situation. Fortunately, they had enough raw material stocked to tide them over until new countries of supply could be found. But the price of raw material went up, and the cost of transportation from the United States went up every month. Although they had a large production in portable electricity, it was impossible to supply the demand. As regarded the future, the prospects were absolutely secure. Manufacturers were getting busy in pleasure motor-cars, and though the electrical trade for them had been rather upset, it seemed that in the next few months it was going to rapidly increase.

Great London Fair.—Both the Agricultural Hall and Olympia have been engaged for a London Fair and Market on a gigantic scale in March, 1916. Among the various sections will be those relating to hardware in every branch, lighting, heating and cooking appliances, and electrical apparatus. Each hall will have its complete sections, and a fleet of motor-cars will be employed to convey visitors from one hall to the other. The organisers are the International Trade Exhibitions, Ltd., Broad Street House, London, E.C.

Swiss Information Office.—An office has been opened at Zürich for the economic development of Switzerland; it is controlled and financed by the Exhibitions Department of the Swiss Government, and is intended to furnish information free of cost to all who desire to purchase Swiss products, or to sell their wares in Switzerland. Inquiries on trade matters should be addressed to the Secrétariat Général, Bureau Suisse de Renseignements pour l'Achat et la Vente de Marchandises, Metropol, Börsenstrasse 10, I. Etage, Zürich, Switzerland.

Catalogues and Lists. — From Messrs. Alfred Graham & Co, of St. Andrew's Works, Crofton Park, London, S.E., we have received one of their useful desk blotting pads with daily diary for 1915 at left hand. The firm's patent loud-speaking Naval telephones, also telephones for military, mercantile marine, mining, and other service, are well kept before the mind of the user of the pad.

Messrs. Graham have also sent us a copy of their useful little annual pocket-book of tide and speed tables for 1915. Shipping departments doubtless find it of considerable service.

The Sloan Electrical Co., Ltd, 12, Golden Lane, London, E.C.—18-page illustrated pamphlet giving particulars and prices of "S.L." weatherproof and watertight lanterns for half-watt lamps, also bulkhead fittings, hand lamps, and English china fittings.

British Thomson-Houston Co., Ltd., Rugby.—Four new publications, arranged and illustrated in their standard form and style, as follows:—No. 2,256 (24 pp.) type D R, continuous-current motors; No. 2,216 (8 pp.) type D R, continuous-current generators; No. 5,801 (4 pp.) A.C. brake magnets, two-phase and three-phase, 25 to 50 cycles, for up to 600 volts; No. 4,503 (8 pp.) lightning arresters for A.C. circuits—multi-gap type with graded shunt resistance. Prices are given in most cases.

Electric Suction Cleaner Co., 56, Victoria Street, Westminster, S.W.—A folder card which on the outside asks: "Who's the Lady"? tells inside that she is one who owns a Frant Premier electric suction cleaner, and says ——.

Shopkeepers and others who, under war conditions, are required to shield their window and showroom lights will find some cardboard lanterns which are being distributed by the Edison & Swan United Electric Light Co., Ltd., Ponder's End, very serviceable.

Book Notices.—*The Engineer's Year-Book of Formulæ, Rules, Tables, Data, &c, for* 1915. By H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood & Son. Price 15s.—This is the twenty-second year of publication of a work which has established itself in public favour, and the volume consists of 1,800 pages, with 35 sections, several of which have been practically re-written. Amongst the latter are "Power Transmission," "Steam," and "Ball and Roller Bearings," the last-named by Prof. John Goodman. All the other sections have been revised by the specialists who take charge of them, and whose names form an imposing list. By special permission, the Editor has been able to include a number of official regulations, specifications, &c. So familiar a work needs no recommendation.

The *Magazine* of the Finsbury Technical College and Old Students' Association for January contains a portrait of the president, Mr. John E. Raworth, a note on "Phase-Advancers," by J. K. Catterson-Smith, and articles on "Active Service with the London Electrical Engineers," by J. F. Perrin; "Humphrey Pumps," by J. G. Bulger; and "The Diseases of a Field Force," by R. F. Easton. There is also a Roll of Honour of past students.

"Colliery and Mining Machinery (*Bulletin* No. 7)." Part I. London: General Electric Co., Ltd.

"*Journal* of the Institution of Electrical Engineers." Vol. LIII, No. 243. March 1st, 1915. This issue contains papers on "Conditions Affecting the Variations in Strength of Wireless Signals," by Prof. E. W. Marchant; "How a Top Stands Up," by J. Swinburne; and "Representation of the Magnetisation Losses in Iron," by N. W. McLachlan; also a "Third List" of 70 members of the Institution who are serving with the Colours.

"Science Abstracts." Sections A and B. Vol. XVIII, Part 2. February 25th, 1915. London: E. & F. N. Spon. Price 1s. 6d. each net.

Trade Announcements.—Owing to increased business Messrs. G. E. Taylor & Co. have taken larger premises, at 7, Suffolk Lane, Cannon Street, E.C., and all communications should now be addressed there.

The address of Messrs. Creed, Bille & Co., Ltd., is now Telegraph Works, Croydon. Rapid business developments having rendered larger works necessary, the Skating Rink, a large and central building adjoining East Croydon Station was secured, and it has been specially adapted for the firm's work. Adjoining land suitable for further extensions has also been acquired.

Messrs. Pitters Ventilating and Engineering Co., Ltd., has removed its offices to the works—33, Nightingale Vale, Woolwich, S.E.—and all communications should be addressed there. New telephone number: Woolwich 427.

The Dussek Bitumen Co. has changed its address to its additional works—Empress Wharf, Sherman Street, Bromley-by-Bow, E.—and all correspondence should be sent there, though certain of the company's products will still be made at the Deptford works.

Mr. H. Wittusen, whose dissolution of partnership we announced several weeks ago, is continuing to trade as Harry Wittusen & Co., at 24, Thavies Inn, Holborn Circus, E C.

Bankruptcy Proceedings. — G. J. T. J. Parfitt, consulting electrical engineer, Keynsham, Bristol.—First meeting, March 10th, at 26, Baldwin Street, Bristol. Public examination, April 16th, at the Guildhall, Bristol.

G. Burgess (Granville Burgess & Co.), electrical engineer, 27, Museum Chambers, Bury Street, W.C.—Last day for proofs for dividend, March 17th. Trustee, Mr. E. L. Hough, Official Receiver, Carey Street, W.C.

New Zealand.—A Christchurch firm wants to represent a British firm making electric self-starting sets for marine use, which must retail at £10 or less. Apply to H.M. Trade Commissioner, P.O. Box 369, Wellington.

Russian Equivalent Tables.—The Central Translations Institute, Ltd., of 265, Strand, London, W.C., have compiled from official sources a set of Russian equivalent tables, and have issued it at the price of 1s. net. In view of the increasing importance of trade with Russia the issue of such information regarding the somewhat complicated Russian weights and measures, and especially of equivalent tables permitting of instant conversion of British weights, measures and money into Russian, and *vice versâ*, should be of interest to the trading community. The tables cover all ordinary commercial requirements.

Liquidations.—Apparatus and Accessories, Ltd.—Mr. G. E. Corfield, the Receiver and liquidator, reports that, as a result of the satisfactory realisation of the assets of the company, he has collected sufficient funds to provide an immediate distribution of the balance required to make up the agreed composition of 10s. in the £. In addition to the first distribution of 2s. 6d. already paid, a further 7s. 6d. in the £ is now being paid.

Dettifoss Power Co., Ltd.—A meeting will be held at Winchester House, E C., on April 15th, to hear an account of the winding up from the liquidator, Mr. H. A. McMahon.

For Sale.—Battersea electricity department have for disposal a travelling dock elevator track, and horizontal travelling conveyor. Stockport Corporation has for sale one 720-B.H.P. triple-expansion Belliss & Morcom high-speed engine. Particulars are given in our advertisement pages to-day.

A Siemens Dance.—A dance was held at Mozart House, Albion Road, N.E., on Friday, February 26th, for members of the Siemens Dalston staff and friends. Owing to the war fewer social events have been arranged, and as in previous years it had been customary to hold three dances during the winter session it was felt that just one evening's jollification could not be denied. A company of about 70 assembled. Mr. Dennison acted as hon. M.C., and the arrangements were in the hands of the following Committee:—Miss Moloney, Miss Topper, Mr. Dennison, and Mr. Pryor (hon. sec.).

Italy.—An agent in Florence wants to represent a British firm of manufacturers of electrical appliances. Apply Board of Trade C.I. Department in London.

LIGHTING and POWER NOTES.

Aberdeen.—The Corporation Electricity Committee is to renew the agreement for the lighting of Culter on the terms suggested by the engineer. The consumption of electricity in the city in January was 1,250,610 units, an increase of 67,332 units compared with the same month last year.

Audenshaw.—The U.D.C. has decided to oppose the Stalybridge Joint Board's Electricity Bill.

Barrow.—The T.C. on Monday agreed to the electrical engineer extending the extra high-tension ring main at an estimated cost of £2,242.

Beeleek (Co. Fermanagh).—PUBLIC LIGHTING.—The L.G.B. has sanctioned the application of the R.D.C. for powers to enable it to carry out the public lighting of the town by electricity.

Belfast. — POWER STATION EXTENSIONS. — The City Council has decided not to proceed with the extension of the power station at present. It was stated that in three years, the contribution from the tramways to the rates had fallen from £23,000 to £3,000.

Brighton.—RESTRICTED LIGHTING.—The Estimates sub-Committee of the Lighting Committee, reporting on the next year's estimates, recommends that the item for electricity supply for street lighting be reduced from £7,500 to £3,650, and for gas from £1,100 to £550, on the assumption that only one-half of the normal supply of electricity and gas will be used owing to restricted lighting. There will be a reduction of £500 in the item for trimming the lamps, owing to metallic-filament lamps being substituted for the arc lamps; and the estimated total saving on public lighting is £5,000. The Committee points out that the reduction in the amount of energy consumed for public lighting during the next financial year will result in a decrease in revenue to the electricity department of £4,450, and the engineer estimates that there will be a net loss of £2,500, assuming the price of current remains at 1¾d. per unit. The Finance Committee states that any deficit will be defrayed out of the reserve fund.

Bristol.—PROPOSED BULK SUPPLY.—The T.C. has applied to the B. of T. for an order authorising it to supply current in bulk to the Clevedon, Portishead and District Electric Supply Co., Ltd.

Burnley.—RATE RELIEF.—The electricity department estimates the surplus for the relief of rates for the current year ending March, at £5,247.

Ceylon.—The Government has granted permission to Messrs. Walker, Sons & Co. to prepare a scheme for lighting the municipality of Ootacamund by the generation of power from the outflow of the St. Lawrence lake. The municipality proposes to borrow Rs.1 lakh to carry out the scheme.—*Ceylon Observer.*

Continental.—TURKEY.—It is reported that the stores of coal at Constantinople are becoming exhausted, and that the manufacture of gas and electricity will shortly be impossible.

Coventry.—LIGHTING ARTISANS' DWELLINGS.—The City Council has decided that the rate for the supply of light in artisans' dwellings erected by the Corporation should be for a house containing three lamps 7½d. per week; four lamps, 9d., the charges to include the provision and maintenance of lamps. One meter will be provided to a block of houses to check consumption.

Croydon.—NEW BOILERS, &c.—The Electricity Committee has had under consideration a report of the electrical engineer upon the boiler plant at the works, and recommends the disposal of two of the five remaining obsolete boilers, and the installation of one of a normal capacity of 35,000 lb. of steam per hour, a mechanical stoker, superheater, economiser and chimney. This will effect a saving of about £600 a year.

The electricity department has allowed the Lighting Committee £615 in respect of lamps not lighted during the past quarter. Owing to the serious depletion of the engineering staff at the works, it has been decided not to make any allowances to any further members of this section of the staff who enlist without first obtaining sanction.

Cuckfield.—PROV. ORDER.—At a meeting of the R.D.C. on February 26th, it was reported that the B. of T. had written, stating that after careful consideration it had decided to defer the question of revoking the prov. order of the Mid-Sussex E.L. Co. for a year.

Dover.—PROPOSED LOAN.—A loan of £6,000 for the provision of additional plant at the electricity works is recommended by the Electricity Committee.

Dublin.—The Corporation has adjourned for a month, pending the year's estimates being submitted, the proposal to increase the electricity rates owing to the increased cost of coal. It was stated that the consumers numbered this year 7,055. The number of units sold to private consumers had increased to 8,300,000. The income for the year was £97,000. The city treasurer estimated that this year the Corporation would have to pay in capital charges £53,650.

Dundee.—PUMPING PLANT.—The Corporation Electricity Committee is to put down a new pumping station in the neighbourhood of the Eastern Wharf, for the Carolina Port generating station.

East and West Ardsley.—Upon a report by the E.L. Committee as to the carrying out of the E.L. order, the U.D.C. has decided to ascertain the cost of having the order varied by the B. of T.

Eccles.—The Corporation has decided to discontinue the supply of electricity by prepayment meters to Corporation dwellings. In lieu thereof tenants are to be offered a supply either on the flat rate of 4d. in force, or a charge at the rate of 6d. per lamp per week.

Ely.—PROV. ORDER.—The Gas and Electricity Co., which is applying for a prov. order for electric supply, has asked the B. of T. to dispense with the consent of the U.D.C. to the application. The U.D.C. has decided to reply that the Gas Co. under the proposed order was not compelled to supply current in the whole of the district; that the compulsory area did not include Cambridge Road, one of the principal residential thoroughfares in the town; and that the Council objected to both kinds of lighting being in the hands of one company.

Enniskillen.—STREET LIGHTING.—The R.D.C. is applying for powers to enable it to enter into an arrangement with the Tempo Electric Supply Co., Ltd., for the lighting of the streets of Tempo with electricity.

Finchley.—A new oil engine, similar to that erected in 1913, is to be installed at the electricity works.

Frinton-on-Sea.—The Frinton and District E.L. Co., as the result of an appeal, has secured a reduction in rateable value from £280 to £120.

Glasgow.—ARC LIGHTING; ELECTRIC CRANES.—Owing to the shortage and high price of carbons for the ordinary arc lamps in use at Glasgow Harbour, the Clyde Navigation Trustees have approved of the gradual substitution of flame arc lamps in place of those now in use, as supplies of carbon for these could be obtained without difficulty. It is not intended to deal with Rothesay Dock at present, the arc lamps there being modern.

The Trustees have also approved of a scheme for the gradual replacement of the four hydraulic cranes and the steam crane at the coaling quay in Queen's Dock, by three electric cranes. The first, which is a 32-ton electric, is expected to be in use about June. Arrangements are to be made to procure a second electric crane, and, for the third crane, to remove the present 25-ton steam crane, and to procure a number of electric capstans, and a set of electrically-driven pumps for the swing bridge, all at an estimated additional cost of £20,000, which would be spread over the next two or three years.

The T.C.'s lighting department has installed as an experiment a number of 3,000-C.P. flame arc lamps in points in the busier thoroughfares.

Gloucester.—The Electricity and Light Railways Committee reports that the output in the electricity department for January was 156,606 units, an increase of 2,300 units as compared with the corresponding month last year. For the Light Railway section the output was 43,193 units, an increase of over 2,000 units.

Gortin (Co. Tyrone).—E.L. SCHEME.—An electric lighting scheme for the village is being considered, the motive power to be supplied by the Creamery or from the river. A Committee has been formed, and the shareholders of the Creamery are to be approached in the matter.

Grimsby.—PROPOSED LOANS.—The Public Lighting Committee is again recommending the T.C. to approve the proposed battery scheme at the electricity works, and to apply for sanction to borrow £11,000 made up as follows:—Peak load battery, £5,000; prospective expenditure on mains, £4,000; prospective expenditure on services, £2,000.

Halifax.—PROPOSED LOAN.—The Tramways Committee has decided to make application to the L.G.B. for sanction to the borrowing by the Corporation of the sum of £5,000, for prospective expenditure on new electricity mains.

Heston and Isleworth.—The contractors have informed the Electricity Committee that as the colliery from which the coal was drawn had restricted its output, the firm could not give more than 60 per cent. of the quantity contracted for. Under the circumstances, the contractors have been advised that unless coal is delivered to the extent guaranteed in the contract, the Council would buy against them. At the time of writing 200 tons had been ordered from another firm.

Heywood.—Restricted Lighting.—All lights are to be lowered from one hour after sunset to one hour before sunrise as from March 1st.

Hull.—Plant Extensions.—The Electricity Committee has approved of a scheme of plant extension at an estimated cost of £41,500. The scheme provides for the installation of two new boilers, a new turbine of a capacity of 5,000 kw., coal-handling apparatus, water-cooling system, &c.

Kingston-on-Thames. — Proposed Loans. — The Lighting Committee proposes to borrow £16,792 for the purposes of the electricity undertaking, viz., £5,792 in respect of excess expenditure on loans already sanctioned, and £11,000 to meet the estimated requirements for the next four years.

Kingstown.—Mr. Justice Barton, in the Irish Chancery Division, has made an order of the Court the submission and award of Mr. S. L. Brown, K.C., in the matter of the arbitration between the Dublin Southern District Electric Supply Co., Ltd., and the Kingstown Urban Council as to terms of payment for the undertaking; and costs of the company were referred for taxation. The sum of £3,608 is payable to the Electric Supply Co. under the award, as mentioned in our last issue.

Leeds.—Proposed Loans.—The Corporation Finance and Parliamentary Committee recommends to the City Council to apply to the L.G.B. for sanction to borrow £25,000 for a new 6,000-kw. turbo-alternator, with accessories, and £8,700 for a 3,000-kw. turbo-alternator for Crown Point power station. An expenditure of £242,000 is estimated for by the City Tramways and Electricity Committee on electricity undertakings, and it is recommended that application be made to the L.G.B. for sanction to borrow £150,000 for mains extensions and £30,000 for the building and equipment of transformer sub-stations. The Tramways and Electricity Committee estimates the expenditure on tramways capital account for the next financial year at £93,291.

Leyton.—Linking-up Proposals.—The Electric Lighting Committee has under consideration an inquiry from the Hackney B.C. as to whether the District Council would be prepared to consider linking up its works to those of the B.C., so as to take a standby or bulk supply as an alternative to laying down further plant.

Liverpool.—Street Lighting.—Mr. A. G. Smith, the lighting engineer of the city, in his report, states that the lighting by metallic-filament lamps along the whole of the New Broad Green tram-route, as far as the city boundary, is now proceeding, 43 50-c.p. lamps having been fixed on side tramway-poles. Of the 501¾ miles of roads lighted at the end of the year, 8⅜ were lighted by electricity.

London.—Poplar.—Application is to be made to the L.C.C. for sanction to a loan of £10,188 in respect of the electricity undertaking. The Electricity Committee reports the necessity of erecting an additional sub-station at Blackwall to meet increasing demands; meanwhile the engineer suggests the provision, temporarily, of a further 1,000-kw. converter at the generating station for next winter's load. The estimated cost, with temporary foundations, and machine connections, new switchgear, and rearrangements of switchboard, is £3,350. It is also proposed that a 1,000-kw. converter be installed in the northern sub-station to compete with increased demands in this area, at a similar cost to that proposed for the main station. In connection with this extension it will be necessary to lay two low-tension feeders, and extend the existing feeder in Dace Road, at an estimated cost of £3,688.

Bethnal Green.—The Electricity Committee of the B.C. has approved the following scale of charges for electricity. For lighting purposes:—A (1) Minimum guarantee per half-year, as per Clause 9; (2) rate per unit for 30 hours' use of the maximum demand, per month, 8d.; (3) rate per unit for all further consumption in each month, 1d. B (1) £12; (2) 7d.; (3) 1d. C (1) £60; (2) 6d.; (3) 1d. For power, heating, cooking, and all purpurposes other than lighting:—D (1) As per Clause 9; (2) 3½d.; (3) ½d. E (1) £60; (2) 3d.; (3) ½d. For restricted supplies:—F (1) £3; (2) and (3) 1d. for all consumption.

L.C.C.—The Finance Committee recommends the Council's sanction to the borrowing of the following loans:—£15,000 by the Stepney B.C. for mains, and £500 by the Islington B.C. in respect of the additional cost of cooling towers owing to the effect of war conditions upon the price of materials, especially timber.

Stepney.—The B.C. is recommended to apply to the L.C.C. for a loan of £35,000 for the electricity undertaking.

St. Marylebone.—The Electricity Committee recommends that the present domestic tariff be revised, and that an annual charge (the same as existing) plus ¾d. per unit for current and hire of apparatus be made, subject to the consumer entering into a satisfactory agreement specifying a minimum consumption.

St. Pancras.—The Electricity Committee recommends that the offer of the Ecclesiastical Commissioners to advance £22,530 on loan for boilers for the electricity undertaking be accepted. The B.C. has agreed to give a supply up to 1,000 kw. to the L.C.C. Arlington Road sub-station during the ensuing summer at ¾d. per unit, subject to variation according to the cost of coal.

London Electricity Supply Bill.—The Parliamentary Committee of the Middlesex C.C. proposes to obtain expert advice as to how the proposals in the Bill will affect the county, and generally as to the present electricity supply of the County of Middlesex, and how it could best be organised with advantage.

Macclesfield.—School Lighting.—The Electricity Co. has informed the Borough Education Committee that the directors had agreed to lay a cable to the school clinic free of charge, and without any obligation on the Committee's part as to guaranteed consumption of current, provided that the whole of the premises were wired, and electricity used exclusively as an illuminant. The Committee has replied that it is prepared to wire the premises, but cannot agree to the exclusive use of electricity.

Maidstone.—Proposed Loan.—The T.C. has applied for a loan of £7,450 for the provision of a 1,250-kw. turbo-alternator, foundations and girders, pipework, &c.

Manchester.—Loan Sanction.—The Corporation has received sanction to borrow £20,000, repayable within 15 years, for the purposes of the electricity undertaking.

Newcastle West (Ireland).—The electric lighting scheme has been inaugurated, and is now available for the public light of the town. The scheme was carried out by Mr. W. Phelan, and a few nights ago St. Ita's Hall in the town was lighted up for the first time with electric light.

Pembroke (Dublin).—Increased Charges.—The U.D.C. is recommended to increase the charge for energy for lighting and heating from 4½d. per unit plus 5 per cent., to 5½d. per unit, and for power from 1½d. to 2d. per unit, consumers of more than 25,000 units to be charged 1¾d. per unit.

Reigate.—Questions as to whether the Diesel oil engines were satisfactory were asked at a meeting of the T.C. last week. Replying, the Mayor said he considered them a good investment; about three or four years ago the coal consumption at the electricity works was not much less than 1,500 tons. It was estimated that they would probably require 425 tons this year.

Stockton Heath.—Prov. Order.—The Runcorn R.D.C. has received from the B. of T. a communication relative to a request from the Warrington Corporation that in view of the objections in connection with its application for a provisional order to include in its electric lighting area certain districts in the rural district, the Council's consent be dispensed with. A meeting is to be held shortly to discuss the matter.

Stoke-on-Trent.—Electro-Chemical Supply.—The B.C. has decided on the recommendations of the Electricity Committee to give a supply of electrical energy for electro-chemical purposes to Messrs. Keeling & Walker, commencing with 3,000 units per week, taken continuously over 132 hours weekly, at extra-high-pressure three-phase, at a flat rate of ½d. per unit, subject to an agreement being entered into. It is understood that while one furnace will be started initially, three are to be in use in a year, and the factory is designed for 12 furnaces.

The electrical engineer reports for the six months from April to September, 1914, that the total works costs were £9,614, as compared with £11,152, a reduction of £1,538 in generating costs. The revenue was £22,119, as compared with £21,024, an increase of £1,095. The number of units sold was 3,122,220, as against 2,993,969; cost per unit generated ·511d., as against ·707d.; cost per unit sold ·739d., as against ·894d. Coal per unit sold 5·50 lb., as against 7·79 lb. It was decided to request the B. of T. to approve a system of supply for all extensions where new A.C. mains are laid from the power house, at 415 volts per phase for power, and with 240 volts between each phase and neutral for lighting.

Thurmaston.—E.L. Scheme.—The U.D.C. has decided to obtain expert advice as to the probable cost of an E.L. installation for the town.

Warrington.—Rate Relief.—It is proposed to contribute £1,000 from the electricity undertaking and £2,000 from the tramway undertaking towards the relief of the rates.

TRAMWAY and RAILWAY NOTES.

Blackburn.—The local Society of Tramway Workers has made an application for an all-round increase of 1d. per hour in wages to meet the additional expense incurred through the higher cost of living.

Bolton.—Owing to the increased cost of living consequent upon the war, the workers in the tramway and other departments of the Corporation have applied for an increase of wages. The tramwaymen asked for 1d. per hour rise, and the matter has been referred to the T.C.

Bury.—Lieut.-Col. Druitt, B. of T. Inspector, has passed the tramway extensions at Bury to Jericho and Walmersley, and the routes have now been opened for public use.

Continental. — Italy.—Application has been made for a concession for the construction and working of an electric tramway between Turin, Sassi and Superga, the existing funicular railway between Sassi and Superga being inadequate to the traffic requirements of the localities named, and its concession, moreover, expiring on December 31st, 1916.

Spain.—A concession has lately been granted for the construction and working of an electric tramway between Ferrol and Santa Maria de Nera.

Croydon.—New Tramways.—The T.C. has received the B. of T.'s sanction to a loan of £900 for the construction of a double line of tramway in Cherry Orchard Road. The total outlay will be £1,480, and the balance, representing the outstanding debt on works to be superseded, is to be paid out of the renewals fund.

Dublin.—Petrol-Electric Cars. — The Blessington Steam Tramway Co. has ordered two petrol-electric cars for the summer traffic.

Halifax.—Tramway Extensions.—A deputation from the Southowram U.D.C. reported to the Tramways Committee that it was not satisfied with the terms offered by the Committee for extending the existing tramway, and suggested that the guarantee should be £20 per annum for the first five years, £10 per annum for the second five years, and £5 per annum thereafter, provided that when the whole line paid from the centre of the town to the terminus, as extended, the liability of the U.D.C. for any further payments should cease. The Tramways Committee decided that it could not modify its previous decision on the matter.

Ilford.—Electric Vehicle.—The Electricity Committee has decided to purchase a 4-ton electric battery road van, with automatic tipping gear. The van is for use between the railway siding and the works.

London.—The L.C.C. Finance Committee has decided that war allowances to tramway employés, estimated at £81,000, shall be charged to the tramways account; the Highways Committee reports that despite the improved tramway results this procedure will lead to a deficit on the year, which will further deplete the general reserve fund, which was drawn on to meet the loss on last year's working.

At the last meeting of the Council a motion to refer back this decision, the contention being that such expenditure should be met by a special vote, was lost.

Northampton.—It is estimated that the balance to the credit of the tramways undertaking for the year ending March 31st next will be £1,171.

North London Railway Electrification.—At the annual general meeting of the company, Lord Rathmore stated that there was every reason to hope that electric trains would be running between Broad Street and Richmond over the Hampstead Junction line by the end of the year; the anticipated completion of the electrification of the North London and North-Western local lines this spring had been hindered by the war.

North-Western Electrification.—At the general meeting of the company on February 26th the chairman stated that, including £249,716 advanced to the London Electric Railway Co. in connection with the Paddington—Queen's Park extension, the capital expenditure for the year had been £1,233,250, of which £527,752 was in connection with the Euston—Watford electrification. During the current year it is estimated that £1,800,000 will be spent, the greater part in connection with the new electric railway.

The engineer's report mentioned that the new line between Queen's Park and Willesden was approaching completion. The new power station and repair shed at Stonebridge Park are well advanced and the six sub-station buildings nearly completed.

Southport.—In response to an application by the Tramways Committee for a reduction in the price of energy, the Electricity Committee has stated that alterations to be made at Crowlands will, no doubt, result in a saving of coal, and the Committee will be prepared to consider the application when the alterations are completed.

It is understood that the Corporation tramway workers are about to ask for an advance of 4s. per week in wages, to meet the increased cost of living.

South-Western Railway Electrification.—The yearly report of this company states that the electrification of the company's suburban lines has made steady progress during the past year. The main power house at Wimbledon and the substations at other places are practically completed, and the machinery is being erected. Several of the new electric trains have been constructed and the remainder are being proceeded with. Good progress has also been made with the placing of conductor rails, the bonding of track rails and the laying of high-tension cables on the first section of the railway to be electrified, *i.e.*, the lines from Waterloo to Kingston *via* Twickenham and *via* Malden. Capital expenditure during the year has included £153,303 on electrification of suburban lines and £169,221 on electric power stations, &c.

Uruguay. — The *Diario Oficial* publishes a law authorising the Executive Power to make arrangements for the transfer to the State of the Ferrocarril y Tranvia del Norte. Within a year of the nationalisation of this system, the new directorate of the line will present to the Executive Power a scheme for the electrification and extension of the tramway, which undertaking must be completed within three years.—*Board of Trade Gazette.*

Warrenpoint.—Electrification Scheme.—A project is being promoted by a Belfast company to secure the interest of the directors in the Warrenpoint and Roskern Tramway Co., and to introduce an electrical system. The line had always been worked by horses. Quite recently it closed down.

TELEGRAPH and TELEPHONE NOTES.

Illicit Wireless Apparatus.—At Newcastle-on-Tyne Police Court on the 2nd inst., R. H. Barnett, of 25, Dean Street, Newcastle, was charged with having in his possession, without written permission of the Postmaster-General, component parts of apparatus for sending and receiving messages by wireless telegraphy. Defendant pleaded guilty.

It was shown in evidence that Barnett was a retail dealer, who had in his shop window, and exposed for sale, a wireless spark coil. The proceedings were taken at the express request of the military authorities, who desired that attention should be specially directed to the necessity for a person who had anything to do with wireless apparatus to have a licence. None of the parts had been sold since the war began.

The Court, although convinced of the *bona fides* of Barnett, fined him £10 and costs.

Imperial Wireless Chain.—Whilst stating in the House of Commons that a considerable amount of work had been carried out in connection with the English and Egyptian stations, the Postmaster-General added that the question of proceeding further with the construction of the Imperial wireless chain was under consideration, in view of the altered situation arising from the war.—*Times.*

International Telegraphic Conference.—The Conference, which was to have been held at Paris this spring, has been postponed.

Telegrams in Code.—The Postmaster-General has authorised the use of Broomhall's Imperial Combination Code in communication with all South American countries except Brazil and Dutch and French Guiana. This is in addition to the A B C (5th ed.), Scott's (10th ed.), Western Union, Lieber's, and Bentley's codes.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 6th. U.D.C. Twelve months' supply of cables, meters, joint-boxes, &c., lamps, uniforms, tickets and other stores. See "Official Notices" February 5th.

Australia.—Brisbane.—March 10th. Motor-generator, power board, &c., for Postmaster-General. See "Official Notices" January 15th.

Melbourne.—March 16th. White Wheatstone receiving tape, for Postmaster-General. See "Official Notices" February 5th.

Belfast.—March 15th. Twelve months' supply of stores for the Tramways and Electricity Committees. See "Official Notices" February 19th.

Birkenhead.—March 9th. Corporation. Continuous-current meters and house-service fuse boxes. See "Official Notices" February 26th.

Burnley.—March 22nd. Electricians' work for the B. of G. Forms, &c., from Mr. J. S. Horn, Clerk, Union Offices.

Bury.—March 8th. Constructional steelwork in connection with the electricity generating station extension. Mr. J. Ainsworth Settle, Borough Engineer, Bank Street.

Dover.—March 9th. Electrical sundries and cables for a year, for the Harbour Board. Mr. Martyn Mowll, Registrar, Castle Street.

Dundalk. — March 23rd. U.D.C. Twelve months' supply of stores for the Electricity Department. See "Official Notices" to-day.

Edmonton.—March 10th. Electric lamps for the B. of G. Mr. F. Shelton, Clerk, The Grange, White Hart Lane, Tottenham.

Grimsby.—March 8th. Corporation. Two years' supply of motor-type meters. See "Official Notices" February 26th.

Heston and Isleworth.—March 6th. U.D.C. Twelve months' supply of electrical stores. See "Official Notices" February 26th.

Hove. — March 26th. Corporation. One 500-KW. mixed-pressure steam turbine, complete with D.C. 230/285-volt generator and surface condensing plant; also a battery of 115 accumulators. See "Official Notices" to-day.

Ilford.—March 9th. U.D.C. Supply and delivery of electric coal-wagon. Mr. A. H. Shaw, Electricity Works.

Italy.—Telephone and electric lighting material, telephone wires and motor plant, for a firm at Palermo. Write to Secretary, British Chamber of Commerce for Italy, 1. Via Innocenzo, Frugoni, Genoa, quoting Board of Trade reference, No. 514.

Kirkcaldy.—March 22nd. Corporation. Twelve months' supply of brass castings, pitch, iron castings, &c., for the Electricity and Tramways Committee. Forms of tender from Mr. O. F. Francis, Burgh Electrical Engineer.

Liverpool.—March 12th. Electrical fittings for a year for the Select Vestry. Mr. G. W. Coster, Clerk, Brownlow Hill.

London.—L.C.C.—March 16th. Reconstruction of three miles of single-line tramway on the underground conduit system. Specifications, &c. (£5), from Chief Engineer, County Hall, Spring Gardens, S.W.

HORNSEY.—March 16th. Meters, cables and stores, &c., for the T.C. See "Official Notices" February 19th.

BOW.—March 9th. Electrical supplies, for the Managers of the Poplar and Stepney Sick Asylum District. Forms of tender from the Clerk, Devons Road, Bow, E.

WANDSWORTH.—March 15th. B. of G. One month's supply of electrical fittings, for the Wandsworth Union. Forms of tender from the Clerk, Union Offices, St. John's Hill, S.W.

Londonderry. — March 13th. Corporation. Engine-room stores, carbons, meters, bitumen. fuse-boxes. Forms of tender from the Electrical Engineer, Electricity Department.

Macclesfield.—March 10th. Cheshire County Asylum, Parkside. Electrical goods for one year. Mr. Wm. Tingay, Clerk.

Manchester. — March 9th. (*a*) One 250-KVA. transformer, and (*b*) E.H.T. and L.T. cables. Mr. F. E. Hughes, Secretary, Electricity Department.

March 10th. Three 3-wire balancers for the Electricity Committee. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Newport (Mon.).—March 15th. Uniform clothing for the Corporation Electricity and Tramways Department. Mr. N. J. Young, General Manager.

Pontypridd. — March 8th. U.D.C. Twelve months' stores for Electric Light and Tramways Department. See "Official Notices" February 19th.

Rochdale.—March 11th. Twelve months' supply of stores for Tramways Department. Mr. G. Webster, General Manager, Tramway Offices, Mellor Street.

Salford.—March 8th. Axles and wheels for 24 bogie cars. General Manager of tramways, 32, Blackfriars Street.

South Shields.—March 12th. Twelve months' supply of engine-room stores for the electricity works. Specification from Mr. H. S. Ellis, Borough Electrical Engineer.

Spain.—The Ministerio de la Gobernacion is inviting tenders for the construction of a telephone line between Barcelona and La Junquera, and one from Barcelona to Valencia.—*Board of Trade Journal*.

Swindon.—March 13th. Corporation. Twelve or six months' stores for Electricity and Tramway Departments. See "Official Notices" February 19th.

Swinton and Pendlebury.—March 19th. U.D.C Cables, joint-boxes, bitumen and joint-box compound. See "Official Notices" to-day.

Transvaal. — BETHAL. March 25th. Municipality. Supply and erection of generating and pumping plant and overhead electric distribution system. Specifications from the consulting engineer, Mr. H. Hancock. P.O. Box 62, Klerksdorp (deposit £1 1s.).

Warrington.—March 9th. Electrical goods (German or Austrian barred) for the B. of G., for six months. Forms, &c., from Arthur Bottomley, Clerk, Bewsey Chamber.

March 16th. Motors, cables, and E.H.T. feeder panel, for the Electricity Department. See "Official Notices" to-day.

Wigan.—March 16th. Corporation. Supply of stores for the Electric Light Department. See "Official Notices" to-day.

Wrexham.—March 17th. Meters, oils, coal, &c., for the Corporation Electricity Department, for a year. Borough Electrical Engineer, Willow Road.

CLOSED.

Barrow.—The T.C. has placed an order for a 200-KVA. transformer with the British Westinghouse Co., at £125; this was the lowest of three tenders received. The T.C. has adopted the engineer's suggestion that wherever possible, existing contracts for oils and stores should be renewed for 12 months with the same contractors.

Bingley (Yorks).—The U.D.C. has placed a 12 months' contract for the sole supply of single and polyphase balanced load meters with the Electrical Apparatus Co., Ltd.

Birmingham.—The City Council is being asked to sanction the purchase of 2,000 tons of steel rails and fishplates from the Lorain Steel Co., of America.

Blackpool.—The Corporation has accepted the tender of the Davenport Engineering Co., for a new cooling tower at the electricity works.

Bolton.—The Electricity Committee has accepted the tender of the British Thomson-Houston Co., Ltd., for switchgear.

Cardiff.—The Building and Sites Committee has accepted the tender of Messrs. H. J. Cash & Co., at £2,400, for the electric installation at the new Technical Institute.

Croydon.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for the following plant at the electricity works:—

Boiler, superheater, and economiser, £4,215; two chain-grate stokers, £920; motor-driven induced-draught plant with iron chimney, £795; indicating steam flow meter, £23.

Dewsbury.—The B. of G. has accepted the tender of Mr. F. Dutton, of Heckmondwike, for electric bell work at the Nurses' Home and Infirmary, at £27 17s. 6d.

Dover.—The Corporation Electricity Committee has accepted the tender of the British Thomson-Houston Co., Ltd., for a 1,000-KW. turbo-alternator set complete with exciter, condenser and pumps, at £4,725.

The Tramways Committee has given an order to Messrs. Dick, Kerr & Co. to supply 50 tons of rails and the necessary fishplates, at £8 15s. and £11 15s. per ton respectively.

Finchley.—The D.C. has decided, should circumstances render it necessary, to buy against the contractors for the supply of 500 tons of coal for the works over a period of three months. The firm, having delivered 93 tons of the quantity arranged, have written stating that they will be unable to deliver any further quantities in the immediate future, but will do so when circumstances permit.

Glasgow.—The Clyde Navigation Trustees have accepted the following tenders for equipment in connection with the new 32-ton electric crane at Queen's Dock:—Cables—Johnson & Phillips, £947; switchboard—Crompton & Co., Ltd., £111; coaling cradle—Sir William G. Armstrong, Whitworth & Co., Ltd., £650; and three weighbridges—W. & T. Avery, £540.

Horsham.—The U.D.C. has placed a contract for D.C. meters with the Electrical Apparatus Co., Ltd., for the year ending March, 1916.

Ilford.—The following tenders have been accepted by the Electricity Committee for supplies of coal for a period of three months:—

E. Foster & Co.—1,000 tons Ibstock medium peas, 19s. 11d. per ton; 500 tons Ibstock D/S nuts, 17s. 5d. per ton; 500 tons ditto slack, 17s. 5d. per ton.

Bradbury, Son & Co., Ltd., Warwickshire (Tamworth).—D/S nuts, 50 tons per week, 21s. 1d. per ton.

Leyton.—The tender of Messrs. W. Rickard, Ltd., has been accepted by the U.D.C. for a six months' supply of cable at basis prices, ranging from £32 11s. for 3/18 to £101 13s. for 7/14. The tender of the Oliver Arc Lamp, Ltd., has also been accepted for the supply of 22,000 pairs of "Oriflamme" carbons, at £5 7s. 6d. per 1,000 pairs, and 18,000 pairs of "Metroflamme," at £5 15s. per 1,000 pairs.

The present contract for the supply of engine oils to the Electricity Department is to be extended for a further period of 12 months upon the same terms.

London.—BETHNAL GREEN. The B.C. is recommended to accept the tender of Messrs. Measures Bros., at £534, for iron and steel work at two sub-stations.

L.C.C.—It is stated that the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., at £62,003, has been accepted for the supply of two 8,000-KW. turbo-generators at the electricity station at East Greenwich.

ST. PANCRAS.—The B.C. Electricity Committee has received the following tenders for the supply of 250,000 pairs of open-type arc lamp carbons:—

General Electric Co., Ltd. (recommended)	£2,039
Wells Electrical Co.	2,185
Oliver Arc Lamp, Ltd.	2,185
Engineering and Arc Lamp, Ltd.	2,185
British Central Electric Co.	2,480
Wm. Geipel & Co.	2,585
London Commercial Electrical Stores, Ltd.	2,630
The Electrical Supplies Co.	2,830

The engineer, in recommending the acceptance of the above tender, pointed out that the cost of a similar quantity of carbons at last year's price would only have been £871 15s.

ST. MARYLEBONE.—The Electricity Committee recommends the acceptance of the tender of Messrs. R. H. Towler, for the supply of a blow-down tank, at £87.

The Committee has accepted the tender of Messrs. T. Press & Co. for renovating the interior of Aybrook Street sub-station, at £34 10s., and of Messrs. Carter & Co. for retiling and renovating the rotary converter room, at £53.

Stepney.—The Electricity Committee has received the undermentioned tenders for the supply of 50 tons of moulded pitch:—

T. Crow & Sons (recommended) ..	£1 9 6	per ton
Forbes, Abbott & Lennard, Ltd. ..	1 14 9	,,
Grindlay & Co., Ltd.	1 17 3	,,
J. Smart & Son	2 0 0	,,

The Committee has accepted offers of 1,930 tons of coal for the Electricity Department at prices varying from 15s. 9d. to 21s. 6d. per ton.

Bermondsey.—The Electricity Committee has had under consideration tenders for the supply of coai for the period ending June 30th next, but as the increase in price is very considerable, and having regard to the Government statement as to bringing down coal prices, the Committee does not consider it would be advisable to make a contract at the present time. It is therefore proposed to purchase 400 tons of Shipley peas from Messrs. Myers, Rose & Co., Ltd., at 22s. 3d. per ton.

The following tenders have been received by the London Education Committee for installing electric light at the Scawfell Street School, Haggerston:—

Johnson, O'Sullivan & Co.	(recommended)	£313
A. Hawkins & Sons		322
Alpha Manufacturing Co.		344
Lund Bros. & Co.		375
T. N. Kingdon & Co.		397
G. Weston & Sons, Ltd.		415

Luton.—The T.C. has accepted the tender of the Harris Patent Feed Water Filter, Ltd., for a water-softening plant for the refuse destructor, at £129.

Maidstone.—Subject to a loan being granted, the T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for a 1,250-kw. turbo-alternator of the Ljungstrom type, at £6,887.

Manchester.—The Electricity Committee has accepted the following tenders:—

J. Spencer, Ltd.—Low-pressure pipework and valves, Stuart Street Station.
B. I. and Helsby Cables, Ltd., and W. T. Henley's Telegraph Works Co., Ltd.—Cables.

The Gas Committee has approved the Electric Construction Co., Ltd., as sub-contractors for dynamos required in connection with the construction of a retort house.

The Rivers Committee has accepted the tender of Messrs. Glenfield and Kennedy, Ltd., Kilmarnock, for electrically-operated rectangular channel penstocks.

The Tramways Committee has accepted the tender of the B.I. and Helsby Cables, Ltd., for tramway rail bonds, and that of Messrs. Hadfield, Ltd., for steel portable track rails.

North Bierley.—Out of 32 tenders submitted for the supply of 800 lamps to the North Bierley Union Authorities, Bradford, that of Mr. H. Moss has been accepted.

Salford.—The Electricity Committee has accepted offers for the purchase of the undermentioned plant, to be displaced at the Electricity Station, Frederick Road:—

S. Openshaw. Two reciprocating engine sets, £1,650.
T. Mitchell & Sons, Ltd.—Three continuous current motors, £105

The tender of Messrs. G. Wragge, Ltd., has been accepted by the Committee, at £104 14s., for steel and glass partitions at the Electricity Station.

Wolverhampton.—The Corporation has placed a contract for the whole of its requirements for A.C. meters with the Electrical Apparatus Co., Ltd., for a year.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Saturdays, March 6th and 13th. At 3 p.m. At Albemarle Street, W. Lectures III and IV on "Recent Researches on Atoms and Ions," by Sir J. J. Thomson, F.R.S.

Salford Technical and Engineering Association.—Saturday, March 6th. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "The Strength of Iron Castings," by Mr. E. L. Rhead.

Association of Engineers-in-Charge.—Saturday, March 6th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Debate on "How to Pay for the War," a scheme proposed by the British Engineers' Association.

Wednesday, March 10th. At 8 p.m. Paper on "Modern Steam Laundry Machinery, more Particularly as Applied to Institution Work," by Mr. B. P. Flockton.

Institution of Mechanical Engineers (Graduates' Association).—Monday, March 8th. At 8 p.m. Paper on "Propelling Machinery for Ships," by Mr. W. J. Drummond.

Institution of Civil Engineers.—Tuesday, March 9th. At 8 p.m. At Great George Street, S.W. Paper on "The Improvement of the River Clyde and Harbour of Glasgow, 1873-1914," by Sir T. Mason.

Wireless Society of London.—Tuesday, March 9th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Lecture on "Waves," by Dr. Erskine-Murray.

Royal Society of Arts.—Wednesday, March 10th. At 8 p.m. At John Street, Adelphi, W.C. Paper on "Patent Law Reform and the War," by Mr. J. W. Gordon.

Institution of Electrical Engineers.—Thursday, March 11th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Electric Cooking, mainly from the Consumers' Point of View," by Mr. W. R. Cooper.

(**Yorkshire Local Section**).—Wednesday, March 10th. At 7 p.m. At Philosophical Hall, Leeds. Paper as above, by Mr. W. R. Cooper.

(**Manchester Local Section**).—Tuesday, March 9th. At 7.30 p.m. At Engineers' Club, 17, Albert Square. Paper on "Electricity Applied to Mining," by Mr. C. P. Sparks.

(**Scottish Local Section**).—Tuesday, March 9th. At 8 p.m. At Princes Street Station Hotel, Edinburgh. Paper on "Automatic Protective Switchgear for Alternating-Current Systems," by Mr. E. B. Wedmore.

Institute of Marine Engineers.—Friday, March 12th. At 8 p.m. At Tower Hill, Minories. Annual Meeting.

Physical Society of London.—Friday, March 12th. At 8 p.m. At Imperial College of Science, South Kensington. Papers on "The Estimation of High Temperatures by the Method of Colour Identity," by Messrs. C. C. Paterson and B. P. Dudding; "The Unit of Candle-power in White Light," by Messrs. C. C. Paterson and B. P. Dudding; and "The Relative Losses in Dielectrics in Equivalent Electric Fields, Steady and Alternating (R.M.S.)," by Mr. G. L. Addenbrooke.

South-Western Polytechnic Institute.—Friday, March 12th. At 8 p.m. At Manresa Road, Chelsea, S.W. Presentation of Prizes and Certificates by Mrs. Hayes Fisher.

Greenock Electrical Society.—Saturday, March 13th. Visit Messrs. Mavor and Coulson's Works, Glasgow.

NOTES.

Patents and Alien Enemies.—Mr. C. E. Lugard has been granted licences by the Board of Trade in respect of Patents Nos. 13,067-8-9, of 1906 (Schuster and another).

Educational Notes.—In connection with classes held at 23, Great Quebec Street, Marylebone, W., Mr. K. H. Bird, M.A., now undertakes the preparation of candidates for science and engineering degrees (external students) of the University of London; entrance to the City and Guilds Engineering College, the Finsbury Technical College, &c.; Graduation and Associate Membership of the Institutions of Civil, Mechanical, and Electrical Engineers; factory inspectorships, &c. The engineering department has been organised and is carried on under the personal direction of Mr. G. W. de Tunzelmann, B.Sc., M.I.E.E., consulting engineer, formerly Professor of Physics at the Royal Naval College, Dartmouth, who, as many of our readers will remember, organised, and for some years conducted, one of the best known private engineering schools in England, and is a recognised authority on the education and training of engineering students.

The Ponder's End works of the Edison & Swan United Electric Light Co., Ltd., Middlesex, were visited on Wednesday, the 24th ult., by the members of the Chemical Society of the Royal College of Science, South Kensington, Mr. E. W. Swann, their excursion secretary, being responsible for the arrangements. An interesting tour was made through all the lamp manufacturing departments, including carbon and drawn-wire sections.

Public Lighting in War Time.—The *Illuminating Engineer* states that a Committee of the Illuminating Engineering Society, formed to consider the framing of recommendations on shop-window lighting, so as to enable merchants to comply with the requirements of the authorities, and at the same time to get the best illumination possible in the present circumstances, has prepared a series of recommendations which have been approved by the Council and submitted to the authorities. The Committee has invited the co-operation of several representatives of the Joint Committee formed to prepare the draft standard specification of street lighting, in order to consider what steps can be taken to make a similar study of the "scientific darkening" of the streets.

Trade Statistics of the United States.—An American report just issued quotes some interesting preliminary figures showing the course of trade of the United States during the year 1914. Imports in that year showed a slight decrease as compared with those in 1913, and there was a decrease of about £75,000,000 in exports, the figures for 1914 being roughly [illegible], as compared with £489,000,000. While the European war has undoubtedly had a considerable share in causing this reduction, other factors have not been without influence. The largest decreases are to be found in the headings raw materials for manufacturing and manufactures ready for consumption. The following statement of the imports and exports from and to belligerent countries are of interest:—

	Imports from.		Exports to.	
	1913. Dollars.	1914. Dollars.	1913. Dollars.	1914. Dollars.
United Kingdom	271,954,987	[illegible]	[illegible]	[illegible]
France	138,933,833	104,215,131	153,922,526	170,104,041
Belgium ...	41,458,376	30,362,019	64,317,469	34,771,023
Russia	22,322,957	12,306,334	25,965,351	22,260,062
Japan	[illegible]	[illegible]	[illegible]	[illegible]
Germany ...	184,211,352	149,389,366	351,930,541	158,294,986
Austria-Hungary	19,083,392	15,683,880	22,244,599	12,801,195

The effect of the control of trade routes is clearly shown in these figures, but it is a noticeable fact that the exports from America to Italy showed an increase of about 30 per cent., a circumstance from which it is not difficult to draw an inference.

Incorporated Municipal Electrical Association.—The President of the I.M.E.A., Major H. Richardson, having been called up for Service on the outbreak of the war, and being unable, therefore, to discharge for the present the duties of his office, the Council appointed the senior vice-president, Mr. A. C. Cramb, as acting-president during Major Richardson's absence. Later, when it became necessary to consider the question of the 1915 Convention which was to have been held in Dundee, the president expressed a wish that only the necessary business of the Association should be carried on at present, and that the usual Convention should not be held this summer. The Council, after due consideration, decided that instead of the proposed Convention in 1915 in Dundee, business meetings should be held in London for the transaction of routine business necessitated by the articles of association and for the discussion of matters of general interest to the members.

The following is the preliminary outline programme of the arrangements, which (other than dates) are subject to variation.

The meetings will be held at the Institution of Electrical Engineers, Victoria Embankment, W.C., by courtesy of the Council of the Institution, and will be restricted to members and official delegates.

Thursday, June 17th.

10 a.m.—To receive and discuss a report prepared by Mr. A. S. Blackman (chief electrical engineer, Sunderland), and Mr. T. Roles (chief electrical engineer, Bradford), on behalf of the "Point Five" Association, on "The Practical Result of the Point Five Tariff."

2.30 p.m.—To receive and discuss a report prepared by Mr. Frank Ayton (chief electrical engineer, Ipswich), hon. secretary of the Electric Vehicle Committee of the I.M.E.A. on "The Use of Electric Vehicles in Municipal Service."

The meeting will be followed by a parade and demonstration of electric vehicles.

Friday, June 18th.

10 a.m.—Annual general meeting. To receive the annual report and balance sheet; elect the officers and Council; and transact other business.

2.30 p.m.—If necessary the members will reassemble to complete any adjourned business.

The usual visitors' list will on this occasion be suspended; there will be no social functions, and it is not proposed to invite ladies. The headquarters of the Council will be the Hotel Cecil. The detailed official programme will be issued later. All communications relating to the business meetings should be sent to the secretary, at 28, Bedford Square, London, W.C.

Development Committee.

At the second and third meetings of the Development Committee, held at the Institution of Electrical Engineers, on January 15th and February 12th, 1915, respectively, the steps taken with regard to co-opting further members of this Committee were reported upon, and the complete list to date is as follows:—

Representing the I.M.E.A.—

Chairman, S. E. Fedden (Sheffield).

S. T. Allen (Wolverhampton).
F. Ayton (Ipswich).
A. S. Blackman (Sunderland).
R. A. Chattock (Birmingham).
A. C. Cramb (Croydon).
Coun. Crowther (Sheffield).
J. E. Edgcome (Kingston).
Ald. Ellaway (Birmingham).
F. M. Long (Norwich).
H. Richardson (Dundee).
Ald. Pearson (Bristol).
H. F. Proctor (Bristol).
T. Roles (Bradford).
A. H. Seabrook (Marylebone).
Ald. J. Smith (Barrow).
W. A. Vignoles (Grimsby).
G. Wilkinson (Harrogate).

Acting Hon. Sec., J. W. Beauchamp (West Ham).

Representing the A.M.E.E. (Greater London).—

W. C. P. Tapper (Stepney).

Representing the B.E.A.M.A.—

R. J. Ireland (British Thomson-Houston Co.).
G. Maurice (General Electric Co.).
H. C. Siddeley (Lancashire Dynamo Co.).
D. N. Dunlop (Sec. B.E.A.M.A.).

Representing Electrical Contractors' Association.—L. G. Tate (Secretary).

Representing Cable Makers' Association.—L. B. Atkinson (W. T. Glover & Co., Ltd.)

Representing Association of Electrical Power Companies.—W. A. Chamen. A. de Turckheim (Secretary).

Representing British Electrical Federation. W. L. Madgen.

Representing Society for Electrical Development, U.S.A.—F. W. Wilcox.

Sub-Committees were appointed to deal with the following matters:—

1. Publicity, to be operated from London district. Secretary, A. C. Cramb (Croydon).
2. Electrical Installations, to be operated from the Bradford district. Secretary, T. Roles (Bradford).
3. Domestic Appliances, to be operated from the Birmingham district. Secretary, S. T. Allen (Wolverhampton)

Further particulars in regard to the constitution of these Committees will be given when they are completed.

It was considered advisable to distribute the operations of these Committees over different districts of the country, in order to make it easier for persons who might, by reason of their experience or otherwise, be very useful, to attend the meetings.

It was also decided that Sub-Committees should have the power to co-opt persons, not necessarily members of the Development Committee or of the Incorporated Municipal Electrical Association, who, by reason of their experience in connection with different branches of the electrical industry, might be willing and able to give assistance in the work of the Sub-Committees.

A Rathenau Foundation.—It is announced that the Prussian Ministry has just given approval to the Emil Rathenau Foundation established by Herr Emil Rathenau in conjunction with the directorate and board of supervision of the A.E.G. The object of the Foundation is to place the Physical-Technical Reichsanstalt in the position of being able to promote enterprise in the department of electricity and magnetism by the acquisition and maintenance of distinguished workers and the grant of aid to its members and constant collaborators for undertaking journeys of investigation to similarly equipped institutions in Europe or in transmarine countries, together with the appropriate provision of costly instruments for which State funds cannot be rendered available. The Foundation has been established in honour of the creator of the A.E.G. on his 75th birthday. When it is mentioned that the assets of the Foundation merely consist of obligations or debentures in the A.E.G. for 100,000 marks (£5,000), it will be obvious that the promoters of the scheme have prepared a comprehensive programme for attempted realisation, although the real value of the obligations must have been much greater than the nominal value prior to the outbreak of the War. At the same time, further contributions are looked forward to, as an administrative council composed of the president of the curatorship of the Reichsanstalt, a member of the curatorship and the president of the Anstalt has been appointed to decide upon the use to be made of the available means and of any future additions to the fund.

"Powerful Lights" Defined.—*The Motor* states that "a case was heard at Mortlake recently in which a member of the Automobile Association was summoned for driving with powerful lights. The case was particularly important because it was the first in which the police attempted to define the meaning of 'powerful lights.' The lamps complained of were electric side lamps of 6 c.p. each, and the police stated that the law officers of the Crown had given it as their view that any lamp showing a greater power than that of the ordinary oil lamp carried by taxicabs would be considered a 'powerful light' within the meaning of the Regulation now in force. This definition means that the side lamps, if electric, must be kept down to about 2 c.p. each in order to conform with the present requirements. Motorists must therefore reduce the power of their electric lamps either by using smaller candle-power bulbs or by adequately masking the glasses."

Manchester Tramway Employés' Society. — The Manchester Corporation Tramway Employés' Social and Athletic Society reports that during the past year the membership stood at 2,889, an increase of 300. Of the total members, 780 are now on active service. The society has furnished members in military training at Morecambe with football jerseys and knickers, and 100 packs of playing cards have been sent to soldiers at the Front. The income of the society last year amounted to £1,304, and the expenditure, including depreciation, to £1,196, leaving a profit of £108.

Golf.—At the annual meeting of the Aberdeen Electric Golf Club it was reported that the season so far as it went was satisfactory. The most important competitions, the Campbell Cup and the medal, had to be abandoned, as over 30 members were serving with the Colours. Mr. D. C. Campbell was re-elected captain, Mr. E. F. Stuart secretary and treasurer, and Mr. A. C. Duthie assistant secretary.

Ownership of Italian Water Power.—A curious dispute on the question of the ownership of the Lake of Gherla has arisen between the Società Varesina per Imprese Elettriche and the Domainal authorities. The latter granted to the former water rights in the Magorabbia torrent for the generation of electricity to work the Varese-Gherla-Luino Railway, but, on the ground that a portion of the waters of the Lake, claimed as Domainal property, fall into the torrent, sought to impose a rule limiting the intake of water from both the torrent and the Lake. As the Varesina Society had already paid a private individual who claimed the Lake as private property, for the use of this water, the Domainal claim was resisted, and the matter brought before the Court at Varese, the Ministers of Finance and of Public Works being cited as witnesses. The local Court having dismissed the case on a point of form, the question has been referred to the Corte d'Appello for decision.

German Wireless. — Among the German war news received by Marconi wireless, and published in the *Times* of Saturday last, was a paragraph stating that "the General Electric Co. of Belgium will subscribe five million marks to the new War Loan." There is obviously an error in translation here. The title is practically identical with that of the Belgian branch of the General Electric Co., Ltd., of London, which, of course, knows nothing about the matter—indeed that branch company only has a capital of £10,000. If there be any truth at all in the news, it must relate to one of the German electrical companies operating in Belgium.

Institution and Lecture Notes.—Diesel Engine Users' Association.—At the February meeting of this Association held at the Institution of Electrical Engineers, the President (Mr. J. E. Edgcome) announced that further particulars were being obtained in connection with the question of the use of Mexican fuel oil in Diesel engines, and in connection with specifications for fuel oil, and that both these subjects would be brought up for further discussion at a subsequent meeting. He also announced that at the next meeting the general question of insurance of Diesel engines against breakdown would be further discussed.

The discussion on the breakdown of a Carels Diesel engine at Oxford, which had been reported at a previous meeting, was resumed. Mr. F. H. Francis exhibited a bolt head from the connecting-rod big end of his engine at Oxford, and explained that this bolt was one which had failed at a previous breakdown in May, and not at the breakdown now under discussion. He stated that both bolts were very similar, and that both were obtained from the Consolidated Diesel Engine Manufacturers, Ltd. The second bolt which broke had been tested by the Sheffield Testing Works, Ltd., and they had stated that it was made of good quality iron. Mr. Francis considered that steel would have been more suitable. He then produced a table of figures which he had worked out from particulars supplied to him by various Diesel engine users, and pointed out that Mr. Philip Smith's contention that the bolt was overstressed in the case of the Oxford engine appeared to be correct. It was interesting to note that in the case of the Carels engines at Chelsea and Clacton, which are of the same size as the Carels engine at Letchworth, the big-end bolts are 25 per cent. to 35 per cent. larger in area. Apparently in the case of the Chelsea and Clacton engines the makers had rehammered out the big ends so as to take the largest bolt they could get in without altering the design of the big end.

Mr. Philip H. Smith, who had been invited to attend the meeting, gave data of relative stresses in big-end bolts in the case of engines of various makers. He contended that the bolts of the big end of the connecting-rod were of insufficient strength for their purpose, and that the absence of a proper radius under the head of the bolt was a weak point in the design. In the course of the discussion which followed, he expressed the view that periodic annealing of the connecting-rod bolts was not to be recommended, but he considered that such bolts should not be stressed above 3,000 lb. per sq. in., and that they should be renewed every 12 months or so, or say, after about 3,000 hours' run. He added that in mentioning a definite period for the use of the connecting-rod bolts he was to a great extent guided by information given him by Diesel engine users.

Mr. Everett gave some further particulars concerning the fracture of a gudgeon pin on his Carels engine at Clacton-on-Sea, and Mr. Smith expressed his opinion that this might have been due to the strain caused by a pre-ignition, which was known to have occurred on the engine on one occasion when the fuel cam was not in order.

Mr. H. L. Dixon, of Leatherhead, considered that without some further explanation it would not appear to be advisable that the bolts of the big end should be a tight fit, but that any shearing strain on the bolts should be taken by a spigot, to which Mr. Smith replied that, in his opinion, a tight fit for the bolts was preferable, but that he considered that a jaw-shaped connecting-rod was the best arrangement.

The next meeting is to be held on Wednesday, March 17th, at the Institution of Electrical Engineers. Information and particulars concerning the Association can be obtained from the Acting Hon. Secretary, Mr. Percy Still, of 19, Cadogan Gardens, London, S.W

Institution of Electrical Engineers.—At the meeting of the Newcastle Local Section on Monday (March 1st), and that of the Birmingham Local Section on Wednesday, Mr. C. P. Sparks read his paper on "Electricity Applied to Mining."

Swedish Electrical Exports.—The exports of electrical machinery from Sweden last year only attained a value of £188,600, as contrasted with £254,250 in 1913. On the other hand, there was an increase in the exports of telephone material and apparatus—from £318,310 to £340,520.

Parliamentary.—*Second Readings.*—In the House of Lords on February 24th, the Aberdare U.D.C. (Tramways, &c.) Bill, and the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board Bill were read a second time.

National Electrical Week.—It is proposed that the National Electrical Week to be organised by the Society for Electrical Development, Inc., of New York, shall take place early in the spring of 1916.

Appointments Vacant.—Shift engineer (37s.), for Dewsbury Corporation ; switchboard attendant (30s.), for Stockport electricity department ; plumber-jointer (40s.) ; two substation attendants (30s. each) ; arc lamp trimmer, for borough of Wolverhampton ; assistant electrician and fitter (£84), for Leicester Borough Mental Hospital ; shaft engineer (42s. to 45s.), for Redditch U.D.C. See our advertisement pages to-day.

Inquiries.—Makers of the Arcazon arc lamps, suppliers of graphite and manganese peroxide in large quantities, and makers of accessories and spare parts for use with the Santoni and Sunshine flame arc lamps are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Mr. H. J. Hazelgrove, draughtsman, was presented with a pair of pictures, as a mark of esteem, by the staff of the Battersea Council's electricity department, on his leaving to take up a more lucrative position with the Sturtevant Engineering Co.

Mr. H. H. Partington, of Falkirk, has been appointed as substations superintendent at the Salford electricity works, at a salary of £200 per annum. This sum has been fixed as the minimum salary for future holders of this position.

Mr. F. Pape, of Barrow-in-Furness, has been appointed as shift engineer at Eccles (in place of Mr. Bedford, who has volunteered for military service).

Mr. George J. Hollyer, A.M.I.E.E., has been promoted by the Walthamstow U.D.C. to the position of assistant electrical engineer. In this capacity he will have entire charge of all departments of the electricity undertaking during the absence of the chief engineer.

Mr. Fred. Tyrrell, assistant electrical engineer at the Ascot works, and formerly of Kingston-on-Thames, has received a similar appointment at Lagos, Nigeria.

Mr. Fred. Duckworth has been appointed head clerk in the Haslingden Corporation electricity and tramways department.

Mr. Alfred L. Lunn, who for the past five years has been one of the charge engineers at the Corporation Works, Sunderland, has been appointed to a similar position under the Manchester Corporation, at the Stuart Street works. He began his new duties on Monday. Before going to Sunderland Mr. Lunn was at Manchester. The Sunderland electricity staff presented him with a case of fish servers and eaters. Mr. Wilfred Yorke, assistant engineer, made the presentation.

Mr. F. P. Evans, who has acted as mains and meter superintendent to the Urban Electric Supply Co., Ltd., Grantham, since December, 1907, severed his connection with the Grantham Works on February 24th. The staff presented him with a set of military hair brushes, a letter case and a fountain pen. He left Grantham to take up the position of chief assistant at Market Drayton.

Under the present circumstances, the Ilford Electricity Committee has adjourned *sine die* the question of the salary of the electrical engineer.

Tramway Officials.—Croydon T.C. has increased the salary of Mr. Gordon Stanley, engineering assistant in the tramways department, from £160 to £185 per annum.

General.—Dr. Archibald Barr, Emeritus Professor of Civil Engineering and Mechanics at Glasgow University, has been honoured by professional bretheren and former students on the occasion of his recent retiral from the professional chair. At a largely-attended meeting in the Bute Hall of the University, one portrait of Dr. Barr was presented to the University and the other offered for Mrs. Barr's acceptance. Mr. J. S. Nicholson, lecturer on Electrical Engineering at Glasgow University, presided, and the presentations were made by Mr. Hugh Reid, LL.D., of the Hyde-park Locomotive Works, Principal Sir Donald MacAlister accepting on behalf of the University authorities.

Mr. Hudson, of Messrs. Hudson, Sheed & Towell, Ltd., has severed his connection with that firm, and has taken up his old position with Messrs. Fredk. Thomas & Co., 189, Drummond Street, N.W.

At last Monday's meeting of the members of the Royal Institution, a letter was read from the Hon. Sir C. A. Parsons, K.C.B., F.R.S., enclosing a cheque for £5,000, which he said "might be of some help at the present time." The managers passed a resolution expressing their most grateful appreciation of Sir Charles's munificence and discernment in unconditionally placing the sum at their disposal for the purposes of the Institution. The resolution read :—"They accept the gift as a timely and noble recognition of the good public work the Institution has done in the past, and is still doing, in the acquisition and diffusion of scientific knowledge, and as an incitement to maintain and extend its usefulness in the unique position which it has for more than a century occupied."

Mr. Wm. E. Hemingway has been appointed by the Dewsbury B. of G. as electrician to the workhouse.

The Erie Pump and Equipment Co., Erie, Pa., have appointed as sales engineer Mr. N. H. Brown, who was until recently Chicago representative of the Bury Compressor Co.

We congratulate Mr. Alan A. Campbell Swinton on being selected by the Council of the Royal Society for recommendation for election.

Obituary.—The official announcement of the Singapore riot of February 15th stated that Mr. Belfield North Woollcombe, who, with his wife, was killed, was an official of the Eastern Extension Telegraph Co. It is stated that Mr. G. O. Lawson, of the Singapore Volunteer Rifles, who was also killed, went out to Singapore as an electrical engineer about three years ago.

It is reported in a financial daily that Mr. Fred W. Lawson, of Leeds, a director of Fairbairn, Lawson, Coombe, Barbour & Co., died at Bath on February 24th.

The funeral took place at Blackamoor Church, Blackburn, on February 25th, of Mr. Robert Dugdale, of 431, Bolton Road, Ewood, an electrical installation contractor of Preston New Road. Death was due to pneumonia.

Mr. Charles Holliday, who has died at Crossgates, at the age of 69 years, was a former chief superintendent of telegraphs at Leeds Post Office, retiring in 1906, on reaching the age limit. He joined the Electric Telegraph Co. in 1860, and shortly afterwards became an operator with the United Kingdom Telegraph Co. In 1901 he was made superintendent in succession to the late Mr. E. Trenam.

NEW COMPANIES REGISTERED.

Smith & Mortimer, Ltd. (139,485).—This company was registered on February 26th, with a capital of £1,000 in £1 shares (210 preferred "A," 30 preferred "B," and 760 ordinary), to carry on the business of electrical engineers, automobile and accessory manufacturers, engineers, founders, smiths, contractors and manufacturers and sellers of an improved combined magneto lighting and charging set for the use of motor-propelled vehicles invented by C. H. M. Smith, and to adopt an agreement between H. Mortimer, C. H. M. Smith, H. W. Mortimer and S. J. Mortimer. The subscribers (with one share each) are:—H. Mortimer, Shanklin House, 41, Crescent Gardens, Bath, auctioneer; C. H. M. Smith, "South Brook," London Road, Bath, electrical engineer; H. W. Mortimer, 15, Crescent Gardens, Bath, accountant; S. J. Mortimer, Shanklin House, 41, Crescent Gardens, Bath, automobile engineer. Private company. The number of directors is not to be less than two or more than four; the first are H. Mortimer, C. H. M. Smith, H. W. Mortimer and S. J. Mortimer (all permanent); qualification, £50; remuneration as fixed by the company. Solicitor, J. S. Carpenter, 2, Pierrepont Street, Bath.

Surrey Electrical Co., Ltd. (139 460).—This company was registered on February 24th, with a capital of £2,000 in 1,750 6 per cent. preference shares of £1 each, and 5,000 ordinary shares of 1s. each, to carry on the business of manufacturers and sellers of electrical appliances, lamps and electrical novelties, motor appliances, &c., and to adopt an agreement with F. R. Marks, E. Dance, A. T. Redgwell, F. Tammage and F. Coates. The subscribers (with one share each) are:—F. R. Marks, Sussex Lodge, Wimbledon Park Road, Wandsworth, S.W., merchant; J. D. Cassels, Spring Lodge, Southfields, S.W., barrister; E. Dance, 57, Geraldine Road, Wandsworth Common, S.W., traveller. Private company. The number of directors is not to be less than three or more than five; the first are F. R. Marks, J. D. Cassels, E. Dance and A. T. Redgwell; qualification, 250 ordinary shares. Registered office, 77, East Hill, Wandsworth, S.W.

East London Electric Co., Ltd. (139,431).—This company was registered on February 23rd, with a capital of £1,000 in £1 shares (500 6 per cent. cumulative preference), to carry on the business of electrical engineers and contractors, suppliers of electricity, manufacturers of and dealers in electric, magnetic and galvanic apparatus, &c. The subscribers are:—W. B. Allcock, March Green House, Dagenham, electrical engineer, one ordinary share; P. H. Dipple, 186, Barking Road, Canning Town, E., licensed victualler, one preference share. Private company. W. B. Allcock is permanent governing director, with 20 per cent. of the net profits as remuneration. Solicitor: J. Hands, 97, Gresham Street, E.C.

Electrodes, Ltd. (139,422).—This company was registered on February 22nd, with a capital of £10 000 in £1 shares, to carry on the business of manufacturers of, and dealers in, apparatus and appliances for the production of light in reflectors and projectors, electricians, engineers, makers and suppliers of electricity, &c. The subscribers (with one share each) are:—A. M. Billington, Suffolk House, Laurence Pountney Hill, E.C., civil and electrical engineer; A. M. Hay, jun., Suffolk House, Laurence Pountney Hill, E.C., insurance broker. Private company. The number of directors is not to be less than three or more than five; the first are A. M. Billington (permanent) and others to be appointed by the subscribers: qualification, £100. Registered office, Suffolk House, Laurence Pountney Hill, E.C.

David Wilson's Patent Noiseless Winch Co., Ltd. (139,421).—This company was registered on February 22nd, with a capital of £25,000 in £1 shares, to carry on the business indicated by the title, and that of electrical and mechanical engineers, manufacturers and sellers of machinery, and to adopt an agreement with D. Wilson. The subscribers (with one share each) are:—D. Wilson, 18, Greenkeys Road, Liscard, engineer; W. H. Pealing, 604, Tower Buildings, Liverpool, secretary. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration as fixed by the company. Secretary, J. S. Haynes. Registered office, 38, Drury Buildings, Water Street, Liverpool.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Suppliers' Construction Co., Ltd. (66,081).—Capital, £350,000 in £5 shares. Return dated December 31st, 1914. All shares taken up. £350,000 paid. Mortgages and charges: Nil.

Sun Electrical Co., Ltd. (63 261).—Capital, £45,400 in £1 shares (20,000 preference). Return dated December 29th, 1914. 17,141 preference and 5,400 ordinary shares taken up. £22,541 paid. Mortgages and charges at date of return: £3 325, since registered; satisfaction to the extent of £275 on February 9th, 1915, of debenture stock dated March 31st, 1911, originally securing £7,000.

Electro-Mechanical Brake Co., Ltd.—A mortgage on land in Moor Street, West Bromwich, with the Eagle Foundry thereon, dated February 1st, 1915, to secure all moneys due or to become due from the company to the London City and Midland Bank, Ltd., 5, Threadneedle Street, E.C., not exceeding £7,500, has been registered.

Bishopscastle Electric Light and Power Co., Ltd.—Particulars of £500 debs., created February 8th, 1915, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £180. Property charged: The company's undertaking and property, present and future. No trustees.

Spensers, Ltd.—Issue on February 17th, 1915, of £850 second debs., part of a series of which particulars have already been filed.

Shipston Electrical Co., Ltd.—Particulars of £200 third debs., created February 20th, 1915, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

CITY NOTES.

Lancashire United Tramways, Ltd.

The directors report that the result of the working of this and the operating companies comprised in this company's system, worked out as though they were one combined undertaking, is as follows for 1914:—Traffic receipts £85,144, miscellaneous receipts and electrical energy sold £5,889, = £91,033; less working expenses £52,786, cost of generating electrical energy sold £2,718, general charges (including direction, management, interest, etc.) £5,401, rent of leased lines £5,188, = £66,093, leaving £24,940, plus dividend on holding in the New St. Helens and District Tramways Co., Ltd. £1,534, making the profit of combined undertaking £26,474. The receipts, compared with those of the previous year, show an increase of £3,472, notwithstanding a decrease in traffic receipts of £1,889 since the outbreak of war. The receipts amounted to 8.91d. per car mile.

The increase in expenditure amounted to £4,651. This was due principally to the additional expenses occasioned by the working of the Little Hulton and Farnworth extensions and motor coaches, and to heavy cost of maintenance of permanent way, owing to the increased wear and tear of the track by heavy motor goods traffic. During the year the rates of pay to employés have been increased.

The company is making allowances to the dependents of men who have joined the colours. Down to December last £230 had been granted.

Three motor coaches were purchased at the end of May, but the chassis were impressed by the military authorities early in September. They proved successful during the short period they were running. The profit amounted to £241, after writing off the loss on the sale of the vehicles. Orders have been placed for new chassis to enable this traffic to be resumed at the termination of the war.

The interest and dividends received by this company from the operating companies, together with sundry receipts, amounted to £14,438. After deducting interest on the prior lien debenture stock and expenses, there remains £158, which has been carried to depreciation account. There is also an undivided surplus on the year's working of the operating companies, after payment of the interest and dividends before mentioned, of £13,816. The depreciation and renewals accounts and amounts carried forward in the combined companies now amount to £38,744.

During the year 17 cars have been fitted with top covers, and the directors propose to cover a further number of cars this year.

Owing to the increased demand for power, a new agreement has been entered into with the Atherton Urban District Council for the supply of electrical energy for 20 years from January 1st, 1915.

The Hon. Arthur Stanley, M.P., presided over the annual meeting, held at Winchester House, E.C., on Friday last. He said that the profit of the combined undertaking for the year amounted to £26,474, as against £27,653 in 1913. The profit in 1913 was over £8,000 in advance of any previous year, and considering the abnormal conditions obtaining in the last few months the profit of the past year was a fairly satisfactory one. The increase in receipts was £3,472. Up to the end of July the traffic receipts showed steady weekly increases aggregating £5,000 for the seven months, but from the date of the outbreak of war there had been a considerable decrease in traffic. The running of the three motor coaches for three months resulted in a profit of £241. Those coaches had been commandeered by the Government, but their experience during the short time they were working confirmed their action in entering on this branch of passenger traffic, and they had therefore made arrangements to resume same as soon as possible after the war. The expenditure had increased by £4,651. The working of the Little Hulton and Farnworth extensions for a full year as against four months in 1913 accounted for £1,500 of this; higher rates of pay to workmen £800; and the maintenance of permanent way had gone up by £2,300. This was due to the great increase in wear and tear of track by motor goods lorries. The number of these vehicles now on the roads, and the certainty of further expansions in this traffic, had created a serious problem for those responsible for road maintenance. Tramway authorities had discussed the matter at length, and in the near future it was hoped that some concerted action would be taken to relieve those undertakings of the very onerous conditions which now obtained in connection with the maintenance of the highways. They had adhered to their practice of transferring from the operating companies just sufficient revenue to meet the interest on the prior lien debenture stock, consequently £13,816, representing the balance of profit of the combined undertaking for the year, had been retained by the operating companies, the greater portion having been placed to renewals account, and the remainder carried forward. The depreciation and renewals accounts and amounts carried forward in the combined companies now amounted to £38,743. Owing to the increased demand by the Atherton Urban District Council for the supply of electrical energy, it had become necessary to make further additions to the generating plant, which they proposed to do this year. In consequence of this they had thought it advisable to enter into a new agreement with the Council, who had agreed to extend the period during which they would take a supply from them from ten to twenty years. Up to date 129 employés of the associated companies had joined the colours. In the cases of married men and single men with dependents they were supplementing the Government allowances, so that each family received not less than the average wages earned before enlistment.

Mr. J. S. Austen seconded the motion.

The report was adopted.

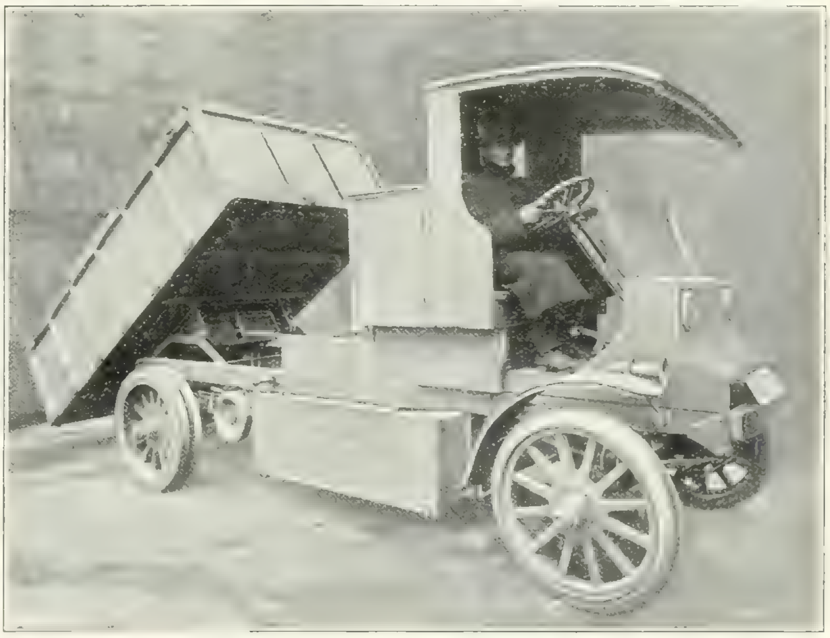
(*Continued on page* 329).

THE ELECTRIC VEHICLE.

The advantages of using the electric vehicle for municipal services in the initial stages of the electric vehicle movement in this country, have been pointed out on more than one occasion by ourselves and others. But municipal bodies are proverbially slow to move, and the difficulties of penetrating the charmed circle of municipal thought with a new idea have perhaps been under-estimated, certainly so in those only too numerous cases where an apathetic chief engineer has not taken the trouble to investigate the claims of the "electric" and to enlighten the Council as to its possibilities.

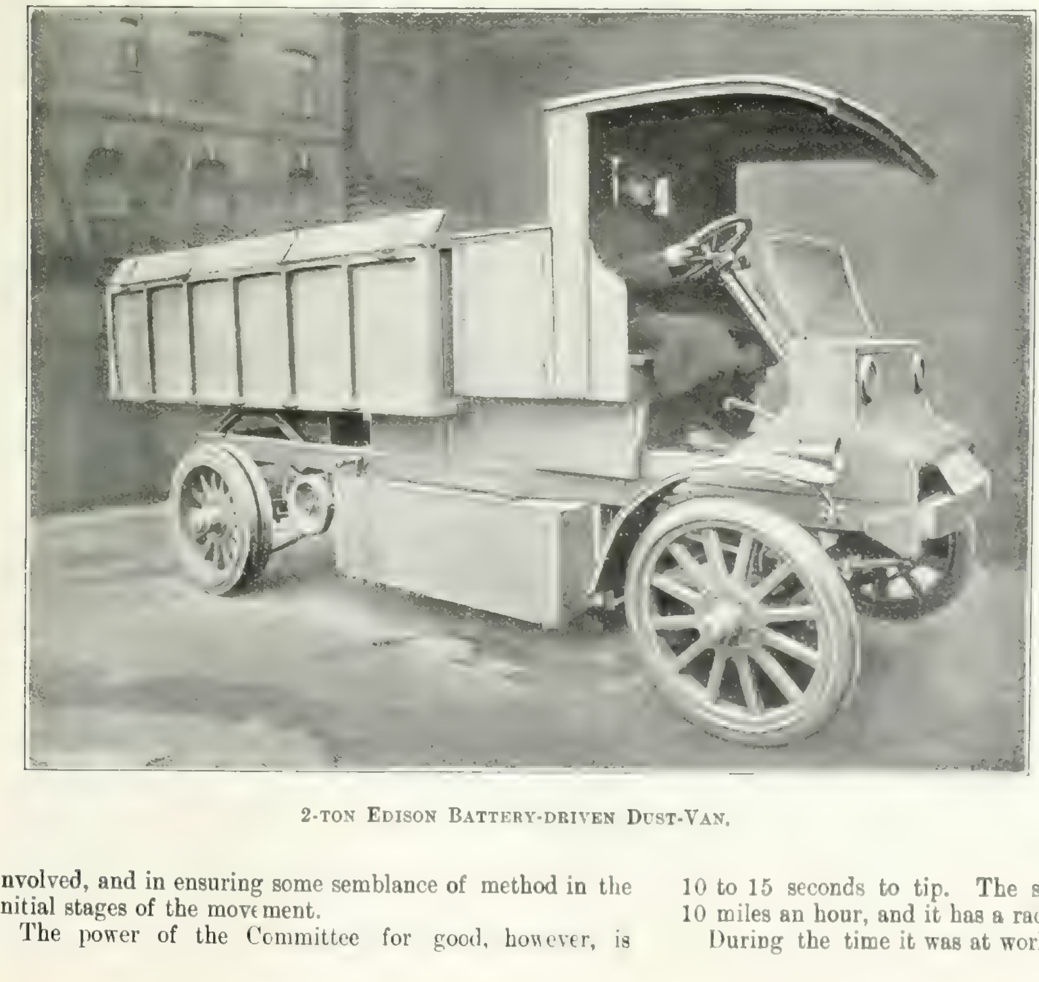
A Corporation which owns both electric lighting and tramway undertakings, and yet cannot find a place for the electric battery vehicle amongst the road equipment of its various departments, cannot expect the inhabitants of the town to attach much weight to any arguments in its favour. An ounce of practice in a case of this sort is worth a ton of theory, and it is up to our municipal authorities to lead the way—as in fact they did when the more expensive but more efficient electric tramway superseded horse traction.

A few municipal authorities are now taking a really active interest in the electric vehicle; a number can also lay claim to be supporters of the Electric Vehicle Committee, which is a very different thing; while of the remainder we should not be surprised to hear that a considerable proportion had not perceived, even if they have heard of, the existence of the electric vehicle.



Edison Dust-van, showing Body Tipped.

In justice to the Electric Vehicle Committee, we may add that it has always appealed to us as a shining example of unity of purpose, and we do not doubt that it has done yeoman service in bringing together the various interests involved, and in ensuring some semblance of method in the initial stages of the movement.



2-ton Edison Battery-driven Dust-Van.

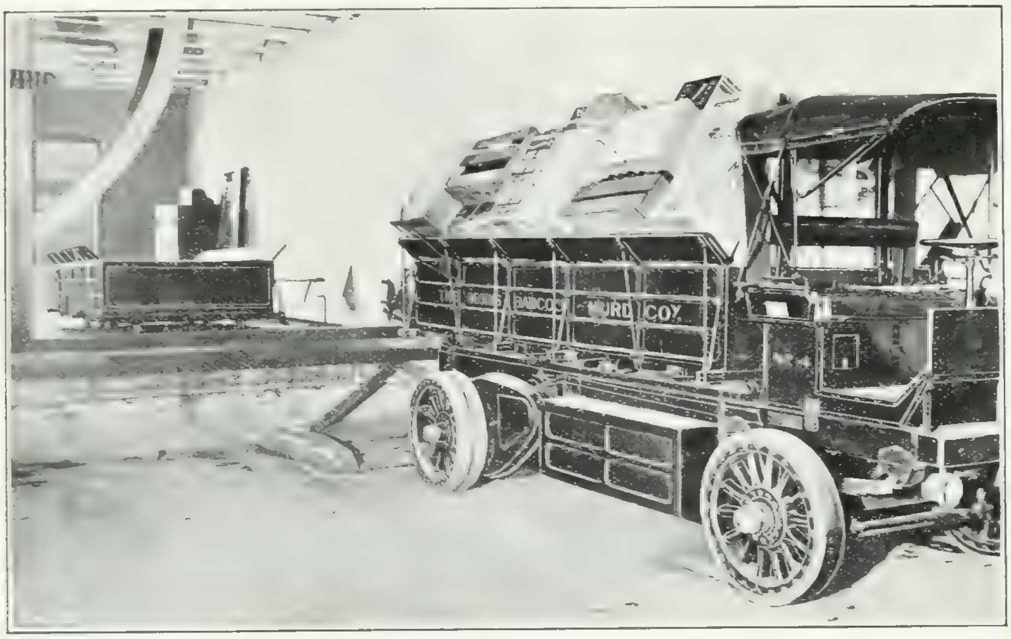
The power of the Committee for good, however, is dependent on the support accorded to it, and it seems pertinent at the moment to inquire just how far this is being given by our station engineers.

It would be a thousand pities were the introduction of the electric vehicle to be hindered at the present time, when events—ill in other respects—have conspired to give it an advantage over the too easily requisitioned horse or petrol vehicle.

At the moment a good deal of interest is being taken in the electrically-propelled dust van, and trials of such a vehicle have been carried out at Hounslow, Barnes, Wolverhampton, Birmingham, West Bromwich, Sheffield and Croydon, resulting in certain definite recommendations. For instance, Mr. G. Bruce Tomes, surveyor to the Barnes Urban District Council, has reported to his Council on the experimental use of two electrically-propelled dust vans, which have proved very satisfactory and resulted in a recommendation for the purchase of four such vans.

We gather that the first van tried was supplied by Edison Accumulators, Ltd. The cost is stated to be £915 complete with chassis, battery and tipping body; the body is tipped by a small motor driven from the main battery, and only takes from 10 to 15 seconds to tip. The speed of the van is about 10 miles an hour, and it has a radius from 40 to 45 miles.

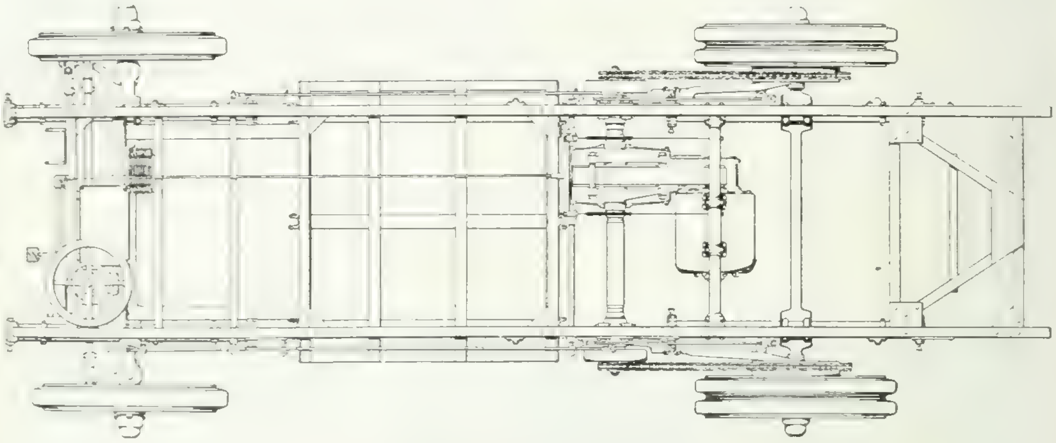
During the time it was at work, careful tests were made



Baker Electric Truck, with Detachable Body.

of the mileage, current consumed, &c , and the running cost per day, including interest and repayment on the loan, wages, current, tires, maintenance of battery and chassis, insurance, and oil waste and sundries, &c , worked out at 19s. 4d. per day. This includes an allowance for charging apparatus.

The second van was a Baker electric chassis supplied by the Wolseley Motor Co. The price of the chassis with battery is given as £660, and a body with hand-tipping gear would bring the cost up to £750. The speed is somewhat less, but the radius and running cost works out the same as in the former case.

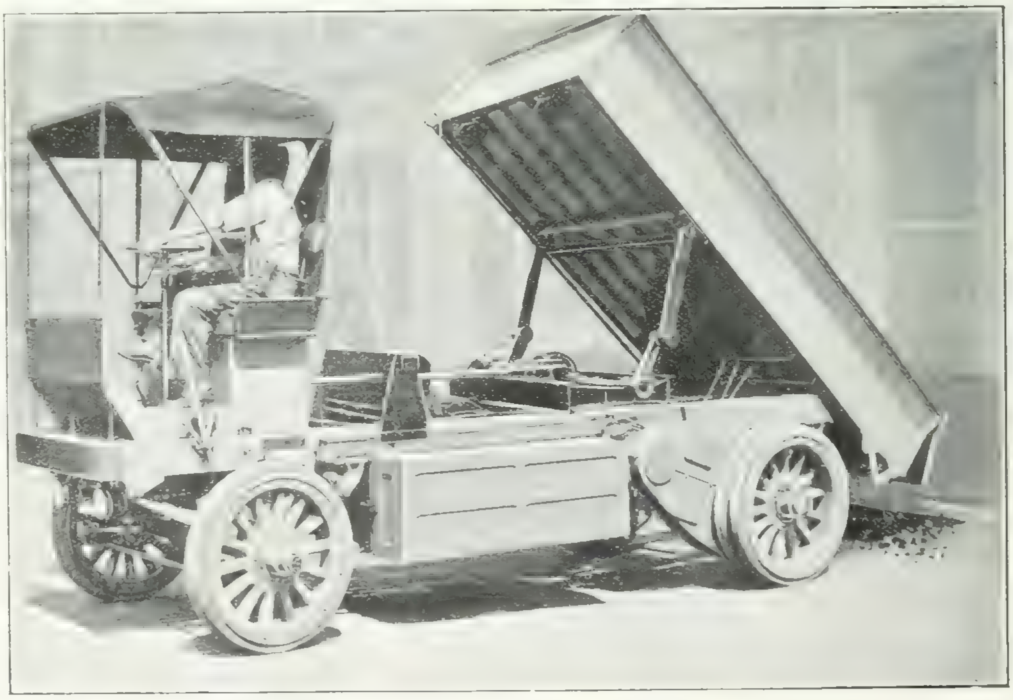


Plan of 2-ton Baker Chassis.

With regard to the work done, it was found that one van will take the place of 16 horses per week, and as the number of horses and carts required for dust removal averages 62 per week, four vans will do the work with a small margin to spare. On these lines the comparative cost would be as follows :—

62 horse-cart days, at 11s. = £34 2s.

24 dust-van days, at 19s. 4d. = £23 4s : two extra fillers to replace one-fifth of time of 10 carmen employed in filling, each at 30s. = £3, making a total of £26 4s., which represents a saving per week of £7 18s., and a saving per year of £410 16s.

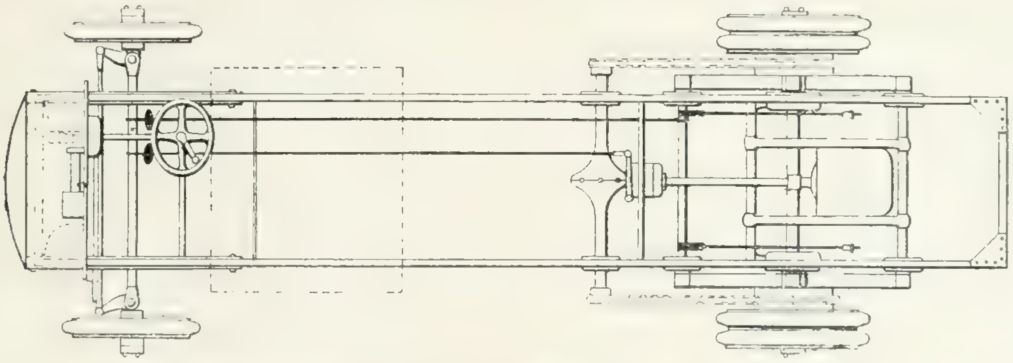


Baker Electric Dust-van, showing Body Tipped.

Notwithstanding a capital expenditure of £4,000, a saving of at least £400 per annum can be effected by the change of system.

The comparison can also be made in a somewhat different way by the number of cubic yards collected. A motor-van collects 28 loads per week, and four vans would collect 112 loads per week, which, at 4½ cb. yd. per load, would make 504 cb. yd. A horse and cart collects 21 loads per week, and at 10⅓ carts per day (the number now in use) would collect 217 cart-loads, which at 2¼ cb. yd. each would make 488 cb. yd. Four motor-vans would therefore do the work with 16 cb. yd. to spare.

The most striking point in the statistics is the great difference in the times occupied by the two classes of vehicles in "collecting" and "travelling."



Plan of Edison 2-ton Electric Chassis, as used on Dust van.

The horse and cart spends 2¼ hours per day collecting, and 6¼ hours per day in travelling to the destructor and back again. The motor-van spends an average of 5 hr. 56 min. per day in collecting, and 2 hr. 34 min. per day travelling to and from the destructor, thus reversing altogether the time in which the vehicle is effectively employed in the collection of refuse.

Mr. Tomes arrives at the obvious conclusion that a change of system should be adopted, and motor-vehicles substituted for horse-drawn vehicles for the purpose of house-refuse removal.

The following tabulated data regarding the performance of the Edison van during the week's test may also be of interest:—

Average number of loads per day	5
Total number of loads per week...	30
Average number of miles per day	22·65
Total number of miles per week...	113·5
Average energy per day	22·15 units.
Total energy per week	126·9 ,,
Number of fillers (two days only, 2)	3
Total time collecting	35 hr. 40 min.
Total time journeys to and from destructor and tipping...	14 hr. 30 min.
Average time collecting per day (less Saturday)	6 hr. 16 min.
Average time on journeys per day (less Saturday)	2 hr. 38 min.

Electric Horse Ambulance by the Commercial Truck Co., New York (see page 328).

Rather more detailed but unofficial figures regarding another week's test of the same Edison van at Croydon are as follows:—

Total mileage	163
Average mileage per day	27
Total loads collected	32
Average loads collected per day	5·3
Average number of loaders	7·3
,, time of loading	49½ min.
,, ,, unloading	10 min.
,, ,, working day	10 hr.
,, mileage from destructor	4·2
,, stops per journey	37
,, time of boost of current per day (not imperative)	50 min.
Total weight carried	70 tons 13 cwt.
Average weight per day	11 tons 15 cwt.
Total current used	159 units.
Cost per mile	1d.
Weather conditions	Very wet.
Road conditions...	Muddy and soft.
Number of horses replaced	Nearly 3 per day.
Loaders' time averaged	40 hr. per week.

Loaders employed on road-sweeping, balance of time.

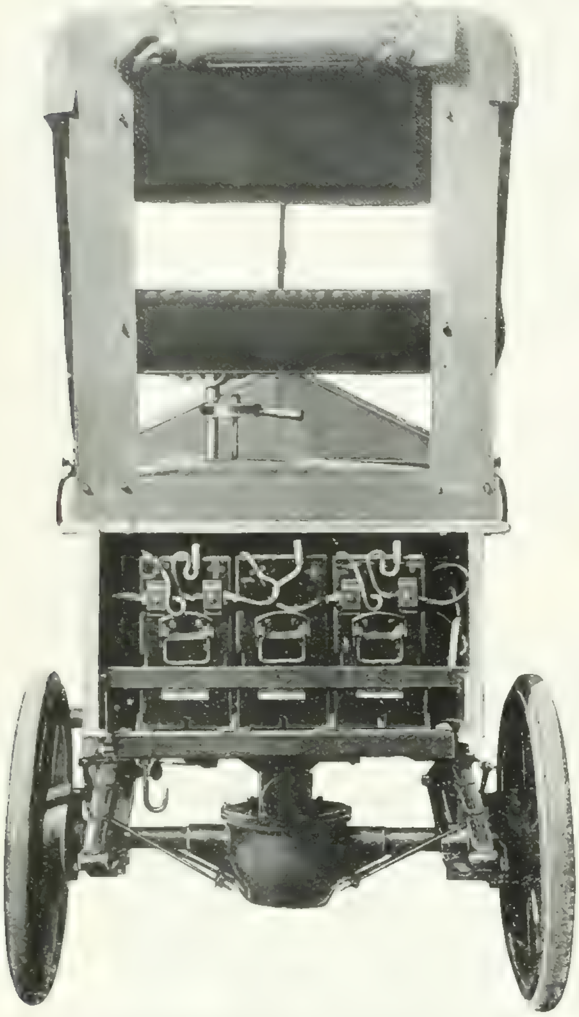
We understand that the Croydon Municipal Authorities are giving careful consideration to these results with a view to employing several 3-ton vehicles.

In the case of Sheffield, unofficial figures for a trial extending over a day and night show that during the day three experimental trips were made, 6 ton 3 cwt. being carried a distance of 19½ miles, on 22 units, while at night five similar trips were made between 11.30 p.m. and 6.20 a.m., the time occupied on each journey (out and home) being roughly one hour. Some 10 ton 14 cwt. was carried a distance of 10½ miles on 12 units. The standard 2-ton Edison tipping van, to which reference has been made, is equipped with 60 A-8 type Edison cells, for operating a single enclosed type motor (72 volts, 40 amp., 900 r.p.m.), which has a flexible shaft drive on to a differential counter shaft, and roller chain drives connecting each end of the latter to sprockets on the rear wheels.

The flexible shaft drive is a feature of the vehicle, the shaft consisting of a flat spring tempered-steel blade, which is self-aligning and exercises a cushioning action which tends to save the vehicle from undue stress while at work and increases its efficiency.

The accumulator can be housed in a compartment below the driver's seat and on the top of the chassis, this position having advantages in the matter of accessibility under some conditions and offering good protection to the battery.

The controller is of the continuous-torque drum type, giving five forward and two reverse speed positions with a positive stop between forward and reverse; it is placed under a hood in front of the dash where it is accessible for inspection. Ball and roller bearings are fitted to the wheels, motor, differential, &c. The vehicle is provided with a safety switch operated by a driver's key, also with a Sangamo ampere-hour meter, reading the input to the battery when charging, thus giving a ready check on bills for power.



Rear view, Voltacar 5-cwt. Van, showing Battery (see page 329).

The rated travel of the vehicle on one charge is 40 miles fully loaded and the speed under good conditions, 11 to 12 miles an hour. The dust-van is fitted with a sheet-steel body provided with automatic tipping gear. This is an electrically operated device put into action by a simple reversing switch. A small electric motor gives the body a direct thrust backwards through the medium of a reduction gear and square threaded screw of ample proportion.

The body is provided with rollers, which run on a steel runner path of special profile, such that when the body is pushed backwards, a tilting motion is also given to it. This arrangement possesses the advantage that the bodywork is stable in all positions, whilst the centre of gravity travels almost horizontally; thus the amount of energy used for tipping, and the time taken for the process, are greatly reduced as compared with other mechanical methods in use for effecting this action.

We are able to illustrate, on page 326, a Baker electrical tipping van of the type tried at Barnes. This vehicle is equipped with 42 Exide ironclad cells carried in a cradle slung under the chassis frame. A single series-wound motor is fitted and drives through a Renold silent chain to the counter shaft, while two roller chains couple the latter to the rear wheels. Timken roller bearings are fitted in the front and rear wheels, and roller bearings on the motor and counter shaft. The working mileage per charge is about 40.

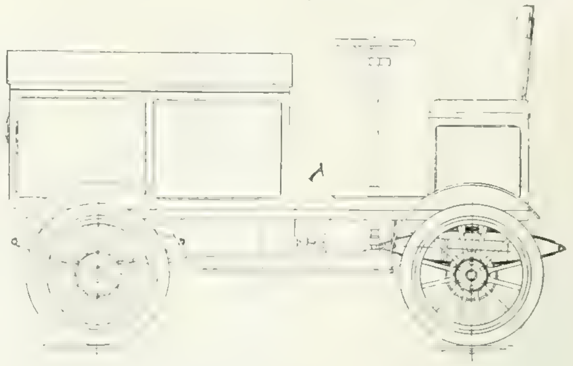
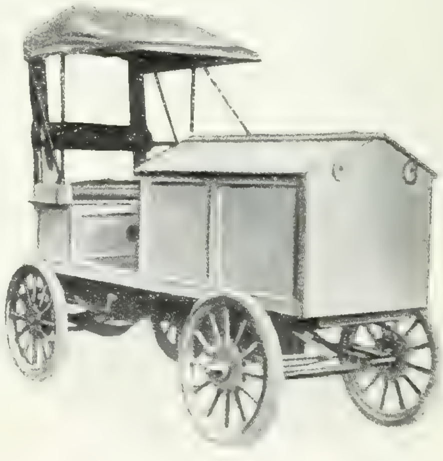


Diagram of the Voltacar Delivery Van (see page 329).

An Electric Motor Ambulance for Horses.

Notwithstanding the great increase in the use of automobiles, it is estimated that no less than 15,000 horses died in New York last year, of which over 1,000 were taken from the streets for treatment in veterinary establishments. The removal of dead horses from the streets is attended to by the New York Department of Health; the care of sick horses devolves upon the veterinarians of the city, while emergency relief is undertaken by the American Society for the Prevention of Cruelty to Animals, which was started about 40 years ago, and which maintains horse hospitals in Manhattan and Brooklyn. The present ambulance equipment consists of seven vehicles, five of which are horse-drawn, one is of the petrol-electric type—but is to be converted to an electric vehicle—while the latest, which was put into service last spring, is an electric vehicle built on a two-ton chassis by the Commercial Truck Co., of New York. As will be seen from the illustration (page 327) of the ambulance, for which we are indebted to the *Edison Monthly*, the rear axle is dropped in order to enable the floor of the vehicle to be brought close to the ground. For convenience in handling sick horses, the vehicle is provided with an additional bottom board or stretcher which can be rolled down the inclined tailboard to the street. The horse is strapped to this, and then, by means of an electrically-operated winch and cable, is hauled into the vehicle. The battery of accumulators is carried in a compartment below and behind the driver's seat, and the vehicle is driven by motors mounted on the front axle. The vehicle has a maximum speed of 14 miles per hour, and has covered a distance of 40 miles on a single charge. So far its longest emergency call required a round trip of 32 miles. It is during the hot summer months and in the winter when the streets are covered with ice, that the ambulances of the Society



The Voltacar Electric Tradesman's Van (see page 329).

are busiest. As many as 55 calls have been answered in a single day, while frequently there are 30 or more.

Edison Vehicle Progress.

It may be of some interest to our readers to know that Messrs. Edison Accumulators, Ltd., have had orders placed for 36 vehicles during the present year. These include 18 half-ton delivery vans for Messrs. Harrods; also vans for the Wilts United Dairies and Hovis, Ltd., and a truck for Messrs. Hadfields.

For municipal service the Liverpool Corporation has ordered a 2-ton van, and the Glasgow Corporation ½-ton, 1½-ton, and 3-ton vehicles; while, we understand, that the Edinburgh Corporation is also obtaining a 30-cwt. van.

Following the lead of South Shields in regard to Edison battery 'buses, four similar vehicles have been ordered by the West Bromwich Council, and an equal number by the York Corporation; the Loughborough Motor Omnibus Co. has ordered one 'bus with the option of taking three more this year.

As previously mentioned, the Barnes Council has also decided to purchase four Edison electric dust-vans with automatic tipping bodies.

Light Electric Delivery Van.

A vehicle, which has been named the "Voltacar," has lately been introduced by the Cyco-Lectric Co., of 1,790 Broadway, New York. It carries 5 cwt., and is intended to meet the requirements of small tradesmen and others having need for some means of making frequent and rapid deliveries within a restricted area.

The mechanical portion of the chassis is of simple design. The electric motor, taking 40 amperes at 28 volts, is mounted centrally in the pressed steel frame, and drives the back axle through a longitudinal propeller shaft and overhead worm gear. A universal joint is introduced between the shaft of the motor and the propeller shaft, the latter being also provided with a sliding joint at its rear end.

The necessary current is supplied by a battery of 12 lead or 24 Edison cells, the capacity being stated to be sufficient for a run of from 35 to 50 miles on one charge at a speed of 15 miles per hour. In order to provide sufficient traction whether the vehicle be empty or loaded, the accumulators are carried in a receptacle above the back axle, this receptacle also forming the driver's seat.

Owing to the employment of a low-voltage battery, the individual machine with single battery would be unduly expensive; for this reason purchasers are being given an opportunity of purchasing two extra batteries with the machine, so that all three can be charged at the same time with maximum economy; furthermore, the user will always have a battery in reserve ready for emergency service needs.

The controller, the lever of which is mounted below the horizontal steering wheel, works in a notched quadrant plate, so that there is no danger of accidental reversal of the machine. The mechanical details have been worked out with great care, one example of the up-to-date design being seen in the front steering road wheels, the hubs being made concave so that the steering pivots fall in the vertical plane of the wheel centres, so greatly reducing the wear on the tires. The usual brakes, operated by a pedal, are fitted to drums connected with the hubs of the rear wheels.

The vehicle has a wheel base of 5 ft. 8 in., and a track of only 3 ft. 4 in., so that it can be stored in a relatively small shed. The body, which has a volume capacity of about 24 cb. ft., is provided with lift-up doors at either side.

A feature of the vehicle which will appeal to the tradesmen for whom it is intended is its relatively low price, £117, complete with battery. As a means of popularising the new vehicle, an original scheme of contract service has also been devised, by which a tradesman can buy a vehicle without the battery at a proportionately reduced cost, while the battery and all service will be supplied by the company. This work will include the exchange of the discharged battery for a fresh one once a day, or oftener if required, maintenance of the car in first class condition, including the replacement of all parts from whatever cause, and also the tires and repainting of the vehicle once a year. For this service a flat rate of 9s. 4d. per day will be charged. A further project of hiring out the vans with uniformed drivers at a flat rate of 16s. 8d. per day is also in contemplation.

A second type of van has been developed by the Cyco-Lectric Co., with the driver's seat at the front—the battery being below it—and a van body behind, with a capacity of about 50 cb. ft.

CITY NOTES.

(*Continued from page* 324.)

South Metropolitan Electric Light and Power Co., Ltd.

Mr. H. St. John Winkworth presided on Monday, at Winchester House, E.C., over the annual meeting. He first referred to the war, and stated that 24 per cent. of the staff had joined the forces of the Crown, which was the limit the company could spare, bearing in mind its serious responsibilities. The company had agreed to reinstate the men at the end of the war, and in the meantime to make up the difference between the Army and Navy pay and the full salary or wages each man was receiving. Notwithstanding the war, the progress of new business had been fully maintained. Five hundred and eighty new consumers and 41,277 lamps (equal to 1,179 kw.) were connected during the year. The latter figure, however, included an addition of about 9,000 lamps (35-watt) made as the result of an inspection during the year of the large power installations, which revealed the fact that additional motors had been connected without notice to the company, the whole of which might not have been added during the year. Indeed, some might have been added during the previous year, and some even before that. The recount brought their installation particulars up to date. Apart from this, the growth of new connections within the year had created a new record, and was well above the average of the last three years. Turning to the revenue account, however, as might be expected in the abnormal conditions of the last five months of the year, the increase in the revenue had not kept pace with the increased business obtained, due to restricted lighting, a general desire to economise, and reduced demands for certain classes of power. The factory load was also affected in the earlier part of the year by a dispute in the building trade. The total units sold amounted to 6,695,481, as compared with 6,662,842 last year, an increase of .5 per cent. Although considerable additions were made to the connections for power, the factory load fell off by about 165,000 units, which was a little more than made good by increased sales for lighting, heating and cooking, and the average price realised was a trifle higher in consequence. The receipts at £62,068 showed an increase of £970; rental of meters and apparatus on hire was about £200 more, and the total receipts amounted to £66,791, an increase of £1,157. On the other side, there was a saving in the cost of coal of £890, which was very gratifying, especially in view of the adverse conditions of the last few months; wages were about £322 up, and there was also an increase of £246 in the management salaries, part of which was due to the special payments which they were making to those who had joined the colours. Insurances were a little more, due to the cost of insurance against damage to the works and revenue through aerial craft, and development expenses were about £200 more, as after the commencement of the war the transactions in the sales of fittings, etc., which up to that time had again shown an improvement over the previous year, began to fall off. During the months of August, September, and October new business was very difficult to obtain. The total sales in the showrooms for the year amounted to £8,150, as compared with £10,050, and the number of transactions was therefore reduced to about 3,750 as compared with 4,180 in the previous year. There had been an improvement of late, and the returns for the last two months had been about the same as for the corresponding period of last year. The total expenditure amounted to £[illegible], and showed a decrease of £[illegible] as compared with the previous year, and the net revenue amounted to £[illegible], an increase of about £1,500 for the year, which was very satisfactory in the circumstances. The general manager estimated that the loss of net revenue through the war amounted to about £4,000, which meant that they should have had an increase of at least £5,000 in the net profit for the year in normal conditions. The earnings of the company for the past year, after providing for debenture interest and dividend on the preference shares, amounted to a little over £[illegible]. As the provisions of the debenture trust deed would require the company to set aside to a special reserve fund for depreciation, etc., about £15,371 for the past year, if any dividend were paid on the ordinary shares there would not remain out of the profits of the year a sufficient sum available for such dividend. In these circumstances, and in view of the [illegible] [illegible] to the war, the directors considered, and he was sure the shareholders would agree, that the best interests of the company would be served by strengthening the financial position at the present time. The business of the West Kent Co. was being actively developed, and the net revenue for the past year showed a satisfactory profit upon the capital employed. Further important orders for power and light had been secured, which guaranteed a gross revenue of nearly £10,000 for the present year, and a minimum of over £20,000 a year from January 1st, 1916. The greater part of these demands would be supplied from the South Metropolitan Co.'s power house. E.H.T. mains were now being laid to afford the supply, which were expected to be completed about the middle of this month. He was pleased to say the West Kent undertaking was becoming an important and valuable property, and as the South Metropolitan Co. held practically all the shares of the West Kent Co., whose powers were held in perpetuity, it would benefit materially by its profitable development. It was very difficult to give any forecast of the future in the present disturbed state of affairs, but the progress of new business continued, the number of orders obtained up to date being about the same as for the corresponding period of last year, while the factory load for the month of January of this year was practically the same as for January of last year, and the meters at the works recorded an increased output. On the other hand, they were having some difficulty in connection with the delivery of coal. The contracts were made at reasonable prices to satisfy their requirements until the middle of next year, but it was difficult to obtain proper deliveries. Moreover, the quality of the coal, as frequently happened in times of shortage, was not up to the proper standard. They were providing for part of their requirements by the use of coke breeze, and every effort was being made to keep the generating costs at as low a figure as possible. In conclusion, the Chairman referred to the loyal services of the staff, to whom he considered the thanks of the company were greatly due.

Mr. H. W. Bowden (engineer-in-chief), in seconding the motion, said that notwithstanding the year under review being an abnormal one, their costs of generation were again the lowest on record for the company. The last new turbine plant had been largely responsible for the improved results in the generation of energy. The machine was put into commission in May, 1913, and had proved highly satisfactory. The work done during the year by this machine represented 8.37 million units out of a total 9.21 million units generated at the power house, equal to 91 per cent. of the total output. Important work had been carried out during the last few months in their efforts to burn inferior fuel, called "coke breeze." The fuel was of the lowest grade leaving the gas retorts, and could be obtained quite cheaply, owing to the power house adjoining the gas works. After inspecting several boilers on the Continent burning coke breeze successfully, a contract was entered into with the Gas Co. for the supply of breeze, and the apparatus placed on order to make a trial on one boiler. The results obtained (although by no means complete) had justified the trial and the arrangements then made. This was more marked if they had regard to the very high price of fuel at the present time. The boiler on test had been working almost continuously for the past few weeks on coke breeze unassisted by coal, producing practically the full output of the boiler. The saving in fuel was considerable, and if the results could be ensured without additional expense in repairs and attendance their costs of generation should in normal times show a marked improvement when further boilers had been equipped. So far as he was aware, it was the first power house installation in this country where mechanical stokers had been fitted and coke breeze burned successfully for several weeks together unassisted by coal without letting the fires down. He had on several occasions emphasised the importance of securing low generating costs, owing to the increasing demand made for power at very low rates. He ventured to think they had in a measure been successful in their recognition of this fact and thanks were due to the power house staff for the assiduous attention given in their endeavours to obtain this end, resulting in a reduced coal bill of approximately £900 for practically the same output as the preceding year. With regard to the distribution department, the usual extensions of mains had been made during the year. Considerable extensions were in progress for this year in order to meet the demands of the West Kent Co. Work had been started on the laying of cables for a distance of approximately nine miles, which should be completed by the end of next month. The efficiency of distribution had been slightly affected, partly on account of the power units being down and partly owing to these units being more widely distributed to additional power consumers, *i.e.*, the factories, within the immediate neighbourhood of the power house have not been so fully employed; and perhaps also owing to the restricted lighting.

Efficiency of distribution.—76.92, compared to 78.71 last year.
Output of feeders.—8.7 millions, compared to 8.46 millions.
Units sold.—6.69 millions, compared to 6.66 millions.
Maximum load.—4,200, compared to 4,700.
Coal costs.—0.30d., compared to 0.34d.
Works costs.—0.49d., compared to 0.53d.
Total costs.—0.85d., compared to 0.87d.

There was a reduction of 0.04d. in the coal costs, enabling the company to maintain second place for lowest generating costs of London supply companies so far as results were at present published.

Mr. Hughes asked if the amount which had to be paid under the debenture trust deed was cumulative. In other words, how much profit would the company require to make in a year before they could declare a dividend.

The Chairman said the amount to be set aside under the debenture trust deed varied according to the capital expenditure. Last year it was £14,700, and this year £15,374.

Mr. Joyce Thomas alluded to the fact that during the ten years he had held shares he had received but one dividend of 2½ per cent. He asked for some explanation regarding the issue expenses of capital.

Mr. Horace Boot asked if the company was to attain its silver or golden wedding before the shareholders received a dividend. Personally, he could see no dividend in sight until the debenture interest was out of the way. When the fresh capital was raised he strongly criticised the arrangement, and it really looked as if some of the shareholders were not fools, and foresaw what would happen. With regard to Mr. Bowden's statement, he would like to know the price at which he bought the coke breeze, because he himself went very fully into the question in regard to some big works. At that time the coke breeze was offered at 6s. a ton, and recently the price had gone up to 8s. 0½d. Mr. Bowden spoke of the same output with the coke breeze, but his experience of using it and trying to get the same output was that it meant reducing the life of the boiler by one half. They did not want that, for the future of the company rested on the capital expenditure being kept as low as possible.

The Chairman said the preference shares issued were issued to the shareholders, who were given a commission of 1s. for each share subscribed. But for the war there was no doubt but that year they would have had an improvement of £5,000 in net profits, which would have meant that they would have £20,000 available after providing for the debenture and preference share requirements, and would have enabled them to provide a reasonable dividend. The new business obtained last year had at any rate been fully equal to the average business obtained during the past three years, and they had large new business coming, as he had told them, and therefore in normal times they should be able to pay the ordinary shareholders quite a satisfactory dividend. Indeed, he believed they would be able to give the ordinary shareholder such a return as would repay him for the long years he had waited. He had every confidence in the inherent soundness of the undertaking, in the large undeveloped area, and also in the prospects of the West Kent Co., whose powers were held in perpetuity.

The report was then adopted.

Warrants for dividends, payable March 1st on the 7 per cent. cum. first preference shares and 6 per cent. cum. second preference shares, have been posted.

South Staffordshire Tramways Co., Ltd. — The accounts for 1914 show an available sum, including £603 brought forward, of £3,728. A dividend of 3½ per cent. on the preference shares is recommended, leaving £843 to carry forward.

City of Carlisle Electric Tramways Co., Ltd.—The gross revenue in 1914 was £10,311. After providing for repairs, maintenance, &c., debenture and loan interest, and appropriating £1,000 to reserve for redemption of second debentures, the credit balance of £33 brought forward was increased to £586.

Aberdeen Suburban Tramways Co. — The half-yearly meeting was held on Friday, when the directors' report and balance-sheet were adopted.

Manila Electric Railroad and Lighting Corporation.—The directors have declared a quarterly dividend of 1½ per cent. for the quarter ending March 31st.

Mansfield and District Tramways, Ltd.—The directors, after placing £1,400 to depreciation reserve and £1,000 to renewals fund, recommend a dividend of 6 per cent. on the ordinary shares for 1914, carrying forward £1,535.

John Spencer & Sons, Ltd.—An interim dividend at the rate of 5 per cent. for the half-year ended December last is recommended.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent., for the three months ending March 31st, on the 6 per cent. cumulative preference shares.

Metropolitan Electric Supply Co., Ltd.—Dividend on the ordinary shares for the last half of 1914, at the rate of 3 per cent. per annum, making 3½ per cent. for the year, compared with 4½ per cent. a year ago.

Mather & Platt, Ltd.

Sir William Mather presided at the annual meeting, held on February 26th, at the works at Manchester. Comparing the results of the business during 1914, he said that in his opinion they were very satisfactory. A dividend of 10 per cent. on the ordinary shares plus a bonus of 2½ per cent. free of income tax had been declared. In arriving at their statement of profit during the past year, the directors had thought it prudent to first secure the business against unforeseen contingencies that might arise in consequence of the unprecedented situation created by the sudden change from long years of peace to a state of war on a colossal scale. They, therefore, decided not to add to the already large reserve fund, but to carry forward a larger sum than ever before—£66,838. The directors did not anticipate a revival of active business with the countries engaged in war to any great extent during the war. The firm had contracts booked with such countries, but would be unable to execute them until after the war. Meantime, their works were fairly well employed and they had undertaken certain contracts which the Government placed with well-equipped firms. It was a popular delusion that Government contracts were exceedingly profitable. Such contracts had to be completed under tremendous pressure, and it was the duty of contractors on patriotic grounds to make every effort, regardless of cost, to supply the Government with what they needed; by strain and stress and all possible overtime the work had to be done to meet the demands. Another consideration which would affect the profits of most industrial concerns during the war was the indisputable fact that the cost of food had risen, and might still rise, to a price that would sensibly affect the workpeople of the country by seriously diminishing the purchasing value of wages. This was a grave question which employers and all concerned with industrial undertakings should meet sympathetically and patriotically with the desire to lighten the burdens of their workpeople. The working classes, being most numerous, furnished most of the fighting men. Their families would feel most acutely the pinch of excessively dear food. It was not right to ask sacrifices of them for the common weal greater than those which all other classes made according to their means. Charitable relief of the working classes was least effective and most demoralising. The greatest help that could be given to workpeople was to provide them with work at a living wage, adjusted to the cost of living frugally and carefully with self-denial and self-restraint on their part during the war. It seemed to him that company directors and shareholders should frankly face the facts affecting the people's food supply. Large dividends during war times should not be a primary consideration with them. They should first try to provide as much work as possible at wages that would enable workmen to reasonably nourish themselves and their families, having due regard to the avoidance of waste and self-indulgence. Business profits earned under those principles might be small, but shareholders ought to bear the sacrifice of part of their dividends as their contribution towards the relief of the universal suffering which the war had caused. Strenuous efforts should be made to keep the industries of the country alive during the war. Violent trade disputes on account of wages amounted to high treason at such a time. The war would pass all the sooner if those concerned in the industries of the country held well together, and after the war a long, lasting peace, with great prosperity, would repay them for the sacrifices they had now to make in order to secure the victory.

Northampton Electric Light and Power Co., Ltd.

The annual meeting was held at Northampton on the 25th ult. Mr. F. H. Thornton, J.P., presided, and said that the year had been one of continued success and progress. The company had sold nearly £2,000 worth more current than in the previous year, an increase of 8¼ per cent. In units the increase was 15 per cent. in power and 8 per cent. in current sold for lighting. They had done that with an increase of only £100 in the cost of coal. That was due to the fact that they had the advantage of the new turbine of 1,800 H.P., which was put in last year, and also to the fact that they bought their coal during the year at a decreased price of 6d. per ton. The company had experienced a great increase in the amount of current sold for cooking, which might be attributed to the fact that they were now letting out cooking stoves at 5s. per quarter, and people found that cooking by electricity was as cheap, if not cheaper, than any other form and much pleasanter. They had also had an increase in the current sold for heating, the new type bar radiator giving a very much better heat than the old type. On cold days there was a very appreciable increase in the quantity of current sold for heating. Those two things were most satisfactory, for they showed that people in the town were realising the possibilities of electricity for domestic purposes. They anticipated that they would go on in the future with as much success as in the past. The undertaking had developed in a way they never anticipated eight years ago. They did not anticipate that the cost of coal would increase very materially, and they had very favourable contracts for the ensuing year. Although they had had difficulty in getting coal along the railway, because of it being taken up for military purposes, they had been able to get an ample supply in consequence of the Government considering their undertaking to be a valuable concern in helping the boot industry, which was carrying out big Army contracts. The amount put to the reserve fund was £250 more than last year, but it was the right thing to be on the safe side in that respect. The year had been a strenuous one, but the staff had worked with as much keenness as if the undertaking had been their own. The great difficulty had been to obtain material to carry out orders, with which they were inundated owing to Admiralty contracts.

Mr. W. Tomes seconded. He said the great strides which had been made by the company could be seen by the way in which the mains had been extended throughout the town. They were already supplying one of the suburbs, and they might look for an increased custom in that direction.

Fife Tramway, Light and Power Co., Ltd.

Presiding at the annual meeting, held in Edinburgh, Mr. William Low said that the earnings from the Dunfermline and District Tramways Co. during the year, paid over to the company by way of dividends and management fees, amounted to £15,250, compared with £15,020 for the preceding year, and £12,200 for the year 1912. Keeping in view the abnormal conditions since the beginning of August last, shareholders were to be congratulated that this department had done so well. The growth of traffic continued steadily during the first seven months of the year, and at the end of July the earnings were over £1,000 in excess of the corresponding period for the previous year, due to some extent to the opening of an additional line. Notwithstanding the diminution in receipts during the latter part of the year, the tramways revenue was still slightly greater than for any previous year. The company had statutory powers for the construction of a tramway to Rosyth Naval Base and Inverkeithing. These powers expired in July next, and the directors had made application for an extension of time for construction, and for the laying of a connecting line along the North Queensferry Road. Turning to the power and lighting business, the Chairman said the revenue from the Fife Electric Power Co. and the electric light undertakings received by this company as dividends and management fees, amounted to £11,276, as compared with £8,561 for the preceding year—an increase of nearly £3,000. The increase in profits, although very satisfactory, would have been greater had normal conditions prevailed throughout the whole year. The additional generating plant at Townhill power station was installed during the year, and the capacity of the station was thereby nearly doubled. A coal conveyor gear was now being installed and would be complete in a week or two. The economy in coal-handling would largely compensate for any abnormal price of coal during the current year. The transmission lines and mains had also been extended during the year, increasing the number of prospective consumers brought within immediate reach of the company's supply. With reference to the current year, notwithstanding the disturbed condition of affairs the directors had every confidence that the earnings would be maintained, and even possibly increased. The earnings of the power company up to date this year were in excess of the corresponding period of last year, but it was somewhat difficult to forecast the earnings of the tramway company. The directors, however, felt confident that the combined properties would produce a result at least equal to that of last year. They had additional debenture powers of approximately £170,000. In the past their directors had taken care of extensions by the issue of ordinary and preference shares, without encroaching, except to a minor degree, on the borrowing powers of the company, which were in reserve for extensions in future.

Mr. George Balfour, in seconding the resolution, pointed out that the power company, without further expenditure, apart from expendture on incidental auxiliary plant and extensions to cables, was now in a position to sell an amount of electricity largely in excess of the present demand.

The report was adopted.

Rushden and District Electric Supply Co., Ltd.

The annual meeting was held at Northampton on February 25th. Mr. F. H. Thornton, J.P., presided, and in the absence of the Secretary (Mr H. St. John Browne), who is away on active service, the duties of secretary were discharged by Mr. E. M. Browne. The Chairman said that for the first year's working the accounts were most satisfactory. There was a small net profit of £6 3s. 8d., and, considering they had nothing to start with, it was creditable to have a profit instead of a loss. The number of customers at the end of the year was 79, and since then it had gone up to 85. The quantity of current sold in the first quarter was £69, in the second £68, in the third £100, while for the Christmas quarter the receipts from the sale of current were £217. They might now look forward to going on upon a paying basis, as people were constantly being connected up. It was an extremely satisfactory thing that they sold so much current for motive power. At first people were a little shy of taking it, but one manufacturer who had just had his factory connected with the mains at once asked if he could buy some shares. That showed how satisfied he was. At the end of the year the number of lamps was 5,561, and they had since added about 1,000. The company was lucky in having oil as its chief fuel, as it was more easily obtainable along the railway at the present time than coal.

Mr. Clark seconded

Liverpool Overhead Railway Co.

The annual meeting was held on February 23rd at Liverpool, Mr. H. C. Woodward presiding.

The Chairman said that the war had monopolised their thoughts and affected every industrial and trading enterprise, and especially the working of the great system of railways. Their system was placed under the care of the Railway Executive Committee, but that body did not interfere with the actual working and management in detail of the various railways beyond what military necessities might require. The plan involved the pooling of all net receipts, with the intention that those railways that showed an increased net revenue owing to the war, should contribute out of the excess to recoup, to a certain extent, those companies that suffered by diminished traffic. Consequently, as their revenue had increased, they had to pay over a certain amount, not yet exactly ascertained; but seeing that they already had an increase in the first half-year, they were practically guaranteed that they should be in no worse position than in the previous year; and on the whole he thought it was a fair arrangement, and was agreed to by all the great railway concerns. This plan, of course, affected the form of the accounts. They had carried during the past year, on railway and tramway, exclusive of season-ticket holders, a total of 13,361,944 passengers, being an increase of 178,623 over 1913, and nearly 1,200,000 over 1912, and it was the greatest number carried since the railway was opened for traffic. This represented an increase of 5 per cent. in their first-class and 1 per cent. in third-class, but a decrease in the "workmen" class of 3 per cent. The general increase was partly due to the presence in the spring of the new Cunard liner *Aquitania* in the Gladstone Dock, which proved a great attraction, while the encampment of troops at Seaforth, Waterloo, and Crosby materially helped their tramway traffic in the early autumn. After paying preference dividend they recommended a further dividend on the ordinary shares at the rate of 3½ per cent. per annum (making 3 per cent. for the year). The ordinary dividend was the same as for 1913. The total expenditure on railway and tramways amounted to £56,845, being an increase of £1,369. This was partly accounted for by an increase in wages and extra cost of coal. Out of their employés 42 had joined His Majesty's Forces, which was equivalent to about 12 per cent. of the whole of the staff, and this made them rather short-handed in some departments. It gave him great pleasure again to testify to the good conduct of the men and the ability and energy of the general manager (Mr. E. J. Neachell) and his principal assistants, while he could not pretend that their modest dividend of 3 per cent. on the ordinary stock was entirely satisfactory to the shareholders in these days of high prices, yet, looking to the reports and dividends of other railways throughout the Kingdom, he thought they must be thankful that they were able to come through so strenuous a year without any reduction of dividend, and with increased reserves.

Mr. G. D. Killey seconded, and the motion was carried.

London Electric Supply Corporation, Ltd.

Mr. R. H. Benson presided on February 25th, at Winchester House, E.C., over the annual meeting. He said that the Board felt very well satisfied with the latest year's addition to the figures, and this happy result had been accomplished simply by minding their business. Special thanks were due to the officials, beginning with Mr. Bain and Mr. Partridge, and including not merely the seniors in the department but also those juniors who had not enlisted, and who were just as useful to their country in this instance by staying at home and cheerfully doing what their hand found to do. The figures established new records in units sold, in cost of generation, and both in net and gross receipts. The gross receipts showed a rise of over £28,000, and the net had increased from £71,753 to £92,234—an increase of no less than £20,481. This in such a year was a result on which the board felt they had the right to congratulate themselves. But for the war the net revenue would have been even higher, for he need not tell them that the rise in the price of coal in the later months had affected their expenses, whilst the darkening of London at night had diminished the demand for light. The results financially justified the policy they had pursued now for a good many years of developing, and directing their chief efforts to, power supply. They had always believed that by generating current on a sufficient scale they could sell it as cheaply as any similar company in the world and make profits besides, and they claimed to have done both. They recommended a dividend on the ordinary stock of 4 per cent. instead of 3 per cent. as last year. This, he was aware, might be considered by some shareholders as ultra-conservative, but the conditions were exceptional. The war and the doubt of its duration overshadowed everything, and it affected capital as well as revenue. They could not tell what coal was going to cost them, and therefore they had got to husband their resources until the situation became clearer. Also they had got to face the situation, the solution of which was becoming more necessary, viz., that of their overspent capital account, which now amounted to over £137,000. They would remember that as long as Lord Wantage was alive he provided the money the company needed for additional plant to meet the expansion of the business, and alone shouldered other people's burdens, but since his death they had had to rely on themselves. Year by year he had had to point out that as the period of their tenure decreased as 1931 approached, so did the amount of the sinking fund increase, which was needed to extinguish fresh issues of capital. For instance, the sinking fund for the redemption of the debenture stock by 1931 demanded in cash £12,000 a year out of revenue, in addition to the sums receivable annually from their good friends and neighbours, the Westminster and St. James's Companies. This year out of surplus revenue they had allocated £7,000 to contingencies account and £10,000 to reserve, and they further increased the carry forward from £5,097 to £8,828. That was a measure of conservation prescribed by the necessities of the situation caused by the expansion of their business during wartime. He would like to draw attention to the fact that, concurrently with the large increase in the number of units sold—no less than 11,000,000—they would notice that the total generating cost per unit sold had fallen from .62d. to .5d. That was, of course, partly the direct result of the larger output, but it could not have been achieved if they had not in their engineers and staff an altogether exceptional combination of ability, zeal and goodwill, and it was a great pleasure once more to give full testimony to what the Board and the shareholders owed to those on whom the practical working of the business depended. This figure of ½d. for the cost per unit sold was actually by far the lowest reached in London, and as Mr. Bain pointed out last year, even in Chicago, where the great company sold 1,250 million units per annum, against their 46 millions, it did not equal them. So far as their company was concerned therefore, their figures demonstrated that in the area which they served London was not suffering from any lack of a cheap supply of power. That bogey, which had furnished a popular excuse for yearly attacks on the statutory terms on which electrical enterprise was undertaken, was now he hoped finally laid to rest. There was no longer any excuse for outsiders to try and get in between the County Council and the 13 companies and blandish the public with illusory promises of cheaper power. When the war was over it was to be hoped the parties interested would get together, and either under the Act of 1908, or further powers, would "associate," to use the words of the Act, to combine their plant, and so get the utmost economy in generation. For the present, the London County Council had dropped their Bill, and the ten companies, who also had a Bill, had in deference to a suggestion of the Chairman of Committees, also dropped theirs. Therefore, he need not discuss the vexed question of private enterprise compared with municipal enterprise, especially as he did so at some length last year. But he wanted to draw public attention to the solution which had lately been reached for a similar problem, after four years of violent disputes, in one of the larger and most progressive cities in America. The municipality of Kansas City had granted to the Tramway and Lighting Co., a new franchise for 30 years after or during which the undertaking was purchaseable at an agreed fixed price of 5,130 thousand dollars, plus proved capital expenditure during that period, and in the meantime, the municipality was to receive two-thirds of the net revenue remaining after providing certain capital expenditure and 6 per cent. upon the purchase price. In other words, the company got 6 per cent. upon the agreed valuation, plus one-third of the profits, and this profit-sharing of the municipality was a better bargain for the municipality than their fixed rate. America was a great country of experiment and they dashed into all sorts of things—some successful and some unsuccessful. They might in this country do worse than copy their successful experiments. It was 14 years since Lord Wantage presided over that meeting, and, although he did not live to get a dividend, yet his courage never wavered, and he had the satisfaction before his death of seeing the company in comparatively smooth waters after its costly pioneering in the effort to give the public of London a supply of electric light and power. He had told them how Lord Wantage furnished money on easy terms whenever the company needed it and they would remember that whereas their ordinary share capital was originally £555,000, they wrote off £2 of the £5 shares and reduced it to £333,000, and in that reduction Lord Wantage was the chief sufferer. In 1901, the year after his death, the total capital was £914,700, and the net revenue was £25,220. Last year the capital was £1,291,555, and the net revenue was £93,234. In other words in these 14 years their capital had increased by 41 per cent., while their net revenue had increased by 269 per cent. He need say no more to give them confidence in the company and in its ability to work out its own destiny. He did not mean to say that they could expect such a ratio of increase of net revenue this year. On the contrary, during the wartime, all companies seemed to be expecting a set-back, chiefly because of the price of coal and the diminution of lighting; but he wanted them to realise the steady progress made year by year for 14 years by the fact that net revenue had increased compared with capitalisation by 6½ to one.

Mr. R. Stewart Bain, the managing director, seconded the motion and gave as usual some interesting particulars regarding the year's work. He said the capital expenditure had amounted to £34,956, the greater portion of which had been incurred for the new 10,000-kw. turbo-generator ordered in connection with the extension of the electrification of the Brighton Railway. That plant was to have been delivered last November, but owing to the war, delivery had not yet taken place, although they were informed by the manufacturers that it was nearing completion. In addition, £8,600 was expended in laying several miles of new mains, particularly in connection with the supply of power for industrial purposes, which he was glad to say was extending very satisfactorily, bringing the total of mains laid to 207 miles. The expenditure was £6,861 more than last year, of which coal accounted for £5,600. As against that they sold over 11 million units more than in 1913, the consumption of coal being 73,000 tons, as compared with 62,000 for the previous year. The average price paid for coal during the year was 14s. 1d. per ton, as against 15s. 2d. in 1913, but the extra cost during the last five months of the year had added nearly 1s. a ton over the whole year. Since the beginning of this year, the price of coal had increased very materially, owing to the difficulty in getting delivery by water. During the last two months the charge for freight alone had been more than the total contract price for the delivery of the coal alongside their wharf. It had been quite an anxious time getting deliveries sufficient for their consumption. He was glad to say that up to the present they had been able to overcome those difficulties without unduly depleting their stock, although the difficulties and the price of coal were daily increasing. The gross revenue showed an increase of £28,000 over the previous year. The average price received for every unit sold—lighting and power—was .94d., as compared with 1.04d. in 1913, while the cost of production had been reduced from .62d. to a halfpenny. Their executive and technical staff had every reason to feel proud of such excellent results and they were a fine tribute to their efficiency and zeal. As far as that company was concerned, it could not be said that the district which they supplied was suffering from the want of a cheap supply of electric power, and it was doubtful whether unification of the system of supply, or amalgamations of the companies, although beneficial in other respects, would show such good results. The results compared favourably with those of any company, either in this country or abroad. Traction and power supplies again showed satisfactory increases, although the large increase of power for the extension of the electrification of the Brighton Railway, which was to have commenced this month, had had to be postponed on account of the war. In common with other companies, a considerable number of their staff had joined the colours, and in such cases the directors had agreed to keep their places open and to give them half-pay while they were absent.

Replying to questions, the Chairman said that they always made their coal contracts in the spring when, as a rule, the lowest prices were ruling, but *force majeure* had superseded all contracts. Nobody regretted more than the directors that they had not been able to pay a larger dividend, but they had only acted prudently in carrying forward £3,000 more than last year.

The report was adopted.

Westminster Electric Supply Corporation, Ltd.

Mr. J. Browne Martin presided on February 24th, at the offices, over the annual meeting. After referring to the death of Lord Suffield, the Chairman said that they had recommended a reduced dividend for the half-year. It would have been possible to pay the full 10 per cent., but this would have left them with a much smaller sum to carry forward; they could not recommend that course in view of the present situation, for the war had not only reduced receipts, but it had also increased expenses, and might possibly do so still more. The Government lighting regulations considerably reduced the sales for lighting during the last quarter of the year. Coal had increased in cost and was still going up. Carbons for street lighting cost much more than they did. They had also had to spend money on the protection of their stations. Then over 60 of their officials and men were serving with the colours, and they had promised to pay their wives or dependents half wages during the war, and to keep their places open. These half wages amounted to over £3,000 a year, which had necessitated some readjustment of duties. They had also thought it right to subscribe to the war funds. This would show them that they had had a good deal to contend with, and it was for the shareholders to judge how far they had been successful. They had not increased their charges for supply, they had maintained their full rate of depreciation, and they had only reduced the dividend for the year by one per cent. Had it not been that everyone belonging to the company had put his shoulder to the wheel such a result would have been impossible, and he was sure they would desire him to thank the staff and workmen, who were just as anxious for the success of the company as were the shareholders and directors. Their stations were watched day and night by special constables—gentlemen who had given up their time for the country, and who were patrolling outside in all sorts of weather. It was extremely tiring and monotonous work, and they would, he was sure, wish to show by a hearty vote of thanks their appreciation of what they were doing. In regard to the valuation of their investments, there was the choice of valuing them at three dates:—Dec. 31st, 1913, as the insurance companies were doing with the approval of the Board of Trade; the end of July, 1914, as the banks had done; or December 31st, 1914. The latter date would give no result of any practical value. A date just before the war would have been possible, but credit was then beginning to be shaken, and they thought that as their investments were not intended for sale it was better to follow the insurance companies. The auditors had approved of this. They had increased their investments by taking up £25,000 of the war loan. In regard to the future, the supply of coal continued to cause anxiety. Deliveries were uncertain and irregular, and prices had gone up considerably. Both electric and gas companies had represented to the Government the difficulty they were in, and something had been done lately to improve matters. But they thought it should be possible to obtain a regular supply at a reasonable rate, and felt there was room for some improvement in both these points, an improvement which only the Government could ensure as they controlled communications. With regard to carbons for street lighting, no reduction in price could be expected for some time to come, and they would have to wait until new factories could be established of sufficient output to bring down the price more nearly to that at which they had hitherto been sold by the big factories in Germany. Their expenses, therefore, were not likely to decrease during the war. Their receipts would also be reduced so long as the present lighting arrangements were necessary. The greater part of the loss was due to reduced shop lighting, but this, he was pleased to say, would not be so heavy in the summer as in the winter. They would probably have seen in the newspapers that the L.C.C. produced yet another Bill to absorb them all, but this Bill had been dropped. They also, with nine other companies, joined in promoting a Bill for forming a company to take over and utilise to the best advantage the existing resources of the companies supplying electricity in London, with a view to providing eventually one uniform system of supply. The Government had, however, decided that this Bill was contentious, and therefore could not proceed. It had consequently been withdrawn, and he need not trouble them with details.

The Rt. Hon. W. Hayes Fisher, M.P., seconded the motion.

In reply to questions raised, the Chairman said the present Bill of the L.C.C. was dropped, but he could not say that it was dropped for good. As to their company and other companies substituting another Bill for the one which the Government considered contentious, he could only say there was nothing in hand at the present time, but it was only commonsense that when ten companies came together to amalgamate for a certain purpose there should be no difficulty in getting them together again if the opportunity offered. He thought something of the kind would have to be done or otherwise the County Council would certainly interfere. They wanted an extension of life as well as amalgamation.

Mr. W. J. Fisher remarked that he had read the company's Bill carefully and he certainly saw a number of contentious points in it. If the companies, however, came together with a reasonable desire to effect consolidation that Bill might form a good basis to go on, with the contentious points eliminated.

Replying to a question by Mr. Reed as to coal, Professor Kennedy said that in the last half-year of 1914 their coal for the station at Westminster was only about 8d. a ton more than in the last half of 1913, but during the last six weeks there was an increase of something like 3s. a ton, and at Grove Road, from which they got the greater part of the supply, the increase had been on the average very considerably greater. They were adopting the policy of getting all the coal they could, and they had no reason to be anxious, but undoubtedly the prices now and in the future would be much greater. It was merely a question of getting the coals up from the collieries. The Government had put some ships at the service of the gas and electric companies, but they had hardly become useful yet, and they had to pay freights which were very high.

The report was adopted.

Tramways, Light and Power Co., Ltd.

Viscount Chilston presided over the second ordinary meeting held at 66, Queen Street, E.C., on February 25th. He said that the outbreak of the war in August had had varying effects in different localities. In some of the districts served by certain subsidiary undertakings the abnormal conditions had created an improved demand which, while not in time to reflect substantially for the year under review, would undoubtedly be an advantage for the current year. In other districts the abnormal conditions had an adverse effect, causing depression in trade, which affected the electric supply companies, and especially deterred prospective consumers from incurring any expenditure on motors and other appliances. Further, the public naturally took less advantage, since the outbreak of the war, of the facilities for travelling offered by the traction undertakings, owing to the depression. The adverse conditions affected more particularly the districts served by the Nottingham and Derbyshire Tramways Co. and the Derbyshire and Nottingham Electric Power Co. The conditions improved in the localities referred to, and since the close of the year they had evidence of a distinct recovery. The various power and light companies were large users of coal, and it was satisfactory to report that the largest user, viz., the Derbyshire and Nottinghamshire Electric Power Co., had contracted well forward at satisfactory prices. But the high price of fuel would probably operate to a certain extent to the advantage of electric supply companies, because power users, and particularly small power users, would more carefully consider the use of electricity at a time when the price of coal was high. It was satisfactory to hear from the London managers, Messrs. Balfour, Beatty, Ltd., that, notwithstanding the difficult conditions of the moment, they anticipated an increase in earnings during the current year from all the properties owned by their company. So far as the year under review was concerned, the directors estimated that the outbreak of war affected the earnings to the extent of at least £5,000. A feature of all the power and light properties was that a large additional revenue could be earned from the money already expended, owing to the fact that the plant installed was sufficient to deal with a very much bigger load than at present connected, and, in addition, the cables laid were capable of serving a large number of additional consumers. The directors recommended an increase in the capital of the company to the extent of £100,000 by the creation of an additional 100,000 six per cent. cumulative preference shares of £1. He might say for the information of the shareholders that notwithstanding the number of undertakings owned by the company, they had managed, owing to the cautious policy adopted, to keep the capital expenditure, including present obligations, to within £50,000 of the amount of the original issue. They would agree that this was a very small sum spread over so many different policies, especially in view of the fact that the power undertakings covered an area of 3,000 square miles. They could, of course, deal with present requirements by issuing a portion of the unissued debentures, but this would hamper their financial arrangements in the future. It was, in their opinion, unwise to use their debenture powers to the maximum unless all development work was completed or could be provided for out of revenue. The directors had not yet decided as to what would be the most opportune time for making the issue, nor the terms. The consent of the Treasury would, of course, be required before the issue was made, but in view of the fact that the development of properties such as theirs was of material importance from the national point of view in the present crisis, not only because they supplied many different kinds of enterprises with the necessary driving power, but also provided employment for workmen, there should be no difficulty experienced in this connection. The immediate object of the capital was to repay temporary loans which had been incurred to the extent of £40,000. The directors had in contemplation the acquisition of an additional property, but shareholders could rest assured that this would only be effected if the financial arrangements were provided for, and a very satisfactory yield on the capital employed was shown. During the year the power and lighting companies had obtained four provisional orders for electric lighting—two in the area of the Derbyshire and Nottinghamshire Co., viz., the Beeston and the Heanor Orders; and two in the area of the Leicestershire and Warwickshire Power Co., viz., the Hinckley and the Kenilworth Orders. Steps had been taken to utilise the powers, and already in some districts consumers were connected.

Mr. A. R. Holland seconded the motion and it was carried.

The Chairman next proposed a resolution authorising the creation of an additional £100,000 of preference shares to rank *pari passu* with the existing shares.

Mr. G. Balfour, in seconding the motion, said that in issuing these shares, rather than taking advantage of their debenture powers, they were following the method successfully adopted by other tramway and electric lighting companies. By keeping their debentures they could meet any emergency in the way of getting additional plant.

The resolution was adopted.

Bruce Peebles & Co., Ltd.

Mr. F. E. Andrews presided at the annual meeting, held at Edinburgh, on Friday last. He said that they maintained their gradual and steady progress in the first half of 1914, and the satisfactory results shown in the accounts for the year would have shown still better improvement over those of 1913 but for the war. Theirs was essentially and entirely a purely British concern, and at the outbreak of hostilities they had not a single German, Austrian, or Hungarian in their employ. More than 150 of their men were serving with the colours, and on their return they would be reinstated in their old or similar positions. The workmen and staff had inaugurated a fund, to which the company was contributing weekly, for assisting dependents where it was required. A large proportion of the men were their best and most skilled, and their absence had of necessity caused a certain amount of difficulty in the ordinary routine of the works and offices, but the loyal efforts of those remaining at home had minimised the dislocation. The output from the works, which up to the end of July had been quite satisfactory, and better than the previous year, was naturally affected for some months afterwards by the loss of so many hands. This was being gradually overcome, though they were still suffering to some extent both from the difficulty in obtaining suitable men and from delays in getting supplies of raw materials. They had fully maintained their reputation as makers of high-class electrical machinery and had obtained a good proportion of orders, so that the works had been fairly well occupied. The prices at which these orders had been obtained had also been more reasonable than was the case two or three years ago, but the margin of profit had naturally been somewhat adversely affected by the events of the latter half of the year. In this country the company continued slowly, but very surely, to enlarge their circle of customers, especially among the better class of buyers, which was a very satisfactory sign. The Peebles-La Cour converter was being adopted by an increasing number of engineers and was also being put down in larger sizes; the largest converter made in Great Britain up to the present time had been installed and was now running at Manchester. They had all along carefully cultivated trade in the Colonies, and the results were quite satisfactory, showing a steadily increasing volume of business, though in Canada conditions had not been favourable during the last twelvemonths. In various foreign countries also financial stringency or political disturbance had militated against new work being taken in hand, especially in the case of South America and China. Taking everything into consideration, however, they had no cause to be dissatisfied, and they started the new year with an amount of work sufficient to keep them well employed for some time ahead. The profit for the year from manufacturing and trading amounted to £11,649, as compared with £11,751 for 1913 and £3,864 for 1912, so that in spite of the disadvantages since August they had managed to maintain the improvement of the previous year. The net profit was £3,892, as against £2,820 a year ago. This sum went to reduce the adverse balance against profit and loss account, which therefore now stood at £17,783. Debts owing by the company were lower, as were also the debts owing to them, the latter being partly due to the fact that they were able to get somewhat better terms of payment from customers. Cash at bank, £29,084, showed an increase that was very gratifying, because a manufacturing concern such as theirs must have adequate working capital in order to carry on its business in a satisfactory manner, and further, it was essential, during the present unsettled state of industry, that the company should build up and conserve its liquid resources in order to tide over any difficult period which might arrive. Each year they spent an appreciable amount of money out of revenue for maintenance of buildings, machinery and plant, but so far they had not been able to make a suitable allowance for depreciation. This question, as well as that of goodwill, which stood in the balance sheet at over £90,000, must obviously have attention and be dealt with as soon as ever opportunity offered. After the last general meeting, Mr. Lee Murray expressed the desire, owing to his other business engagements, to retire from the board. It was scarcely necessary to remind them of the excellent work Mr. Murray did in the organisation of the company during the five years he was with them, first as general manager and afterwards as a director, and they accepted his resignation with regret. They had also lost another colleague, Mr. A. Bruce Anderson. He was an able and enthusiastic worker in the interests of the electrical manufacturing industry, and they all greatly deplored his premature and untimely death. The Chairman referred to the ability and energy of the managers, secretary, and other officials, displayed in a year that had not been without a considerable amount of worry and anxiety.

Mr. C. J. Shiells seconded the adoption of the report, which, after one or two questions had been asked and answered by the Chairman, was carried unanimously, and a hearty vote of thanks was accorded to the chairman, managers, staff, and directors.

British Insulated and Helsby Cables, Ltd.—The directors announce a final dividend, making 15 per cent. for the year, as compared with 13 per cent. for 1913. There is placed to reserve and depreciation £2,000 less than for 1913, but there is an increase of £21,000 in the amount carried forward.

British L.M. Ericsson Manufacturing Co., Ltd.—The directors recommend a dividend of 8 per cent. per annum on the ordinary shares for 1914, placing to reserve £6,000, and carrying forward £7,023.

Reduction of Capital.—Turners & Manville, Ltd., and Reduced.—A petition for confirmation of reduction of capital from £50,000 to £39,994 has been presented. Particulars of claims, &c., must be sent by March 13th to Messrs. Jackson & Co., Lower Gates, Rochdale, solicitors.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The directors recommend a dividend for the year ended January, 1915, at the rate of 8 per cent. per annum, carrying forward £15,012.

Stock Exchange Notice.—The Committee has been asked to allow the following to be quoted:—Electro Bleach and By-Products, Ltd.—90,200 7 per cent. participating preference shares of £1 each, fully paid, Nos. 1 to 90,200.

Western Telegraph Co., Ltd.—Second quarterly interim dividend, 3s. per share for the year ending June, 1915, being at the rate of 6% per annum.

Held Over.—Pressure upon our space compels us to hold over until next week various City reports and meetings.

Davis & Timmins, Ltd.—The net profit for 1914, including £15,083 brought forward, after allowing for depreciation and commission to manager, was £31,959. The interim dividend paid in September last on the preference shares absorbed £1,800; that on the ordinary shares at the rate of 6 per cent. per annum for the June half-year £1,410; there has been placed to general reserve account £3,000, and to income-tax account £626, leaving £25,124. Preference dividend on the 6 per cent. preference shares for the December half-year requires £1,800; a balance dividend at the rate of 10 per cent. per annum on the ordinary shares for the December half-year, making 8 per cent. per annum for the year, requires £2,350; a bonus of 12 per cent. out of profits amounts to £5,640; and £15,334 is to be carried forward. Annual meeting, March 9th.

France.—*The Société d'Electricité de Paris.*—The chairman of the Société d'Electricité de Paris, which is stated to be under the control of the Empain group of Brussels, informed the shareholders at the recent meeting that the sales in 1914 increased by 20,000,000 KW.-hours to 145,000,000 KW.-hours. After deducting depreciation amounting to £128,000 from the gross profits of £259,000, and providing for interest payments on the loans, the accounts indicate net profits of £102,000, which would permit of the distribution of 16s. on the ordinary shares and 26s. 7d. on the preference shares. It is, however, impossible to make these payments at present as the "liquid funds" are said to be locked up in Stock Exchange investments.

Jarrow and District Electric Traction Co., Ltd.—The annual meeting was held on Monday at Electrical Federation Offices, Kingsway, Mr. H. S. Day presiding. In proposing the adoption of the report, of which we gave an abstract last week, the chairman remarked that it was with much satisfaction that the directors were able to recommend the payment of a 3½ per cent. dividend for the past year, as against 2½ per cent. for 1913. The development in Jarrow was very satisfactory, and there was every reason to hope that the business of the company there would continue to be well maintained even if it did not improve. Mr. F. Cocking seconded, and the report was adopted.

Telegraph Construction and Maintenance Co., Ltd.—The directors report that the net profit for 1914 amounted to £109,186, against £114 863, after charging the interest on the debentures. To this is added £111,860 brought forward, making £221,047. An interim dividend of 5 per cent. was paid last July, and the directors recommend a further dividend of 10 per cent., together with a bonus of 12s. per share, free of tax. The reserve fund is to be supplemented by £20,000 (making it £145,000), leaving £111,407 to be carried forward.

City of London Electric Lighting Co., Ltd.—Subject to completion of audit, the directors have decided to place £50,000 to reserve and to pay 12s. per share (being at the full rate of 6 per cent. per annum) on the preference shares, and 18s. per share (being at the rate of 9 per cent. per annum) on the ordinary shares. On account of these shares 6s. per preference share and 6s. per ordinary share was paid in September, 1914. After payment of the dividend, less income-tax, and providing for other appropriations, £23,500 is to be carried forward.

Llanelly and District Electric Lighting and Traction Co., Ltd.—The accounts for 1914 show a net revenue, including £2,079 brought forward, of £12,188. After providing for loan and debenture interest, and setting aside £2,000 for depreciation and renewals, a dividend of 2 per cent. on the ordinary shares is to be paid, leaving £1,718 to carry forward. The annual meeting was held at 66, Queen Street, E.C., on February 25th, Mr. A. H. Beatty presiding. The report was adopted.

New York Telephone Co.—The report for 1914 shows net telephone earnings $16,169,660, a decline of $1,554,491; and other income, $1,869,394, an increase of $163,190. Total, $18,039,054, a decline of $1,091,301. Interest charges have absorbed $4,027,132, an increase of $448,317; while dividends have taken $10,008,579, a decline of $220, leaving balance to surplus and reserves $4,003,343, a decrease of $1,539,398.—*Financial Times.*

W. T. Henley's Telegraph Works Co., Ltd.—Subject to audit the directors recommend a final dividend payable on March 19th on the ordinary shares of 10 per cent. less income-tax, making 15 per cent. for the year, and a bonus of 5s. per share less income-tax. For 1913 the distribution was 20 per cent.

STOCKS AND SHARES.

Tuesday Evening.

Present days are mostly unexciting in Stock Exchange circles. It is as though people had said to themselves that they would do nothing until the war gave indication of further developments. The best news received for some time past was that dealing with the passage of the Dardanelles, which had a distinctly cheering effect upon spirits, but failed to have any effect upon prices. Definite news of the fall of Constantinople would probably have a stimulating effect; but until something of this sort arrives, investment stays its hand.

Each new issue as it appears has to be rather more attractive than its predecessor. The Treasury is putting very little obstacle in the way of new emissions; and any company which can show that it requires capital in order to provide employés with work, especially if directly or indirectly connected with Government contracts, need have little hesitation in applying for powers to raise money. At the same time, the Treasury restrictions upon Stock Exchange dealing continue to be so severe that borrowers delay making appeals to the public until they are obliged to do so.

The Home Railway market is obsessed by the latest labour fears. Through the curt intervention of the Government, immediate difficulties are bridged over; but such an erection will be only temporary, and the whole question will be revived in a more acute form later on. Londoners in particular are inclined to look at the labour agitations as reflecting gravely upon the patriotism of those responsible for the trouble; and the plain man in the street wonders how on earth any compatriot of his can so deliberately throw in his lot with the enemy as to participate in these disturbances before exhausting every conceivable means for settling debateable points peaceably.

Therefore Metropolitans have gone back to 28½, Districts to 17¼, Central London ordinary to 76, while the tone of the market as a whole is drab. Two or three of the big steam stocks are raising more capital, but we have heard no proposals of this sort in connection with the electric lines. As a point of curiosity, it may be mentioned that Metropolitan Consolidated, South Eastern deferred and South Western deferred all stand about the same price, although the dividends recently declared were 1¼, 1, and 1⅝ respectively. Underground Electric income bonds are ex the dividend of £3 per cent.; at the current price of 80, the return on the money is exactly 7½ per cent., paid free of income tax.

The prophets who foretold a reduction of about 1 per cent. in the City of London Electric dividend have proved correct, and the company is now paying 18s. per share—that is, 9 per cent.—against £1 per share, equal to 10 per cent., last year. The County of London maintained its previous dividend, and County preference shares have been a firm market for some time past. Curiously enough, it is difficult to obtain an adequate bid for the ordinary shares. City Lights keep about 14¼, with an occasional bargain transacted in them. The Charing Cross Co. announces that the profits on its City undertaking advanced during the last financial year, but its West End receipts fell off by nearly £10,000. Mild interest is taken in the course of the London Electricity Supply Bill No. 2; as to the chance of its successful passage through the House of Commons, opinion has been already ventured here.

So far, all the electric lighting companies have announced their dividends, with the exception of the Brompton. Summarised, the results are that the St. James' pays 2 per cent. less than it did a year ago, the City of London, the Charing Cross, Metropolitan, and the Westminster 1 per cent. less, Smithfield Markets ½ per cent. less, Kensington, Notting Hill and County the same, and the London 1 per cent. more. All things considered, the achievements may be fairly regarded as good. Prices on the week show small falls in Brompton ordinary, Charing Cross preference, and Westminster preference. St. James' recovered their dividend of 5s., and County preference are also 5s. higher at 11¼.

We append our usual list of representative stocks and shares:—

Home Electricity Companies.

	Mean price. July 27, 1914.	Mar. 2, 1915.	Rise or fall this week.
Brompton Ordinary	9⅛	8¾	— ¼
do. 7 per cent. Pref.	8⅝	8⅜	—
Charing Cross Ordinary	6¼	4½	—
do. do. do. 4½ Pref.	4¾	4	— ⅛
do. do. City Pref.	4¾	4	—
do. 4 Deb.	91½	90	—
Chelsea	4¼	4¾	—
do. 4½ Deb.	96½	92	—
City of London	16	14¼	—
do. do. 6 per cent. Pref... ..	18½	12¾	—
do. do. 5 Deb.	116½	112	—
do. do. 4½ Deb.	100¼	98	—
County of London	12	11	—
do. do. 6 per cent. Pref. ..	12	11¼	+ ¼
do. do. 1st Deb...	102½	99	—
do. do. 2nd Deb.	100½	97	—
Kensington Ordinary	7¾	7¼	—
London Electric	1 7/16	1½	—
do. do. 6 per cent. Pref... ..	6 1/16	6⅛	—
do. do. 4 Deb.	92½	87	—
Metropolitan	8¾	8⅛	—
do. 4½ per cent. Pref.	4 7/16	4	—
do. 4½ Deb...	97½	96	—
do. 3½ Deb...	83	80	—
St. James' and Pall Mall	9⅝	9 xd	+ ½
do. do. do. 7 per cent. Pref.	7	6⅛	—
do. do. do. 3½ Deb.	84½	80	—
South London	8 1/16	8	—
South Metropolitan Pref.	1¾	1⅛	—
Westminster Ordinary	8⅝	8 xd	—
do. 4½ Pref...	5⅛	4¾	— ⅛

Home Rails.

	Mean price. July 27, 1914.	Mar. 2, 1915.	Rise or fall this week.
Central London, Ord. Assented	88	76	—1
Metropolitan	37½	28½	— ½
do. District	21¾	17¼	— ¼
Underground Electric Ordinary ..	2¼	1¾	—
do. "A"	7/6	6/-	—
do. Income	88	79½ xd	— ⅛

TELEGRAPHS AND TELEPHONES.

	Mean price. July 27, 1914.	Mar. 2, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108¼	104 xd	—
do. Def.	23	21⅜ xd	— ⅜
Chile Telephone	7⅜	6⅝	— ⅛
Cuba Sub. Ord.	8½	8½	—
do. Pf.	16½	12¼	—
Eastern Extension	12⅞	12¾	—
do. 4 Deb.	97½	92 xd	—
Eastern Tel. Ord.	130½	127	
do. 3½ Pf.	77½	73	+1
do. 4 Deb.	96½	94	—
Globe Tel. and T. Ord.	11¼	10¾	—
do. Pf.	12⅝	11⅛	— ¼
Gt. Northern Tel.	32½	28	—
Indo-European	59	51	—4
Marconi	1 13/16	1⅝	—
New York Tel. 4½	101	97	—
Oriental Telephone Ord.	2 5/32	2	—
do. Pf.	1 7/32	1 3/16	—
Tel. Egypt Deb.	98	88½	—
United R. Plate Tel.	6⅜	6	—
do. Pf.	5¼	5	—
West India and Pan.	1¼	1 5/16	—
Western Telegraph	13⅜	13	—
do. 4 Deb.	96½	95½	—

FOREIGN TRAMS, &c.

	Mean price. July 27, 1914.	Mar. 2, 1915.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅞	4¼	+ ⅛
do. 2nd Pf.	4¼	4	—
do. 4 Deb.	91	84	—
do. 4½ Deb.	98½	93	—
do. 5 Deb.	96	88	—
Brazil Tractions	66	51	+1½
Bombay Electric Pf.	11⅜	10⅜ xd	—
do. 4½ Deb.	96	91	—
Mexico Trams	70	85	—
do. 5 per cent. Bonds	84	60	—
do. 6 per cent. Bonds	76	40	—10
Adelaide Sup. 6 per cent. Pf.	5¼	5⅛ xd	+ 1/16
do. 5 Deb.	104	103	+1

MANUFACTURING COMPANIES.

	Mean price. July 27, 1914.	Mar. 2, 1915.	Rise or fall this week.
British Westinghouse Pref.	1¾	1 15/16	—
do. 4 Deb.	74½	72	—
do. 6 p. lien	102½	99	+ ½
Callenders	11⅞	11¾	—
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2½	3 3/16	— 1/16
Edison & Swan, £3 pd.	3/32	11/6	—
do. do. fully paid	1¼	2	—
do. do. 4 Deb.	59	60	—
do. do. 2 Deb.	63½	60	—
Electric Construction	15/32	13/-	—
do. do. Pf.	1/16	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	14	—
do. 4½ Pref.	5	5	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	8¾	+ ¼
Telegraph Con.	38½	37	—

In the foreign group, Anglo-Argentine Trams 1st preference recovered to 4¼, so wiping out their loss of last week. Brazil Tractions at 51 are 1½ higher, on improvement in the Rio exchange. Mexico Trams are a dull and weak market. The 6 per cent. 2nd bonds at 40 are nominally 10 points lower, though what a holder would get, if he wished to sell at the present time, it is difficult to say. The company has just notified that it has no alternative but to defer payment of interest on its bonds in consequence of the action of the Mexican "Government" (inverted commas are ours). Representations have been made to the Government and the United States Government on behalf of the company. Adelaide Supply Debenture stock is better at 103. The Manila Electric Railroad has declared its usual dividend of 1½ per cent. for the quarter ended March 31st last.

The Telegraph Construction Co. maintains its dividend of 20 per cent. free of tax, in spite of a small falling-off in the nett profit for the year; actually, the difference in the disposable balance is the bagatelle of £500, while the reserve fund has been again strengthened by the addition of £20,000. Shares changed hands to-day (Tuesday) at 36⅝ and 37¼. British Westinghouse 4 per cent. debenture stock is changing hands on the basis of 72; and a fairly active market is established in British Aluminium ordinary at 24s. Castner-Kellners have gone back a trifle to 3 3-16. India Rubber shares at 8¾ are 5s. higher, on an enquiry which found no floating supply of shares.

The Telegraph market is very quiet. The feature is a sharp fall in Indo-European shares, which dropped to 51 on the appearance of a small seller. Previously the price had been supposed to stand at 55. Chili Telephones keep dull, and a further fall of ⅛ has occurred. Anglo-American Telegraph deferred eased off ⅜, most securities connected with the United States being somewhat depressed in consequence of the strained international situation. It will be noticed that we have deleted Constantinople Telephones from our list, for the simple reason that there is no market in the shares at the present juncture and that any sort of a quotation at all is at the moment merely guesswork.

War or no war, Henley's profits flow the same way as Tennyson's brook. In declaring a final dividend of 10 per cent. for 1914, with a bonus of 5s. per share, the directors repeat the previous distribution, which was 5 per cent. better than the dividend declared first in 1903, and paid regularly up to 1912 inclusive. In twelve years, therefore, the ordinary shareholders have received 190 per cent.; and if we include one year earlier, when the distribution was also 20 per cent., they will have got their capital back more than twice over in the space of thirteen years—a remarkable achievement for any industrial concern. The company celebrates its thirty-fifth birthday this year. In 1902, just before reduction of the dividend, the £5 shares rose to 19; the lowest they have been since is 9½, in 1905, while in the war crisis of last autumn they never fell below 13. At the present price of 14, the return on the money is 7½ per cent., allowing for the dividend now included in the price.

The principal feature in the raw rubber market is the practical wiping out of the premium on the Pará product, plantation and wild rubber being now virtually the same price. Since the removal of the Government's embargo upon imports of rubber, as it related to the United States, stocks have shown a decided disposition to decrease; and as trade conditions become more and more normal in America, so will the demand for rubber expand, while Japan is also taking substantial quantities. The share market is quiet and steady, without exceptional movements. The armament group improved on the news from the Dardanelles. In which connection, it may be remarked that the outstanding feature is a rise to 15s. in the one shilling shares of the Projectile (1902) Co. Before war broke out, they were about eighteenpence apiece, and almost as unsaleable then as they are difficult to buy now.

MARKET QUOTATIONS.

OWING to the war, the prices given below are, of course, more or less nominal.

Wednesday, March 3rd.

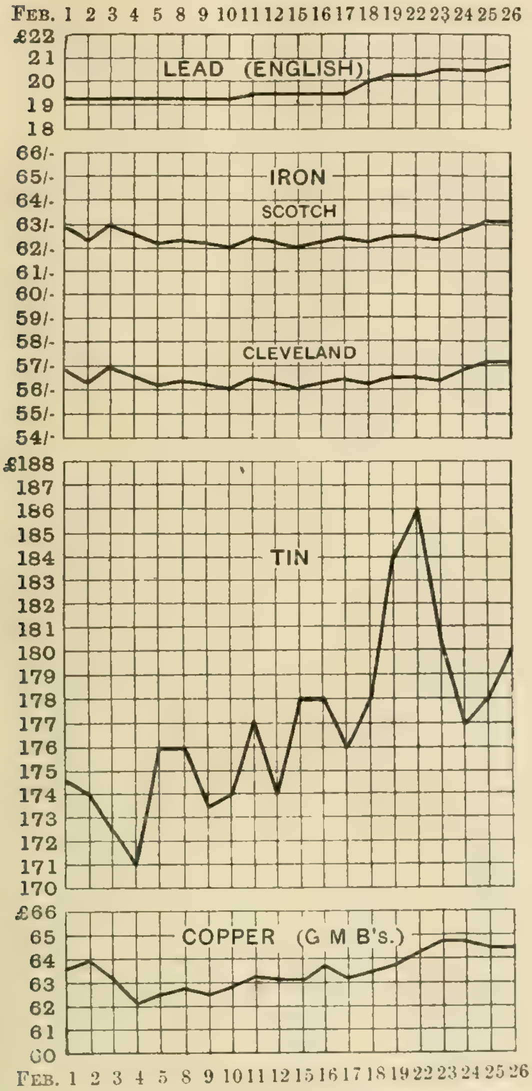
CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a " Nitric	"	19/-	..
a " Oxalic	per lb.	8d.	..
a " Sulphuric	per cwt.	5/-	..
a Ammoniac Sal	"	£49	..
a Ammonia, Muriate (large crystal)	per ton	£49	..
a Bleaching powder	"	£8 10	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£18 10	..
a Copper Sulphate	"	£27 10	£1 10 inc.
a Lead, Nitrate	"	£35	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	6d.	..
a Potash, Caustic (88/90 %)	per ton	..	..
a " Chlorate	per lb.	1/4	..
a " Perchlorate	"	1/-	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£5 10	..
a Sulphur, Sublimed Flowers	"	£11 10	..
a " Recovered	"	£8	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %)	"	£10 2 6	..
a " Chlorate	per lb.	8½d.	..
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	3½d.	..
METALS, &c.			
Aluminium Ingots, in ton lots	per ton	£85	..
" Wire, in ton lots (1 to 14 S.W.G.)	"	£112	..
b " Sheet, in ton lots	"	£112	..
p Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9¼d.	½d. inc.
c " Tube (brazed)	"	10½d.	½d. inc.
c " " (solid drawn)	"	10d.	½d. inc.
c " Wire, basis	"	9½d.	½d. inc.
c Copper Tubes (brazed)	"	11½d.	½d. inc.
c " " (solid drawn)	"	11½d.	½d. inc.
g " Bars (best selected)	per ton	£86	£2 inc.
g " Sheet	"	£86	£2 inc.
g " Rod	"	£86	£2 inc.
d " (Electrolytic) Bars	"	£70	£1 5 inc.
d " " Sheets	"	£88	£1 5 inc.
d " " Rods	"	£76	£1 5 inc.
d " " H.C. Wire	per lb.	9⅜d.	3/16 inc.
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	1/8	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/5	1d. dec.
j Iron Pig (Cleveland warrants)	per ton	56/10	8d. inc.
l " Wire, galv. No. 8, P.O. qual.	"	£17	£1 inc.
g Lead, English Pig	"	£20 10 to £20 15	20/- to 25/- in.
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£12 10 to £12 15	5/- to 10/- in.
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e " " " medium	"	3/- to 5/-	..
e " " " large	"	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/2 to 1/3½	½d. inc.
p " " rolled strip & sheet	"	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£70	..
g Tin, Block (English)	"	£176 to £180	..
n " Wire, Nos. 1 to 16	per lb.	2/5	1d. inc.
p White Anti-friction Metals	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

METAL MARKET.

Fluctuations in February.



Soldering Aluminium.—The last New Zealand mail brings some brief particulars of a new process of soldering aluminium, which has been devised by Mr. W. Overend, a partner of Mr. H. Grinlinton, a cycle importer and manufacturer, of Auckland. It is stated that by the process aluminium can be soldered not only to itself, but also to any other metal, including cast-iron and steel, and also to carbon. It is added that the Auckland Tramways Co. has given Mr. Overend an opportunity of applying his process, and that the New Zealand Government has placed an experimental order for 100 aluminium terminals soldered direct on to carbons.

Foreign Concessions in Norway.—It is reported from Christiania that the Council of State has adopted a Bill in regard to waterfalls, mines and other land property, which proposes the introduction of considerably more severe conditions with respect to the grant of concessions, particularly to foreigners, than those contained in the law of September 18th, 1909. In the case of waterfalls, a distinction is drawn between Norwegian companies and companies with foreign capital. Under the Bill the latter are to receive a concession in future only under special circumstances; and the greatest caution is to be exercised in this respect. The maximum period of a concession is to be reduced to 60 years, although in an exceptional case it may be prolonged to 70 years with the consent of the Storthing. On the expiration of the concession the power station and machinery and accessories, together with the workmen's dwellings, are to pass into the possession of the State free of charge. It would, however, be possible for the State in the first place to purchase the undertaking forming the concession at the end of 40 years, or for the local authorities concerned to do so in the event of the State taking no action in the matter. The Bill further provides for the headquarters of the company to be located in Norway, and for the majority of the shareholders to be Norwegian subjects. It is stated that if the Bill were passed by the Storthing, foreign capital would probably no longer come into consideration in connection with waterfalls in Norway, and the regulations proposed for the latter would also apply to mines, &c.

TRAINING FOR THE INDUSTRIAL SIDE OF ENGINEERING.

By A. P. M. FLEMING, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Manchester, February 23rd,* 1915.)

In the manufacture of engineering apparatus keen competition has directed increased attention to every factor affecting economic production. Labour is one of the most important of these factors, and the object of this paper is to discuss the requirements of training for the various grades of employment in the manufacturing industry and the lines on which such training can most effectively be carried out. In this country, while a great deal of attention has been paid to the training of the technically-educated man, comparatively little has been done to provide the best possible training for youths who are to become skilled workmen.

The grades of employment to be considered may be divided into two classes, namely, those of a non-technical character, and those for which technical training is essential.

Preparation for "non-technical" positions, in so far as it is made at all in this country, is by means of "trade" apprenticeship, for which youths enter works straight from school at the age of from 14 to 16, and are "bound" to a trade until the age of 21. For the "technical" positions many works provide a special practical course, which may be termed "engineering" apprenticeship, the purpose of which is to afford a broad experience in manufacturing processes and methods rather than a high degree of manual skill.

To secure the greatest gain, both to the individual firm and to the industry as a whole, it is important to aim at training each youth so as to develop to the utmost his latent ability, and to prepare him most expeditiously for the position for which his education and ability fit him. While it is important to provide facilities for the able youth to rise from the ranks to a technical position, it is an error to assume that every trade apprentice is capable of so doing and to direct educational efforts solely to that end. The majority of such apprentices will work at the bench all their lives, and their training should consequently be such as to fit them for this sphere.

NON-TECHNICAL EMPLOYMENT.

The ordinary workmen comprise three main classes: (a) the craftsman or skilled workman, (b) the specialist, and (c) the unskilled labourer.

The craftsman and specialist require quite different knowledge and characteristics. The former needs to concentrate considerable thought upon his work, to possess initiative, delicacy of touch, co-ordination between hand and eye in a marked degree, a knowledge of drawing, a thorough experience of his craft, and a sufficient general knowledge to appreciate the importance and function of his efforts in the whole series of operations bringing about the conversion of raw material to the finished product.

The specialist, on the other hand, mainly requires manual skill in a single operation, or dexterity in operating a machine-tool, and the ability to carry out repetition work continuously without diminution in productive capacity.

Sub-division and specialisation in methods of manufacture, and the introduction of machine tools, enable many processes to be carried out by the specialist which originally required the employment of a craftsman, with the result that employers have found it advantageous to exploit juvenile labour on a limited range of work rather than train it for the future supply of skilled workmen and for the ultimate benefit of the industry.

While the problem of devising some satisfactory means for determining the vocational fitness of a youth is engaging considerable attention, the efforts hitherto applied appear to have resulted in very little practical benefit to the engineering trades. In this connection teachers who are in daily contact with youths in the elementary schools could render much assistance by observing those likely to be suited for skilled handicrafts. If observation is supported by a first-hand knowledge on the part of the teacher of the requirements of the trade and of its scope and possibilities, a latent desire for such a vocation might be developed and fostered in the student.

In a number of institutions, recognised by the Board of Education as Junior Technical Schools, pre-apprenticeship training is provided. This includes some bench-work in metals and wood, and instruction in drawing and elementary engineering theory. The courses thus provided are excellent in their way, but the facilities provided by these schools for teaching youths how to become skilled workmen are insufficient for the requirements of the industry. There is need for the provision in every industrial centre of accommodation for a sufficient number of youths to supply local engineering works, and means for affording suitable preparatory education.

Under present conditions the chance of a youth entering a skilled trade for which his vocational fitness is adapted is small, and that organised efforts are necessary to ensure the proper selection of youths. No vocation offers such possibilities of secure employment coupled with unlimited opportunities of advancement, as that of the engineering trades, and it is is advisable to direct to such a vocation the youth possessing the soundest character, best physique, and greatest intelligence.

Under modern conditions a great deal of the apprenticeship period is liable to be inefficiently utilised, and even in those works where special efforts are made to teach manual operations correctly, there is a great deal of trade knowledge of importance to an apprentice which he is unable to obtain readily in the shops.

Suitable training comprises two phases, namely, practical experience in the processes and materials pertaining to the craft, and trade instruction, *i.e.*, a knowledge of the principles underlying the methods and processes employed and of such applications of science as bear on the trade. The former can only be acquired satisfactorily in the shops, provided the apprentice is not looked upon merely as a producing unit and that systematic means are taken to teach him the manual operations of his craft. Trade instruction can best be dealt with quite separately on the lines suggested later.

In most engineering works no special facilities are provided for practical training, and an apprentice has usually to pick up such experience as he can in a more or less haphazard fashion. In some works instructors are employed, and in others a separate training shop is provided. An example in this country is the training shop for instrument makers provided in Mr. Robert Paul's works in London.

The instruction that an apprentice receives during his period of training should be directed primarily to bear on his trade. In most industrial centres, however, the only instruction available is that afforded by evening technical classes, and this, while providing an excellent means by which the ambitious youth can fit himself for technical employment, is usually of little or no assistance to the youth who is to be a workman all his life. Moreover, in most firms it is not compulsory for an apprentice to pursue a course of evening instruction.

In the case of youths who have had suitable pre-apprenticeship education, instruction should comprise the processes applying to the trades and the principles underlying them; the names, description, preparation and uses of the tools and appliances; how to read drawings and diagrams; the physical properties of the materials employed; the cost of the apparatus produced in the trade; the importance of avoiding waste of time, effort, and materials, and the function of the apparatus or parts manufactured.

It is important that the instruction be so imparted as to stimulate the youth's ambition to attain higher skill, to take pride in his work, and to develop his latent powers of dexterity in workmanship to the utmost. Such trade teaching can be imparted by oral and written means; and this method possesses the important effect of developing a youth's ability to acquire knowledge from other sources than his own personal experience.

In Germany vocational training is made an important feature of compulsory continuation education. Youths are permitted to leave school at the age of 14, but must continue with their education for about eight hours per week throughout the period of apprenticeship, for the most part during working hours. At Munich, around which there are a number of comparatively small industrial works, separate classes are arranged for the youths of each trade, and apart from the continuation of general education, both practical and theoretical instruction is given in the trade by skilled workmen and special instructors. In the larger industries in Northern Germany it is more usual for an apprentice school to be provided in each works, or collectively for several works; such schools are recognised by the State, and their students are exempted from compulsory continuation school studies.

Apprenticeship in engineering trades extends over a period of four years, and at the end of this time an apprentice is required to present himself before a committee of experts who examine his knowledge of the trade, and to whom he has to submit a specimen of his workmanship. Successful apprentices secure a master's certificate, and an employer is not allowed to have apprentices unless their training is supervised by one of his staff who possesses this certificate.

The importance and number of apprentice schools attached to individual works is increasing considerably, and the results obtained appear to be in every way satisfactory.

In Switzerland, continuation education of youths embodying trade instruction is carried out on a plan similar to that in Germany.

A typical example of complete apprentice training carried out entirely in school, is that of the Skiensfjorden's Mechanical School at Porsgrund, Norway. Here about 160 youths are given trade instruction and practical training during a 3-year course, part of each day being spent in class and part in school workshops. The results are said to be eminently satisfactory.

In France and the United States there is as yet no national scheme for the vocational training of juvenile workers, although much has been done in this direction by individual employers in various industries. In some of the trade schools youths attend classes on alternate weeks, and in this way disorganisation and loss due to stoppage of machine tools is avoided. Apprentice schools have been established in many of the large engineering works.

In companies such as the Westinghouse and General Electric, most of the practical experience is gained in a special training shop. In the former company a youth spends about six months in the training shop learning the use of one particular tool or process, and then proceeds to the main shop, where he does similar work under commercial conditions. He subsequently returns to the apprentice school and learns the use of another tool or process, and so on till the end of his apprenticeship. Throughout this time he attends class instruction during a certain number of hours per week.

In the General Electric Company the apprentice spends all his time of training either in class or in the training shop. In the latter he is moved progressively from machine to machine, his proficiency being gauged by when he is able efficiently to "break in" the youth who succeeds him. A 4-year period of apprenticeship is becoming customary in the largest works.

During the past few years considerable interest has been taken in the development of the apprentice-school method of training, and most of the large works in every kind of industry are adopting this plan.

In the various industrial countries that have been considered, the combination of practical training either in works or in special training shops and of trade teaching in class is that most favoured for the training of workmen. The apprentice school attached to works represents the simplest and most efficient means of applying this principle. Apprentices work in the shops under commercial conditions for a part of each day, and attend school during certain of the working hours. This method of training affords the most flexible means of dealing with special features peculiar to individual works. The close supervision possible in an apprenticeship school enables those apprentices deserving of promotion to be readily selected. In this way the interest of the remainder is increased, and a spirit of emulation is aroused.

The apprentice-school method of instruction has been adopted by the British Westinghouse Company. Instruction averaging about five hours per week is given during working hours to all "bound" apprentices, numbering altogether about 300, in a school situated in the works. The regular rate of wages is paid during the time spent in study, and all the cost of books and stationery is borne by the firm. The teaching is done by twelve members of the firm's engineering staff, supplemented by lectures from the leading foremen and shop engineers, which deal specially with the trade subjects. The contact between the foremen and apprentices in the school produces excellent results, and removes the diffidence which many of the apprentices feel in approaching the foremen with their difficulties. Where it is required to illustrate special processes or describe particular apparatus, which cannot readily be done in the school by lantern projection or drawings, practical demonstrations are given in the works.

The most promising of the apprentices are selected for work in the testing departments and drawing office, and in other respects are allowed a wider range of work than that covered by their own trade. Each year about ten apprentices are selected as a result of their school work and shop progress, and sent for one whole day each week to the course for engineering apprentices at the Manchester Municipal School of Technology. The cost of tuition, books, etc., is borne by the firm, and no deduction is made from wages during the time spent at the school. Such youths are marked for advancement in the company's service as suitable opportunities occur.

Through their work in the school the interest of the foremen is aroused, and as a result increased attention is paid by them in the shops to the practical training of apprentices.

This apprentice school has only been in operation for about a year, but so far the results both from the point of the company of of the apprentices are most encouraging.

While the primary function of the apprentice school is to prepare youths to become good workmen, its secondary object is to enable a selection to be made of promising youths for promotion to positions where they can be more advantageously employed, as, for instance, charge hands, foremen, and inspectors. In addition to such positions, the apprentice school affords a ready means of selecting apprentices who can profit by technical training and rise to higher posts. The provision of a channel whereby an apprentice can rise from non-technical to technical employment is a most desirable feature, and should be given every encouragement.

Technical Employment.

A technically-trained engineer who enters a manufacturer's works and intends to remain in that branch of the industry requires quite different training from that of one who ultimately expects to take up, for example, civil engineering, operating work, or the broader scope met with in colonial engineering.

The various kinds of technical employment in engineering manufacture are as follows:—

(1) The works side, including such positions as works and departmental managers, shop engineers, leading foremen, assistants in the inspection, testing, estimating, and drafting departments.

(2) Designers.
(3) Commercial engineers.

The works side affords an increasing scope for technically-trained men possessing a bent for organisation, and in whom can be developed the capacity for handling labour and directing manufacturing processes. Such young men, after serving an apprenticeship, should take up junior positions in the works, where they can acquire the further experience and knowledge necessary for economic production.

At the present time most young men on leaving a technical school have a knowledge only of the field of employment offered by design and commercial work, and fail entirely to recognise the importance and possibilities of executive positions in the works. Added to this, there is a feeling that the works and office staffs are of quite a different status—an idea that needs to be vigorously dispelled.

The possibilities of effecting economies in the shops justify the employment there of young men of the best intelligence available in a manufacturing organisation. In this connection there is a growing tendency in large works—and one of which full advantage has been taken on the Continent—to employ shop engineers, whose function it is to supervise technical details and processes, to follow up new designs throughout the various stages of manufacture, to investigate troubles and hitches wherever they occur, to devise economic methods of manufacture, and where necessary to alter existing designs so as to enable the most economic and up-to-date methods of manufacture to be employed. Shop engineers require good technical training, suitable shop practice, and drawing-office experience.

Apart from these positions, important vacancies in the estimating department should be filled by technically-trained men who have an intelligent understanding of works processes. Such men are in a position to detect leakages and determine where economies in working can be effected, which are likely to be overlooked if ordinary clerical labour is employed. In the testing department the leading men should also have good technical training. This department is the backbone of the designing office, and scientifically-trained intelligence there is invaluable.

For the design branch, scientific training is indispensable, and a great many technically-trained students look to it for their future employment. It is not sufficiently realised that for such work thorough practical experience in the shops, including an intimate knowledge of manufacturing costs and processes, is invaluable. Works experience is essential in developing the intuitive capacity which seems to be a particularly marked characteristic of British engineers, and too much attention cannot be paid to this phase of training.

The need for really well-trained engineers for the commercial side is becoming more and more appreciated by manufacturers. Sound technical knowledge and a considerable amount of practical training are indispensable, especially in the many-sided electrical industry.

Of the various plans of training for technical positions, the following are those most common:—

(*a*) By a trade apprenticeship combined with evening or part-time study. This method is particularly applicable to manufacturing.

(*b*) By a short period in works, then a college course, followed by works apprenticeship. This plan is recommended by the Institution of Civil Engineers.

(*c*) By taking a complete college and then a works course.

(*d*) By sandwiching college and works training in varying periods.

(*e*) By taking a complete works apprenticeship prior to the technical training. This is not a satisfactory method for training for technical positions in manufacturing.

Of these plans, (*a*), (*b*) and (*c*) are most suitable from the manufacturer's point of view; but whichever method is adopted, it is desirable that the practical training should terminate in the works, since a better opportunity is afforded to the student for obtaining permanent employment with the firm in which he has obtained his training. It is also most important that the entire training be preceded by thoroughly sound general education.

There is a wide diversity of opinion as to how long a period of practical training a technically-educated young man should have, and what its nature should be. Some firms adhere to the 5-year apprenticeship scheme as applying to all young men, whether they are being trained as workmen or for technical positions, but the more modern tendency is to arrange a shortened course for the latter. While long practical experience is excellent, it is not the most effective method of attaining the end in view. Moreover, a man who has had his intelligence developed by a technical-college course should be able to acquire practical experience at a much quicker rate than one not so educated. The object is to afford an insight into manufacturing methods and economics, and to acquire a knowledge of how to handle men.

In addition to the arrangements for training "trades" apprentices already described, the British Westinghouse Company has for the past twelve years trained "engineering" apprentices according to certain well-defined courses.

Young men of the age of 20 and upwards, who have had a thorough scientific training at a University and possess an Honours engineering degree or are in other respects considered eligible, are admitted to a 2-year course of apprenticeship on the recommendation of their college authorities. [illegible] of from 18 to 20 who have had a good technical education are apprenticed for three years.

In addition to the manufacturing departments, the apprentices have opportunities for entering the testing, drawing-office, designing, and commercial departments. They are moved from department to department, as a rule every few months, and every endeavour is made to develop the apprentice's capacity by giving him responsible work to do. The first six months of apprenticeship are served on probation.

The object of these courses is to train suitable young men for the company's service in either the works or design departments, or in the commercial sections of the organisation at home and abroad. Prior to the end of their course of training apprentices are usually placed in one or more staff positions on trial.

Heretofore, during apprenticeship, only a nominal rate of wages has been paid. Owing, however, to the fact that many promising young men have on this account been debarred from undertaking practical training, a rate of wage is now paid to suitable men which is sufficient to render them self-supporting during their period of apprenticeship.

Candidates for apprenticeship are selected strictly on merit, and are discharged during the probationary period if found to be unsatisfactory. There are as a rule about 100 "engineering" apprentices at all times in course of training, and the results of this plan of training have on the whole been excellent.

From the foregoing considerations, the need for a clearly-defined plan of training youths for manufacturing employment is evident, and the importance of the subject justifies concerted steps being taken by manufacturers to plan the most suitable means of training, and as far as possible to ensure uniformity of action by all employers.

Special pre-apprenticeship instruction is desirable. The function of the subsequent training is two-fold. One is to select those youths who possess the ability to profit by technical instruction, and to provide for such youths facilities for their advancement to positions where their capabilities may be fully utilised. The other is to train youths lacking in such ability so as best to fulfil their function as workmen. In the efficient training of the latter two requirements must be provided—manual experience and trade instruction.

With regard to trade instruction, the evening technical classes available in most industrial centres are quite unsuitable. Such education should be made directly applicable to the trades of the district, and apprentices should be compelled by their employers to attend classes for suitable instruction, which should preferably be arranged during the daytime.

The apprentice-school method of training offers many advantages, and the author is of the opinion that in this method will be found the solution of a great many of the difficulties connected with apprentice training.

As regards "engineering" apprentices, it is not so important that the training be arranged on such uniform lines in different works as in the case of trade apprentices.

Attention is directed to the value of scientifically-trained men in works organisation, and to the fact that except in isolated cases the technical colleges have neglected to give attention to this field of employment.

In connection with the training for all positions whether of a technical or non-technical character, the importance of securing the best possible material cannot be over-emphasised, and it is a short-sighted policy for employers to place any obstacle such as financial restrictions in the way of admitting promising young men to the industry.

As to the economic importance of training apprentices, money and service thus expended may be viewed in the light of an investment. Individual employers reap direct benefit due to the fact that trade apprentices, as a result of careful training, mature at an earlier age than those not so trained. Also, owing to their ability to read drawings and make shop calculations, they require less supervision and assistance from their foremen.

As to the industry generally, improved labour would have a favourable influence in international competition. The development of each worker to his greatest efficiency and usefulness would be a national gain.

THE ELECTRICAL EQUIPMENT OF A COUNTRY HOUSE.

By FREDERIC H. TAYLOR, A.M.I.E.E.

([illegible] Institution of Engineers on *February 19th*, 1915.)

The [illegible] house can hardly be over-rated. Although perhaps the greatest duty entrusted to electricity in the house is lighting, it is called into service over many others, such as: heating, motor drives for domestic machinery, electric bells and telephones.

Plants operated by paraffin engines represent by far the largest part of the installations of the last few years. They are obtainable from 1 to about 12 KW., by a host of makers, and generally are very reliable in character. The paraffin-electric set, together with the use of metal filament lamps, has entirely revolutionised country house lighting, both as [illegible] into the hands of unskilled labour and yet be relied upon to give satisfactory results.

[illegible] employ, except for large houses, is 25 or 50, but 10-watt 100-volt lamps [illegible] cases where 50 volts is to be preferred are now few in number. Where current is required for heating, or motor driving, 100 volts [illegible]

The complete plant consists of a paraffin engine, coupled to a dynamo, the engine being started up on petrol, and afterwards switched over on to paraffin. For a small set giving only 3½ to 4 kilowatts, such as one would use for a house containing about 140 lights, a consumption as low as 1.6 pints of paraffin per kilowatt-hour can readily be had. In a case now before me of this size the cost for fuel will work out at something like 5s. per week during the winter months. The dynamo is almost exclusively used for charging a battery of accumulators. When a new house is to be built the space allotted for the electric plant is usually of the very smallest possible dimensions. The placing of a plant in a very confined space cannot produce the greatest efficiency of working.

Another common mistake in the lay-out consists in the connection between the engine room and battery room by means of the main switchboard. Many electric contractors and architects have a hole left in the wall which divides the engine room from the battery room, the main switchboard being recessed into this. Two results may follow. One is that the acid fumes from the battery have free access to all the bare copper and brass connections of the switchboard, and the other is that, with a view to meeting this point, the back of the switchboard is sometimes boxed in with woodwork so as to form a shallow cupboard, to receive later on various odds and ends, and thus provide a good opportunity for fire.

However small the plant may be, the switchboard should be kept absolutely in the engine room with a clear 18 in. space at the back. The battery stands are often only made about 18 in. high, the result being that the cells rarely get properly examined. Preferably, the cells should be on a stand of a height to allow for convenient and ready inspection, say, 2 ft. 6 in. to 3 ft. high.

Usually mains have to be run from the engine room to the house, and are laid underground. For some reason, contractors usually favour V.I.R. conductors drawn into a screwed pipe, these conductors being sometimes lead covered. Care and experience is required in this class of work, the usual cause of trouble being a pipe line laid without a proper fall or any means of drainage, or the lead sheathing not being properly earthed, even if earthed at all, with consequent risk of corrosion and subsequent breakdown.

In country houses requiring only 50 to 80 lights, the main conductors which feed distribution boards can readily be run in pipe work chased into the main walls. In houses of larger size sometimes the architect provides a small trench, which runs right round the house, to contain the electric mains as well as the pipes required for the other services. Usually it is too limited in size, and often the hot and cold water services are so mixed up with the electric pipe lines that the latter are apt to suffer. A separate trench should be provided for the electric work only.

The mains between the engine room and house should be fused at each end.

Generally, there should be at least one distribution board for each floor, and the lighting fed from any board should be limited to the one floor or part of the house which it is intended to serve. The tendency is for the distribution board system to be much too limited and one has noticed, for instance, a small country house carrying about 100 lights fed entirely from one 10-way distribution board.

The wiring system mostly favoured, particularly for new property, is some class of pipe work, and in this grave errors are often made. A notable instance is the use of slip-socket tube laid under plaster work, which is objectionable. If welded or other absolutely closed tube is used, the point most commonly omitted is the proper earthing of all metal work.

Many contractors altogether ignore the question of voltage drop, so that when a small proportion of the lights are turned on or off a visible jump occurs to the lamps remaining on.

Tests properly carried out are mostly conspicuous by their absence. Not only should the work be tested on completion, but also at regular intervals afterwards, either quarterly, half-yearly or yearly, and a proper record kept of the results. The earthing should be tested as well as the insulation resistance.

Great conveniences can be obtained by proper methods of switch control, commonly known as 2-way and intermediate switching, by means of which a lamp or lamps can be turned "on" or "off" from any one of 2, 3, or more positions regardless of how the switches may have been left at the other positions.

These switches have been almost entirely developed by one firm (Messrs. A. P. Lundberg & Sons), to whom very much credit is due for the good results obtained. The art of multiple-way lamp switching has now become quite a big subject.

The automatic time-switch is of great advantage in securing economy in the use of electricity in the servants' quarters, where, unfortunately, waste will most freely occur. An ordinary lamp switch should be provided to short-circuit the automatic switch in case of emergency.

The scientific treatment of illumination is of great importance, but a compromise has to be struck, and in most cases the scientific treatment has to give way entirely to the so-called artistic tastes of those who will use the rooms. Certain cardinal points can often be adopted if one is tactful enough to avoid too much specific reference to them when advising the user.

Illumination tests are of immense value, practically as well as scientifically. Generally, the illumination must be somewhere between 1 and 2 ft. candles, but for local illumination, such as the dining table or the dressing table, more like 4 ft. candles are requisite, some persons preferring even 6, and for such a special purpose as the billiard table 12 to 15 ft. candles are considered more appropriate.

The Holophane Lumeter is exceedingly useful in taking measurements of illumination and for other photometric work.

ELECTRICITY APPLIED TO MINING.

By C. P. SPARKS, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *February 25th*, 1915.)

Progress during the last nine years has been so substantial that, in addition to the conversion of a large proportion of existing plant to electric drive, modern collieries are now entirely driven by electricity.

The present paper deals principally with the development of electric driving in the Powell Duffryn Collieries, which are raising coal at the rate of about four million tons per annum.

In 1905 the author described the Aberdare section of the Powell Duffryn undertaking, the power house then having a capacity of 5,000 kilowatts, the rating of the motors connected totalling 4,500 B.H.P., and the annual output being 4½ million units. The plant now in use by the company in the Aberdare and Rhymney Valleys is rated at 24,000 kilowatts, the motors being of 44,800 B.H.P., which represents something like 60 per cent. of the total power requirements. The output during 1914 was about 50 million units, and the estimated output for the present year is 62 million units.

The area worked by the Powell Duffryn Company is 16,000 acres. In the Aberdare Valley there are nine collieries, the distance from the power house to the furthest colliery being 2¼ miles; and in the Rhymney Valley six collieries, the distance of the furthest pit from the power house at Penallta being seven miles. The distance between the Middle Duffryn power house (Aberdare Valley) and Britannia Colliery (Rhymney Valley) is some nine miles.

After considering alternative advantages of main steam winding, the Powell Duffryn Company decided to drive the whole of the plant at the new Britannia Colliery electrically. The main winder house and the electrical equipment were erected before the sinking was started. The sinking was commenced in June, 1910, and the two shafts, each 22 feet in diameter, were sunk to a depth of 750 yards by September, 1913. This sinking was seriously impeded by the quantity of water met with, and for many months the continuous input for pumping alone averaged 1,000 kilowatts.

System.

Aberdare Valley—3,000 volts 3-phase 50 periods, neutral earthed.

Rhymney Valley—10,000 volts 3-phase 50 periods, neutral earthed.

Transmission—Aberdare to Rhymney, 20,000 volts 3-phase 50 periods.

Individual drive—Larger motors, 3,000 volts 3-phase; motors below 50 H.P., 500 volts 3-phase; lighting, 110 volts single-phase.

While no one system is completely satisfactory for every form of drive, in the opinion of the author the 3-phase 50-period system is more flexible than any other.

When a supply is available from a power company it should pay individual collieries to purchase the electrical energy required, and so avoid adding to the already multifarious duties of the colliery management, the necessity of supervising an electric power station. Where, however, the requirements of a single colliery undertaking exceed the output of the smaller power companies, it is advisable for such undertaking to generate its own electricity supply.

The use of exhaust-steam or mixed-pressure turbines has increased the field for separate generation. In other cases, coke-oven gas is available, which can be profitably utilised. Provided that the amount of power be sufficient and the colliery suitably located, joint working with a power company should be mutually advantageous in both the above cases.

With the increasing frequency and severity of labour troubles in recent years, the advantage of installing generating plant for pumping and ventilation at each important centre has become of increasing importance. In the case of the Powell Duffryn Company this point has been met by erecting as stand-by plant the original reciprocating sets which have been displaced from the main power house by larger plant, so that power may be available in an emergency at each main centre.

The generating plant, aggregating 24,000 KW., is distributed as under:—

Aberaman Valley.—Middle Duffryn Power Station.—One 5,000-KW. Escher Wyss-Siemens turbo-alternator; two 2,000-

KW. Escher Wyss-Westinghouse turbo-alternators; and one 2,000-KW. Curtis turbo-alternator, all running at 1,500 r.p.m.; total rating 11,000 KW.

Rhymney Valley.—Penallta.—Two 3,000-KW. mixed-pressure Westinghouse turbo-alternators at 1,500 r.p.m.; total rating 6,000 KW.

Bargoed.—Two 1,600-KW. Nuremberg gas engines driving A.E.G. flywheel alternators, and one 800-KW. set of the same type, running at 100 r.p.m.; one 2,000-KW. Fraser & Chalmers-Siemens mixed-pressure turbo-alternator at 3,000 r.p.m.; total 6,000 KW.

Elliot Pit.—Two 500-KW. Fraser & Chalmers exhaust-steam turbines driving Dick Kerr generators at 1,500 r.p.m.

At the Middle Duffryn power station water is drawn from the Cynon River, which has been dammed to form a cooling pond.

At Penallta the only source of circulating water is the pit. Originally the circulating water was cooled by sprays over a shallow pond; owing to the difficulty of keeping this pond watertight, through settlement due to the workings, the pond has been supplemented by two cooling towers by Messrs. Balcke, each having a capacity of 330,000 gallons per hour.

At Bargoed an ample supply of water is available from the Rhymney River, and at Elliot circulating water is cooled in spray coolers, make-up water being obtained from the pit or the Rhymney River.

The largest turbine unit at Middle Duffryn power house is the 5,000-KW. Escher Wyss-Siemens set, which has been in operation about nine months. The turbine is of the Zoelly 12-stage type, steam being supplied at the stop valve at 150 lb. per sq. in. pressure with 100° F. superheat and exhausting to a vacuum of 95 per cent. The plant is governed by an oil relay controlled by a governor, which actuates a double-seated throttle valve. Overload to the amount of 20 per cent. is obtained by means of a by-pass valve actuated automatically from the main governor and controlling live steam admission to the fourth stage. The turbine speed is regulated from the switchboard. The alternator is star-connected, for working with the neutral earthed through a resistance, and has the exciter armature mounted on an extension of the main shaft.

A fan on the rotor draws air from a wet-air filter through channels in the base of the stator and discharges it through an outlet in the top. The surface condenser, which has 12,800 sq. ft. of cooling surface, is immediately under the turbine; the turbine exhaust and the condenser are connected by a water-sealed gland.

The condensing auxiliaries consist of three centrifugal pumps, driven by vertical shafts from motors of the induction slip-ring type. The circulating water pump is driven by a 140-H.P. motor and the air and water extraction pump by a 75-H.P. motor, air being extracted by a jet of high-pressure water forced by the centrifugal pump through the air ejector. The motors are connected at the floor level, so that in the event of the basement being flooded the auxiliaries could still be run, any water entering the basement being discharged by the opening of a valve on the circulating-pump suction.

Exhaust steam from existing winders and compressors is utilised at the following collieries:—

	Maximum rate of flow per minute.	Average per hour winding shift.
Elliot	—	50,000 lb.
Penallta	2,600 lb.	60,000 ,,
Bargoed	2,000 ,,	75,000 ,,

The first exhaust-steam plant was erected at Elliot Pit, and consisted of two 500-KW. exhaust-steam Rateau turbines and Dick Kerr alternators, steam being delivered from the main winders to two Rateau accumulators. The use of this plant is limited to the day shift, as it cannot be run efficiently on live steam.

The second application was at Penallta, where the exhaust steam from the two main winders and a compressor is utilised through two Rateau steam accumulators in conjunction with two 3,000-KW. Westinghouse mixed-pressure turbo-alternators. The turbines are designed to give an output of 1,800 kilowatts with 60,000 lb. of low-pressure steam, and when working mixed pressure to give an output of 3,000 kilowatts with 60,000 lb. of low-pressure steam and 19,000 lb. of high-pressure steam at 150 lb. per sq. in., 100° F. superheat.

As this plant works in parallel with the gas-engine station at Bargoed, close speed regulation was necessary, otherwise the gas-engine plant would have been over-loaded each time the plant changed from high-pressure to low-pressure steam. The makers were very successful in this application, tests showing that the alteration of frequency when changing from high-pressure to low-pressure steam did not exceed 0.3 of a period. The interchange of load when the gas-engine station is working at an average load of 1,800 kilowatts and the turbine load is 2,000 kilowatts does not exceed 500 kilowatts.

The condensing plant for each turbine is designed to deal with steam at the rate of 80,000 lb. per hour, the surface condensers having a cooling surface of 15,000 sq. ft. The condenser auxiliaries consist of an auxiliary steam turbine driving a Leblanc air pump, a centrifugal cooling-water pump, and a condensed-steam extracting pump running at 2,000 r.p.m. The auxiliary turbine, which develops 150 B.H.P., exhausts into the low-pressure steam system between the accumulator and the main turbine.

(*To be continued.*)

WAR ITEMS.

Birmingham Electrical Volunteer Force.—The following is a copy of a circular letter which has been issued this week:—"It is our pleasing duty to acquaint you with the purpose and constitution of the Birmingham Electrical Volunteer Force which was formed in Birmingham last November. It is a serious attempt to organise on a military basis for the purpose of Home Defence, all those connected with the electrical and allied industries in Birmingham who for sufficient reasons—which must entirely satisfy the Committee of Management—are unable to join the Regular Forces of the Crown. It is recognised that the members of the electrical and allied industries possess high technical knowledge and skill which only require a course of military training to become mobile and capable of effective military application. This is the work we aré now engaged upon. The force is fortunate in its military advisers and instructors, and the Committee of Management is composed of men who are prominent in local engineering circles. Two large drill halls are occupied three nights each week for manual training; dummy rifles and miniature range rifles have been purchased and a rifle range has been secured. The following sections have now been organised:—Air Line, Cable Line, Wireless, Signalling, Searchlight, Fortress, Works, Motor Transport, Electric Transport, etc. A room has kindly been placed at our disposal in the Central Technical School, where a series of lectures will be given on military engineering. It is hoped that the force will soon be 1,000 strong, and efficiently prepared to take its part in the defence of our country should the necessity arise. In order to make it easy for manual workers to join us, the subscription has been fixed at a nominal figure, and we have no hesitation in asking for your generous support of the movement, which so closely concerns us all. A sum of £1,000 is required immediately for the provision of the equipment necessary to enable the force to attain military efficiency. The War Office have decided that no grants will be given by them and that all volunteer corps must be self-supporting. Most of our members are working men who are not in a position to contribute more than the nominal subscription already fixed. In these circumstances and owing to the expensive nature of the equipment required for a technical force, it is essential that outside assistance should be obtained.

"The undermentioned donations have already been promised:—General Electric Co., Ltd., £100; Callender's Cable Co., Ltd., £100; Babcock & Wilcox, Ltd., £50; George Ellison, Esq., £50; W. & T. Avery, Ltd. (Automatic Dept.), £25; R. A. Chattock, £10; Donovan & Co., £10; S. R. Hare, £5; D. Shanks £5.

"The Treasurer will gratefully acknowledge your donation.

"R. A. CHATTOCK, President.
"DAVID SHANKS, Chairman.

"14, Dale End, Birmingham.
"March, 1915."

Russia: Trade Routes.—In view of the existing difficulties in shipping goods to and from Russia, the following extract from an American report just issued will be of interest:—"Freight for Russia, which has been going into Archangel and thence by rail via Vologda to Petrograd, can probably not be landed there any more until next summer, because, notwithstanding all the efforts of icebreakers to keep the White Sea open, the harbour of Archangel is now reported to be frozen solid from two to four feet thick. As there is a great accumulation of freight now at that port awaiting rail transportation, it will probably not make much difference for several months. New interest is being taken in the all-rail route from eastern Scotland or England ports to Bergen, Norway, thence to Christiania, Stockholm, Boden, Tornea; thence south through Viborg to Petrograd. There is, however, a gap in the northern portion of this route. This reaches from Tornea to Karungia, say 15 to 20 miles. I met a man a few days ago who had just come over that gap. He said that there was good sledding, enabling freight to be transported now very easily in that manner. He said it took him six days to go from Petrograd to Stockholm. This route, however, ought to offer good attractions for shipment of American freight of any kind to Russia. American ships might run to Peterhead, Scotland, or to Newcastle, and thence to Bergen; or they might, of course, run direct to Bergen. It is reported that a new steamship line is arranging to run between Stavanger, Norway, and some point in England. No doubt this service could be utilised for a certain amount of American package freight, shipped primarily to Liverpool, and going over this route to Bergen for the all-rail route to Russia. In making arrangements for handling this new Russian traffic it is well to remember that our trade with Sweden is rapidly increasing, and the same arrangements for carrying through Russian traffic could be utilised for this growing Swedish business."

A New Veto on German Electrical Exports.—A further extension of the many existing prohibitions has now been made by the German Government by the imposition of a veto on the export trade and transit trade in the following classes of electrical manufactures:—(1) Dynamos, motors, converters, transformers, choking coils, and complete armatures and commutators if they are intended for ships, searchlights and installations for wireless telephony and telegraphy; (2) copper wire, cable and strands, aluminium and alloys of aluminium, plain or covered and with or without an outer metallic armouring; also flexible insulated wires of short length which, as component parts of electric lighting manufactures, are connected with these, or which are provided with contact devices at both ends; (3) searchlights and their constituent parts, excepting so-called projector lanterns; (4) carbons; (5) contrivances for telephony and telegraphy and for wireless telephony and telegraphy, including component parts, excepting telephone, wall and table installations; (6) telegraph standards and other masts for conductors, made of wood; (7) those component parts of installations of conductors for telephony and telegraphy, which in themselves are not subject to prohibition, if they are intended for such installations; (8) pocket lamps, hand lamps and torches and the batteries and accumulators suitable for them, and constituent parts of the same; (9) glow lamps and their component parts; (10) special apparatus for the transmission of orders and compass movements, and their constituent parts; (11) mines and ignition apparatus, together with magnetos; and (12) all electrical products not specially prohibited, if they are goods which fall under the veto on imports, exports and transit trade from the standpoint of their material nature or according to their use.

Thermit, Ltd.—We have been asked to publish the following statement:—"By order of the High Court upon application by the Board of Trade, I have been appointed Controller of Thermit, Ltd., as it appeared to be in the public interest that the company's business should be continued without interference. In view of my appointment, which does not in any way reflect upon the management of the company in this country—as was stated by counsel for the Crown in open court—I am in a position to assure you that no moneys or profits will reach the alien enemy shareholders of the company. As regards the patents, the Board of Trade have decided to avoid two patents belonging to the company, viz., Nos. 10,859/01 and 24,439/02, the first of which would, in any case, have lapsed in about three months from now, and the second about a year after. The company, however, do not regard the loss of these patents as a very serious matter, as for modern practice welding they rely on a number of subsequent improvements, besides certain secret knowledge which will enable them to deliver material of exactly the same welding properties as they have hitherto supplied. All materials, etc., required for rail welding are manufactured in the company's works, at 675, Commercial Road, London, E., and both the office staff and workmen employed are exclusively of British nationality.

"ARTHUR TAYLOR, Controller.
"Hudson, Smith, Briggs, Smith & Taylor,
"Chartered Accountants,
"London and Bristol."

Glow-Lamp Manufacture in Holland.—The annual report of Philips Gloeilampen Fabrieken, of Eindhoven, which is one of the largest works in the world, is stated to show gross profits of £208,000 for 1914, as compared with £149,000 in the preceding year. It is proposed to appropriate £60,800 for depreciation of machinery, as against £54,000 in 1913, and £28,000 for depreciation of works and buildings as contrasted with £24,000, and to set aside a further sum as provision for war risks in relation to debts owing to the company. The balance of net profits amounts to £106,000, as against £66,000 in 1913, and the directors' recommend dividends of 7 per cent. on the preference capital of £187,000, and 11 per cent. on the ordinary capital of £291,000, being the same rates as in the previous year. As compared with the total capital the balance sheet is noteworthy from the standpoint of the large amounts allocated to depreciation, and from the holding of £295,000 in cash, first-class securities, etc., as against £138,000 in 1913.

The War Office and Messrs. Siemens.—A question was asked in Parliament on Monday, by Mr. R. Gwynne, with reference to the placing of War Office contracts with Messrs. Siemens. In reply, Mr. H. Baker said that such contracts were given to the firm named, and he was aware of the constitution of the board. The firm employed a very large staff of British workers, and had given an undertaking that no part of any payments received on War Office contracts would be transmitted to enemy shareholders. He was informed (says the "Times" report) that there were no British-owned firms not already engaged on Government work who were capable of undertaking the contracts which this firm had received. In the circumstances, he did not think it was in the public interest to dispense with the firm's services. He believed it was an absolutely trustworthy firm.

If Mr. Gwynne, and indeed every other member of the House of Commons, were to read the ELECTRICAL REVIEW, the time of Parliament now spent in answering unnecessary questions would be saved.

Coal Prices.—Coal merchants have given notice to Darwen Electricity Committee that, owing to the reduction of the output of coal through workmen enlisting, they are compelled to reduce the supply by 25 per cent., and that any coal delivered over 75 per cent. of the contract quantity will be charged at the rate of 1s. 6d. per ton above the contract price.

More Diabolical Ingenuity of the Enemy.—In the "Wireless World," it is stated that the German trenches are being protected by barbed wireless. Terrible havoc has been wrought through our troops marching into it without seeing it.

Signal Service 1st London Divisional Engineers.—A third Signal Company will shortly be raised. Applications to enlist are required from young well-educated electrical engineers or electrical engineering students. Applicants should possess a practical working knowledge of some branch of the electrical industry or have studied at some technical institute. The work of the company being of a highly technical nature, the experience gained after some months' service renders a man better qualified for appointments in civil life. Most of the men are mounted, but those unable to ride will be taught. The pay and allowances are at the special Royal Engineers' rates, with separation allowance to dependents. Applications for enlistment should be made, in the first place in writing, to the Recruiting Officer, c/o O.C. 2/1 London Divisional Signal Company, 10, Victoria Park Square, Bethnal Green, E.

Uruguay-German Enterprise.—In a recent report to his Government the American Consul at Montevideo states that German competition in that market is still an important factor, though at the beginning of the war it was generally assumed that German trade with South America would be practically suspended. There was an ample supply of German manufactured articles in Montevideo at the beginning of the war, and goods shipped from Germany since the war started are stated to have been offered in Uruguay at competitive prices. The German importing houses and industrial enterprises in the country are expected to serve as effective bases for trade operations after the war, as they did before, and the Germans are quietly making necessary preparations for re-establishing their old business and trade relations as soon as peace is declared.

Australia and German Trade.—From various reports to hand it is apparent that the movement in Australia for avoiding future trading with Germany, and giving substantial preferential treatment to British and Allied countries, is gathering force. A permanent transfer of trade connections from Germany is what is being aimed at, and statesmen and others are not hesitating to say that whatever may have been their views in the past, the war has taught the necessity for considering our own people first.

War Bonus.—The Potteries Electric Traction Company have intimated that men in their employ will receive 2s., and boys 1s., weekly bonus while the war lasts.

Personal.—Included in the first batch of English wounded prisoners exchanged for German prisoners, were Private J. Hopwood, of Astley Street, Dukinfield, and Private Willie Edwards, of Hurst, both of whom were up till recently employed at the Tudor Accumulator Works at Dukinfield.

Accrington Electricity Committee, after considering what to pay Captain Gray, the chief electrical engineer, during the time he is serving in the new Howitzer Brigade, recommends the Council to supplement the captain's army pay by such sum as will make it equal to his salary as chief engineer, and to continue such a rate of payment during the war.

Mr. Wilfrid Gonde, electrical engineer, of Alverston (Lancs.), has joined Kitchener's second army, being recruited at Cambridge.

Roll of Honour.—Sergt. Stephen Gilbert (24), of the King's Royal Rifles, formerly employed at the United Electric Car Works, Preston, has died at Gustrow, Germany.

Wm. Hy. Hunt, a private in the Royal Marine Light Infantry, a former employé of Blackpool and Fleetwood Tramroad Co., is stated to have been among the crew of the armed liner "Clan McNaughton," reported by the Admiralty to have been lost with all hands.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Government and Foreign Trade.

Referring to your remarks under this heading on page 848 of your issue dated December 25th, it is with great satisfaction that this Committee has seen this matter taken up by such an important institution as the British Engineers' Association

This Committee, although formed for the express purpose of sending home volunteers for Lord Kitchener's Army, has also been giving attention to trade questions, and this matter has been under study for some time. We are entirely in agreement with the chairman of the British Engineers' Association that reforms are required in the Consular service if British trade is to be properly looked after in the future.

A great many instances could be cited from this country alone to show how British foreign trade has been neglected in the past, and it is the hope of this Committee that some measures will be taken that will ensure the proper attention being given to this very important matter.

We have no hesitation in saying that the need for reform is felt by British trade throughout the world, and advantage should be taken of the present patriotic awakening to ensure that we do not fall again into the state of indifference existing before the outbreak of war.

Small British communities abroad can do very little more than appeal to those at home, and we trust that all the important journals, such as the Electrical Review, will take this matter up seriously, and put it before the public authorities in such a way that it will be thoroughly inquired into and dealt with without delay.

Wm. Johnston, M.I.E.E.,
Hon. Secretary, British Patriotic Fund.

Santiago, *January 28th*, 1915.

Consulting "Engineers."

I think "Station Engineer" has voiced a complaint that does need immediate attention, but he does not go far enough, for what about cases like this (I can vouch for it). There is a large institution, having extensive works up and down the country, where the chief engineer has never been inside a works in his life, has absolutely no practical knowledge, and could not even point out with any degree of certainty which is the positive terminal of a Leclanché cell. This "engineer" has the preparation of schemes and specifications for electrical and mechanical work. The contractors know this, and have a good time at the firm's expense, for work is not inspected by an engineer who knows his job, although there are some in the office who do, and it is thanks to these men that he is able to "get through." Could nothing be done to make it necessary for positions like these to fall to men who have qualified for such? for there are many who have spent years and a fortune in training.

Ero.

Batteries for Electric Vehicles.

Perhaps you would be good enough to find space for some comments of ours on the recent article appearing in the *Commercial Motor* on the "Choice of a Battery." As pioneers of the commercial electric vehicle in this country, we naturally feel astonished that after the Edison accumulator has been on the market for seven years it should be possible for the writer of the article in question to fall into so many serious errors of fact.

First, concerning some of the *Commercial Motor's* general statements. The lead battery is certainly not the more popular one for electric vehicles in Great Britain, as there are, in fact, about 90 per cent. of all the commercial electrics in this country equipped with the Edison accumulator, as against 10 per cent. with other types.

One concern alone will shortly have nearly 50 Edison accumulator vehicles, having started only about two years ago with a single van. There should be no special difficulty in deciding what type of battery to employ, if it is required to run an electric vehicle at the least possible expense. Where an electric vehicle is in constant and reasonably vigorous service, we assert that the Edison accumulator offers the nearest solution to the problem of economy. Our reasons in support of this statement we have adduced on numerous occasions, and we shall be willing to quote actual figures, which we would guarantee for a given set of conditions, to any *bona fide* inquirer.

Referring to lead batteries in general, it is a fact that no lead battery whatever, excepting the "Ironclad" Exide, is sold with a guarantee in this country. As a battery is mentioned which is sold with a guarantee of two years, we conclude that this one must be the "Ironclad" Exide. The guarantee in this case warrants 80 per cent. of the rated capacity after two years' service. The majority of lead batteries will not give more than from 8,000 to 10 000 miles service, under commercial conditions, and even then must be exceedingly well looked after during the whole of their lifetime, to prevent the injurious sulphation, which, at very slight provocation, will quickly ruin such batteries.

The next statement is unprecedented in our experience of the many extremely inaccurate statements that have appeared, with regard to the Edison accumulator. It should be well known by now that the inherent chemical principle on which the action of the Edison cell is based, preserves it completely from all but the slightest traces of deterioration on open circuit, and that, therefore, the *Commercial Motor's* statement that "the Edison must of necessity be replaced at the end of four years, whether it has been used or not" could not be more inaccurate. In point of actual fact, the Edison cell is warranted, without reserve, for electric vehicle service, that after four years' daily operation in a commercial electric vehicle, it will give 100 per cent. of its normal rated output and efficiency, and will, moreover, during the interim cost nothing whatever for mechanical repairs—that is, no plate renewals or upkeep. If the Edison cell be allowed to remain on open circuit, then the amount of deterioration that occurs is nil; if only used for a few cycles of charge and discharge per annum, its life will undoubtedly be indefinite, running, perhaps, into 40 or 50 years, though this cannot be positively proven by quoting practically-derived figures, as the modern type of Edison cell has only been commercially available for seven years.

Concerning life, we do, however, positively know that in cases where Edison accumulator-equipped trucks have been in service five years, having run 50,000 miles during that time with the same set of batteries, the latter have shown no signs of depreciating below their normal capacity, but have, on the contrary, given more than 10 per cent. above rating at the end of this period. Is a battery worn out, after four years, which shows 10 per cent. above rating after five years? The Adam Express Co., in the United States, which has 800 of its cars equipped with the Edison accumulator, could and would, no doubt, give some first-hand information on its reasons for choosing this type in preference to others which, as the *Commercial Motor's* article states, should for all-round work be the better proposition.

It is quite true that most lead accumulators maintain their voltage better on very high rate discharges, that is, when going up hill, but against that must be set the fact that especially towards the end of discharge, it is extremely detrimental to the lead type of cell to take high currents therefrom, as this causes not only buckling of the positive plates and shrinking of the negatives, but also severe sulphation, unless the cells be charged soon after receiving such maltreatment. Contrast this with the nickel-iron Edison cell, which may be completely short-circuited and left out of commission, should that be necessary, for an indefinite period, without being in the least harmed thereby.

Referring to weight, the annexed table indicates the ratio of weights of the Edison cell, compared with two of the best known makes of lead accumulators. These figures are taken from data supplied by the manufacturers themselves, through the medium of the Electric Vehicle Association.

Make of battery.	Rated KW.-hr. output.	Gross weight in lb.	Weight in lb. per KW.-hr. at rating.	Excess of weight over Edison type.
Ironclad	10·6	1,350	127	53 %
El. S B. Co. thin plate	12·8	1,350	105	28 %
Edison A-4... ...	10·8	900	84	—
Ironclad	13·2	1,620	123	50 %
El. S B. Co. thin plate	17·1	1,720	100	22 %
Edison A-5... ...	13·5	1.100	82	—
Ironclad	18·5	2,200	119	45 %
El. S. B. Co. thin plate	21·4	2,100	98	19 %
Edison A-6... ...	16·2	1,260	78	—
Ironclad	23·8	2,750	115	40 %
El. S. B. Co. thin plate	27·8	2,650	96	17 %
Edison A-8	21·6	1,820	84	—
Ironclad	26·4	3,080	117	43 %
El. S. B. Co. thin plate	32·1	3 080	96	17 %
Edison A-10 ...	27·0	2.250	84	—
Edison A-12 ...	32·4	2,700	84	—

Note.—The weight characteristic taken above for the Edison cell is a conservative figure of 82 lb. per KW.-hr. In actual practice this is generally considerably less, viz., about 75 lb. per KW.-hr.

As to re-charging, although the constant-potential method, involving a steady pressure of 2·3 volts per cell, is frequently advocated by the lead-battery makers, and is, no doubt, very good for ensuring the longest possible life of this type, it should not be forgotten that the procedure is a lengthy one, taking from 11 to 13 hours, and even then does not achieve a complete charging effect, it being necessary to supplement the constant-potential charging by over-charging once a week or thereabouts. Moreover, the lead type of cell, without exception, is not improved by boosting, carried out under conditions such as generally obtain in everyday service. That is, boosting must be kept below the rate at which violent gassing is produced, else the lead type of cell is greatly injured thereby and its life reduced. With the Edison cell, gassing is unimportant, from a destructive standpoint, and merely signifies the wasting of a small amount of current. In fact, boosting rates are possible with the Edison cell, which would after, say, six months' service reduce the majority of lead cells to a heap of lead oxide in the bottom of their containers.

From the above it is clear that the actual service life of the Edison cell may be expected to be far in excess of that indicated by the guarantee period.

Further advantages in favour of the Edison cell lie in its perfect immunity from the effects of long-continued mechanical vibration and the consequent injury occasioned, not only to the plates, but to the containers. Obviously a container made of rolled steel plate with a welded seam is a better mechanical job than any ebonite or rubber compound container could be. Moreover, the Edison cell uses a steel-preserving electrolyte, in the place of acid, thus eliminating a whole train of minor disadvantages which often prove a great nuisance under practical conditions. Anybody who has "suffered" from sulphuric acid will agree hereanent.

Whilst the general upkeep of the Edison cell involves merely charging as and when required, and the occasional addition of distilled water, together with the simple precaution of not allowing the exterior of the cells to become dirty and wet, the procedure in the case of the lead battery is relatively complex and includes a large number of "don'ts" and precautions which may be completely ignored when operating a steel battery. It is also simpler to determine the state of charge and discharge of an Edison cell, since it is a property of the nickel iron type that its ampere-hour capacity is more or less constant, within practical limits, at all rates; energy withdrawn from an Edison battery may be determined merely by measuring the ampere-hours withdrawn by means of an integrating ampere-hour meter. If this instrument be set to run slower on charge, by an amount slightly exceeding the difference between 100 per cent. and actual ampere-hour efficiency, then the readings of such an instrument represent safely at any given moment, the state of charge or discharge of the battery, and no considerations as to voltage, &c., are necessary. An Edison cell is quite unharmed by being discharged to complete exhaustion. It may be left in that state for long periods, and does not suffer in consequence.

We are, of course, prepared by all the usual means to justify the remarks made in this communication, and shall be glad at any time, either personally or through the Press, to substantiate the claims which we herewith make.

For **Edison Accumulators, Ltd.,**
Raymond J. Mitchell, *Commercial Engineer.*

London, S.W., *March 1st*, 1915.

Trouble with Oil.

Referring to the letter of "Inquirer," in your issue of February 26th, *re* a 1,000-KW. D.C. set driven by a Belliss & Morcom engine throwing oil, a few months ago we were experiencing the same trouble with a set of the same make. After having come to the same conclusion as "Inquirer," that the oil was carried in in the form of vapour, and after trying endless devices for preventing the collection of oil in the armature, the idea of a fan was struck upon.

An out-throwing fan driven by a 1½-H.P. motor was fitted in the wall about 14 ft. above the top of the engine cylinders, and 8 ft. away, which gave excellent results.

The set has been running on and off for the last 12 months, and for the last 9 months we have had no trouble with oil collecting or creeping, and the shaft is always perfectly dry.

It is obvious that in the construction of large modern dynamos, the ventilating air-space being so large, a set running at 250 to 300 R.P.M. will create a vacuum inside the armature, and draw in oil vapour from the engine room, which is thrown up through the armature windings, thus forming, if allowed to remain, a thick coating of grease and dust.

Trusting that this information will be of some use to "Inquirer."

Charge Engineer.

Referring to the letter of "Inquirer," I experienced a similar difficulty some little time ago on a somewhat smaller set, and found that the trouble was caused by oily vapour from the H.P. glands of the engine. This vapour rose above the engine, and ultimately was drawn into the generator at the commutator end. The difficulty was overcome by fitting new packing, and by careful attention being paid to the glands.

W. H. B.

Electric Light Switching.

The results of the electric light switching competition, published in last week's issue of the electrical Press, make interesting reading.

There is one outstanding feature, however, which illustrates how the "art of switching" is coming to the fore not merely as a novelty but as a means of efficiently controlling various electrical apparatus—that the various Polytechnics are giving greater attention to the subject.

The recent list contains the names of no fewer than 17 students of the South-Western Polytechnic, who have succeeded in gaining between them one cash prize, five book prizes, and 17 certificates.

East Ham Technical College students obtained one book prize and three certificates.

W. E. S.

Writer's Cramp.

I shall be very much obliged if any reader can advise me regarding the proposed use of an electrically-operated massage vibrator or induction coil or continuous-current battery, in the following case:—One of my clerks, who for some few years past has had to confine his handwriting during office hours largely to signing his own name and initials, now experiences some pain in his wrist when writing—whether it be his name or an ordinary letter. His hand twitches so much at times that it is frequently difficult for him to sign his name neatly.

I understand that electrical treatment has been found of much use in cases of this kind, and if anyone could state from experience the result of such treatment by either of the means suggested above, it would be very greatly appreciated.

W. H. B.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

COLOMBIA.—A decree of December 4th, 1914, effective from January 1st, 1915, increases the river tax on goods transported on the Magdalena River between Barranquilla and the interior of Colombia. The new rates are $4 in place of $2 per metric ton (2,204·6 lb.) on imports, and $1.60 instead of $1 per ton on native exports. In view of this increase in the river tax and the fact that Customs duties in Colombia are collected on gross weight, shippers to the interior of Colombia will see the advantage of combining lightness with strength in the packing of their merchandise.

SPAIN.—In a cablegram to the United States Governments from Madrid dated January 27th, Commercial Attaché C. W. A. Veditz, of the American Department of Commerce, reports that on that date the Spanish Government appointed a new tariff Commission to prepare for tariff revision. It is provided in the Customs tariff law of Spain that the rates of duty shall be revised every five years, in order to take into account the changes in the values of merchandise on which the duties are based. The latest revised tariff became effective on January 1st, 1912, and it is assumed that the revision entrusted to the present newly appointed Commission will go into effect five years from that date.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

2,356. "Means for intermittently starting and stopping as desired electrical machines." W. Brown. February 15th.

2,370. "Switch fuse-box with endless fuse wire and incombustible non-conducting core." J. Kluytmans. February 15th.

2,386. "Electric switches, circuit breakers and the like." British Thomson-Houston Co., Ltd. (General Electric Co., United States). February 15th.

2,387. "Electric liquid heater of the water-flow service supply type." A. Howard. February 15th. (Divided application on 10,930/14, July 11th.) (Complete.)

2,388. "Portable electric lamp stands." Wallace Novelty Co. February 15th. (Complete.)

2,390. "Meters for multi-wire circuits." F. A. Nield. February 15th.

2,404. "Electro-magnetic driving mechanism." T. Rushton. February 15th.

2,433. "Process for the manufacture of finely-divided metals." S. O. Cowper Coles. February 16th.

2,434. "Coating metallic surfaces with zinc." S. O. Cowper Coles. February 16th.

2,435. "Process for the production of a rustless tinned sheet." S. O. Cowper Coles. February 16th.

2,444. "Electrical heating and cooking apparatus." G. W. L. Patterson. February 16th.

2,456. "Electric lamp for reading despatches and other printed matter, applicable also for signalling purposes." A. W. J. Sheldrake. February 16th.

2,462. "Connections for the practically sparkless interruption of an electric circuit." Fried. Krupp Akt. Ges. (Convention date, February 19th, 1914, Germany.) (Complete.) February 16th.

2,488. "Lamp shades." H. J. C. Forrester (J. W. Dunham, United States.) February 16th. (Complete.)

2,489. "Portable electric lamps." H. J. C. Forrester (J. W. Dunham, United States.) February 16th. (Complete.)

2,490. "Starting means for electric motors." W. J. Sheppard & G. A. Yarwood. February 16th. (Complete.)

2,516. "Magnetic-impulse motors." W. E. Clifton. February 17th.

2,532. "Controllers for electric lifts." C. G. Major & Smith, Major & Stevens, Ltd. February 17th.

2,535. "Dynamo-electric machines." B. G. Lamme. February 17th. (Convention date, February 19th, 1914, United States.) (Complete.)

2,546. "Electric fires." H. H. Berry & W. J. Markham. February 17th.

2,565. "Wireless telegraphy and telephony." J. Perry & S. G. Brown. February 17th.

2,570. "Means for protecting and indicating the condition of electric circuits." F. S. Grogan & British Electric Transformer Co., Ltd. February 17th. (Complete.)

2,574. "Electro-magnetic rectifiers." H. J. Dale. February 18th.

2,618. "Dynamo-electric machines." Crompton & Co., Ltd., & N. Pensabene. February 18th.

2,619. "Electric starters for internal-combustion engines." A. H. Midgley & C. A. Vandervell. February 18th.

2,624. "Rotors of dynamo-electric machines." Sunderland Forge & Engineering Co., Ltd., R. G. Scott, & A. T. Robertson. February 18th.

2,636. "Electric ordnance." T. G. Tulloch. February 18th.

2,651. "Lamps for electric lighting." J. T. Sutcliffe. February 19th.

2,656. "Electric resistances." Simplex Conduits, Ltd., & F. F. D. Davidson. February 19th.

2,676. "Electro-magnetic projecting or transmitting apparatus." E. Bachelet. February 19th.

2,685. "Electro-magnetic projecting or transmitting apparatus." E. Bachelet. February 19th.

2,687. "Electric batteries." J. Sutton & G. J. Sutton (trading as Stuart & Moore). February 19th.

2,696. "Tubular electric pocket-lamps." E. C. R. Marks. February 19th. (Interstate Electric Novelty Co., United States.) (Complete.)

2,697. "Maximum cut-outs." G. Jacobus van Swaay & H. I. Keus. February 19th. (Convention date, February 25th, 1914, Holland.) (Complete.)

2,698. "Method of rendering articles made of porcelain, pottery, glass and the like, electrically conductive for the purpose of enabling the deposition thereon of metallic coatings by electrolysis to be effected." P. Marino. February 19th.

2,750. "Magnetic compass." James A. Sinclair & Co., Ltd., & A. Snell. February 20th.

2,762. "Incandescent electric lamps." T. Green. February 20th.

2,766. "Means for preventing discharges from electric conductors." C. B. Burdon. February 20th. (Siemens-Schuckertwerke G.m.b.H., Germany.)

2,767. "Manufacture of electrodes suitable for electrolytic or analogous purposes." Siemens & Halske Akt. Ges. February 20th. (Addition to 605/09. Convention date, February 21st, 1914, Germany.) (Complete.)

2,786. "Transformers." J. Torner. February 20th. (Convention date, February 21st, 1914. Spain.) (Complete.)

2,787. "Electrical press-button switches." E. Ottinetti. February 20th. (Convention date, February 23rd, 1914, Italy.) (Complete.)

2,789. "Electro-deposition of metals on china, earthenware, porcelain, glass, and like non-conducting surfaces." B. G. Clark. February 20th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

24,028. MANUFACTURE OF TUNGSTEN. C. Gladitz. October 23rd.

26,353. MANUFACTURE OF DIAMOND DIES FOR DRAWING METALS. C. Gladitz. November 17th.

29,274. CURRENT-CARRYING COILS FOR ELECTRO-MAGNETIC APPARATUS. J. W. Ewart. December 19th.

1914.

1,895. METHODS OF PROTECTING ELECTRIC FEEDERS AND THE LIKE. E. G. Waters. January 19th.

2,327. DYNAMOS. H. Leitner. January 28th. (Cognate application 12,455/14.)

2,431. LAMP SHADES OR REFLECTORS. M. H. Galsworthy. January 29th.

2,543. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) January 30th.

2,604. ELECTRICAL HEATING APPARATUS SUITABLE FOR COOKING, WATER-HEATING AND LIKE PURPOSES. A. F. Berry. January 31st. (Cognate application 17,762/14.)

2,605. MEANS OR APPARATUS FOR HEATING WATER AND OTHER LIQUIDS. A. F. Berry. January 31st.

2,691. APPARATUS FOR CONTROLLING MOTORS FROM A DISTANCE. A. Mond (Maschinenfabrik Oerlikon). February 2nd.

2,808. ELECTRIC BELLS. W. M. Thornton. February 3rd.

3,455. CENTRIFUGALLY-REGULATED DYNAMO-ELECTRIC CLUTCH. W. Morrison. February 10th.

THE

ELECTRICAL REVIEW.

VOL. LXXVI. MARCH 12, 1915. No. 1,946.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: March 12th, 1915. [No. 1,946.

Page
Education and Industry 345
Russia 346
The Promotion of Russian Manufacturing 347
Russia and Electric Lamp Production 347
Rubber 347
Searchlight Projectors, by C. W. Denny (*illus.*) 348
An Electrically-Controlled Canal Bridge (*illus.*) 349
Legal... 351
War Items 354
Business Notes 355
Notes 361
City Notes 364
Stocks and Shares 371
Electric Tramway and Railway Traffic Returns 372
Trade Statistics of Spain 373
Training for the Industrial Side of Engineering 374
Electricity Applied to Mining, by C. P. Sparks (*illus.*) ... 375
New Electrical Devices, Fittings and Plant (*illus.*) 378
The Selling Side of Electricity Supply.—I. 381

Correspondence—

Coke Fuel for Steam Raising 381
"Totally Enclosed" Motors 382
Trouble with Oil 382
Salaries of Engineers... 382
Trade Routes to Russia 382
Japan-China Cable 382
Consulting "Engineers" 382
Writers' Cramp 383
The Röntgen Society 383
Foreign and Colonial Tariffs on Electrical Goods 383
New Patents Applied for, 1915 384
Abstracts of Published Specifications 384
Contractors' Column ... ... Advertisement page xxii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 1s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
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WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

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EDUCATION AND INDUSTRY.

FROM the *Times* of February 22nd we learn that the Board of Trade has authorised an Exhibition to be held in London with a view to "a more scientific co-operation between education and the industrial arts in this country." This has been done at the instance of a body of men, among whom are Lord Aberconway, Mr. Frank Brangwyn, the artist, Mr. F. V. Burridge, of the Central School of Arts and Crafts, Mr. H. G. Wells, Mr. Gordon Selfridge and Mr. Ambrose Heal. The Exhibition is intended, we gather, to show, as an object lesson to ourselves, how German manufacturers have used the Art Schools of their country to train designers for their particular needs, and have taken steps at the same time to educate public taste and discrimination. In recent years we have seen in this country such a process carried out with great energy, and conspicuous success, by the great furnishing firms. Specimen rooms, and in some cases suites of rooms representing whole houses, have been shown by leading firms, and everyone went to the Ideal Home Exhibition. No one could help seeing there what great judgment and care were required for much of the exhibit, and the general taste and appreciation of the purchasing public has much improved in every direction in late years. We believe this country is now recognised as leading the world in the furnishing trade, and this must be attributed to the action of the manufacturing firms in developing artistic design parallel with skilled workmanship and efficient manufacturing.

The process can be carried out to a greater or less degree in a great number of trades, and the proposed Exhibition will show that German thoroughness has introduced it into trade manufacturing to an extent which few of us would suspect. We look forward to the Exhibition with great interest, and hope that the results may fully answer the expectations of the promoters.

This proposal deals, however, with but one section of a greater question. How are we to rearrange the educational system of the country so that school training shall be part of an ordered and intelligible process, by which a child grows into an efficient and capable worker? The question has been discussed more than once in these columns, and is the crucial problem of national education.

The main scheme of our educational system is far from being closely in touch with trade and industry. Indeed, these hardly come into the picture at all. There is no difficulty in accounting for it. The history of the civilisation of Europe is a sufficient account. But while we have allowed the matter to run on in the groove in which our ancestors started it, Germany has known how to set a wiser course, and has been reaping the advantage of her wisdom. The result is that in this country the secondary schools implicitly, if not explicitly, present to their pupils as the object of training, mental cultivation of the literary and scientific kind, while the ideals of industrial enterprise are not presented at all. The instruction given at our great public schools and the Universities is really not wide enough for all modern purposes. If one were to tell a man who had built a successful career on the basis of such education, say one of the Judges, or a young Bishop or headmaster, that the scope of his instruction had been extremely imperfect, he might be surprised ; he might even be rude ; but the fact is that while English public schools are admirable places for learning manners and conduct, and the *ars vivendi*, their instructional curriculum is very narrow. This may not be a serious matter, having regard to the class from which the boys come ; indeed, for their purposes the curriculum is probably wide enough, but it is not wide enough for other schools ; and what is serious is that they, unluckily, set a pattern and standard to the schools for the middle and upper working classes which is quite unsuitable and is extremely mischievous.

We expect that this promised exhibition will emphasise once more the necessity in this country for an extended system of secondary schools, organised with a clear purpose of industrial training.

RUSSIA.

Various reports and other communications that have lately reached us from Russian sources bear evidence of the great desire that exists among electrical men in the leading cities of that vast Empire to throw off the German yoke and avail themselves of British electrical manufacturing facilities. The new bond of Russo-British friendship will hold good for many a year, and one of its consequences will be to furnish us with opportunities to assist in the electrical and engineering development of a wonderful field for enterprise ; but, at the moment, sheer necessity presses, because German sources, upon which so much dependence has been placed for electrical goods in the past, have been closed for many months. From what we have already read and heard of the efforts that our Russian electrical friends desire to make for removing German influences and control, we are led to hope that they will, as time passes, exhibit in this connection the same determination and resourcefulness which have distinguished the military operations of the Grand Duke Nicholas and his dauntless millions.

We believe, too, that when the Czar's Government comes to deliberate seriously respecting the regulation of matters relating to internal industries and to export and import trade, it will not be found wanting, but will be prepared to render assistance to electrical and engineering works and traders in such ways as shall facilitate the operations of the Allies in competition with present enemies. These enemies have been enabled to prepare to wage this terrible warfare partly by securing profits to the tune of many millions per annum from electrical concessions and trade in the country whose deep-snowed lands have now been dyed in human blood. This Governmental assistance, however, is hardly a matter of immediate possibility—Russia will doubtless develop a new and sweeping international trade policy in due course, and we may reckon that, as far as practicable, that policy will be favourable to ourselves and our Allies, and perhaps some neutrals. When that time comes, probably, the present projects of British electrical manufacturers will have been carried to such a stage that England will be enabled to co-operate from present and extended manufactories. But at the moment, all information is to the effect that, as we have said, sheer necessity for electrical supplies urgently presses. The difficulties that stand in the way of immediate electrical trading operations between us seem to be very great, but the proceedings in the Dardanelles give ground for encouragement, for, when these are successful, providing there is shipping accommodation available—a point which is not likely to have been lost sight of by those responsible for the approach through the Narrows—there will be a free flow of exports and imports again which will inevitably relieve the financial situation and remove or lessen the rate-of-exchange difficulty. British exporters no less than Russian importers are hoping for this relief to come as speedily as possible ; until it does come there must, we suppose, be a continuation of the handicap on trading operations, though we trust that our firms will not be too hurried in turning down the business which is actually offering. We are well aware that our manufacturing ability is to a large extent monopolised by Government demands, and that there is a certain amount of shyness or wariness in relation to the Russian market, but it will be fatal to any schemes that we may cherish for later trade developments if we allow Russian buyers to get the impression that it is useless for them to expect to get what they need from British works. We ought to do our utmost to prevent them thinking either that we can't, or don't want to, do business with them. If such ideas be permitted to gain currency, sheer necessity, when the War is over, will drive them, sentiment notwithstanding, to deal with enemies that are geographically near and have laid themselves out to meet Russian electrical requirements.

It is such considerations as these that should seriously be weighed by us in organising our efforts to "capture" German trade in the Russian market. It is for the future to decide what course the Czar's Government will see fit to adopt, and what course financial settlements will dictate, in regard to German electrical concessions and works in Russia. Ownership of concessions, in German hands at any rate, generally means a German monopoly of most of the electrical needs arising in connection with the development of such concessions. We should like to see more British money invested in Russian electrical concessions, and to have some assurances that the investment of such money will bring us actual business as well as dividends. But, whatever may happen in these directions, we think it is obvious to all who have studied the peculiarities of the position, that Russian electrical trade is not going to be won, and held, unless measures are adopted commensurate to the present and prospective value of the trade, and suited to the difficulties of the case. We believe it is generally recognised that in Canada, a British Dominion, the Americans have been able to secure a firm hold upon some departments of electrical trade by influencing in the past the character of Canadian electrical engineering work. Geographical situation and seizure of early opportunities have assisted to produce this state of things, and the result is that, to British firms, Canada has proved to be one of the least easy of all British Colonies to work.

Now, to an Englishman the Russian character and point of view are not likely to be easier to understand than the Canadian, for our small knowledge of the language at once forms a handicap.

It seems to us that we have got to recognise that when we are not at war, the position in Russia is somewhat similar to that in Canada so far as British electrical firms are concerned. There are on the side of Germany all the advantages that ensue from geographical situation, long years of close study of the market and of the Russian people, financial control, and linguistic attainments. The Allied Russians will not *want* to buy from Germany, but our kith and kin in Canada have frequently said that they *wanted* to order from England—in actual fact, however, they more often go South over the border to get what they want if Canadian factories, often of American ownership and control, cannot meet them. What will happen to those German-owned factories in Russia is, as we say, an interesting question for the future, but we put forward this brief comparison between the land of an Ally and a British Colony more with the view to assisting the trade to a proper understanding of the position so that measures conceived, and plans elaborated, shall be of a suitable character.

By the courtesy of a correspondent we are enabled to publish below some extracts from a letter received from an Englishman long resident in Russia and doing business there in electrical and engineering goods. We believe that they will repay study.

> I may say plainly that quality and endurance are most important points for the market in electric lamps here, for we are flooded with lamps with very short lives, as I know to my cost. An "All-Russian lamp" factory is now just starting in Moscow. . . . It is said that the duty on foreign lamps is to be raised, and this

may help it in competing with foreign lamps. The present duty is 30 roubles per pood. A pood is 36 English lb., but what a rouble is at present (30/13t. December, 1914) it is difficult to say. Before the war it meant 9·5 roubles for £1, but just now, it is about 11·70 for £1. This makes a big difference. Another trouble is that no banks are issuing foreign cheques, so it is impossible to transmit any money at present, but the local papers say that negotiations are on foot between the British and Russian Governments to arrange some *modus vivendi*, so as not to put a stop to all business. In the district of Kieff there are about 300 sugar factories . . . . they require a good lot of lamps. Commission must be liberal in Russia owing to the enormous distances to be travelled, and the hotel expenses, &c., not to speak of the well-known Russian system of bribery. Every order has to be bought. [This impression is discredited by other authorities.—Eds. E.R.]. In Western Europe one can see from one town to another, but here at Kieff it takes 12 hours in a fast train to get to anywhere—400 miles. Three days ago the railway fares and freights were raised 25 per cent., and refreshment still more, as no drink of any kind is allowed, so that all the profit has to be put on the food. Samples to Russia should be sent per Foreign Parcels Post—not by "Express Agents"; they will be here in about three weeks from date of despatch.

Another Russian correspondent (writing from Finland) lays great stress upon the importance of cheapness if British firms desire to capture the German trade in electric lamps. Unlike the above writer, he says that while British-made lamps are recognised as being "far better, giving a brighter light" than German, the cheaper article is preferred – "inferior quality seems no objection." He suggests that British firms should "use cheaper material and be on the competition line," as unless they can produce cheaply they will never do a trade there.

The Promotion of Russian Manufacturing.

The gradual awakening of Russian manufacturers to the necessity for rendering themselves independent of German products resulted in the holding at Petrograd, on February 12th, of a conference, which was attended by representatives from all large towns, of the electrical section of the Imperial Technical Association. As the chairman pointed out, one of the most important problems which had to be solved was to ascertain the factors which would enable the Russian technical industry to dispense with Germany; and this question was followed by a discussion as to the possibility of constructing various apparatus for telephony, telegraphy, and radiography, &c. In this connection it was mentioned that the electrical industry was almost entirely dominated by the Germans, who also controlled most of the patents used in electric lighting work. A great surprise was sprung upon the conference by the announcement that the mines in the district of the Urals, which furnish wolfram ores for the manufacture of incandescent lamps, are still in the possession of the Krupp company of Essen, and that the latter receives delivery of the metal itself at the price of 4 roubles per pood, as compared with the customary charge of 67 roubles per pood. The final result of the conference was the adoption of a resolution deciding to approach the Government with a request for support to the native electrical industry by all means available, in regard to Customs conditions, and freight rates.

Russia and Electric Lamp Production.

At the evening sitting of the Congress on the Russian Electrotechnical Industry on February 13th, Mr. A. V. Olshvang gave a report on the present position of electric lamp production in Russia. He said that at present the Russian factories in Moscow, Petrograd, and Warsaw, engaged in the production of electric incandescent lamps, put on the market an average of 20,000 carbon lamps per day, and about the same quantity of metallic-filament lamps, the aggregate being between 10,000,000 and 12,000,000 lamps a year. But, unfortunately, these so-called Russian lamps included nothing that was Russian except labour, for the Russian factories simply assembled the various parts that had been imported from Germany. The question was, could not Russia make her own lamps without appealing to the foreigner for the half products? He was of opinion that Russia certainly could do so, for she had the material, and all the details of lamp production were well known to her. But until the war broke out no one thought of taking up the production in Russia; in fact, there was no profit in it, for, thanks to the low Customs duty, the parts could be bought more cheaply abroad. No factory in Russia was equipped for making the bulbs, but recently the Russian glass factories had undertaken their production, and already lamps furnished with Russian-made bulbs had been put on the market. The tungsten filament, the most delicate and essential part of the lamp, had ceased to be a secret, and one of the laboratories in a Moscow factory was already producing it. Wolfram was found in Siberia, in the Urals, and in the Caucasus. The speaker referred to the Krupp influence, which was also mentioned at the meeting of the Imperial Technical Association, and said that at the beginning of the war, deposits of wolfram were being exploited by Krupp, who had leased them from a Urals industrialist through one of his agents. When the war broke out, Krupp's agent left Russia, and the owner of the deposits cancelled the contract with Krupp, and so, according to Mr. Olshvang, the exploitation of these deposits remained an open question. The lecturer added that this fact showed how important it was that deposits of minerals in Russia should be protected by the Government from foreign contractors.

One Russian factory had already begun the manufacture of filaments, and probably within four or five months lamps would be available that could properly be termed Russian produced lamps.

The tariff must play a great part in the development of the national production of lamps. Whilst on carbon lamps the import duty was 30 roubles per pood, *i.e.*, about 6 copecks (6 farthings) per lamp, or 20 to 30 per cent. of its cost, the duty on metallic lamps was not high enough, although it had been increased to 65 roubles per pood in respect to them. The position was that the first metallic lamps were somewhat large and not more than 500 went to the pood. But then Germany and other countries began to make miniature lamps, of which more than 1,500 went to the pood. So, whilst previously the duty on a lamp amounted to about 12 copecks (3d.) it became much less for the smaller lamps, making about 1d. each, *i.e.*, about 5 per cent. of the cost. Such an insignificant duty might seriously prejudice the development of the Russian lamp industry. The lecturer's observations closed with an appeal urging the need for exploiting Russia's deposits of wolfram, molybdenum, and nickel.

Rubber.

The market for rubber although showing a quiet tendency, has, nevertheless, maintained a very firm front, and there appears no reason to anticipate any material alteration in the general outlines of the position for some little time to come. The export movement of raw material from the Middle East is considerable, the official particulars of shipments of plantation rubber from the Straits Settlements in January being 2,576 tons compared with 2,334 tons in the previous month, and 1,181 tons in the corresponding month of the previous year. Considerable importance attaches to the progress of affairs in the United States, and the fears which had been acute that a quarter of a million men or so might be thrown out of work owing to the British embargo upon shipments of plantation rubber grown in British Colonies in the East, was promptly dissipated earlier in the year. From then onwards there have been regular shipments of the material made to the United States, and the consuming industries in North America are now more actively engaged than ever before. It can be taken as a fact that the American rubber trade is fully satisfied with the terms of the guarantees imposed in connection with the exportation of rubber goods to the Germans, Austrians and Turks, and also with the arrangements under which it is only possible to export goods to neutral countries by way of Great Britain. At all events, the United States' trade is not unduly hampered by the restrictions imposed, all of which are very necessary for the safeguarding of the British and their Allies, and there is no intention of conceding any points to the enemy in the rubber trade.

It is understood that an amalgamation is to take place between the Linggi and Port Dickson-Lumut Companies. This will certainly be a very interesting event, and one which should be of advantage to both parties to it. In a recently issued report upon the International Rubber Exhibition of last year, the Ceylon Commissioner, Mr. Lyne, makes reference to the relative merits of plantation and fine hand Para rubber, and remarks that he was not able to get any admission from any manufacturer that plantation rubber was as good as fine hard Para where goods that would stand up against the severest tests were required. This is hardly fair, however, to the plantation product, for at least one of the largest rubber using concerns in the country is a strong believer in the cultivated article as against the wild material.

SEARCHLIGHT PROJECTORS.

By C. W. Denny, A.M.I.E.E.

So much has been achieved in the development of the searchlight, that the latest projectors bear but little similarity in features or in size to the very early types. The writer proposes to give a short historic sketch of their uses and growth, including the numerous improvements which have brought the projector up to its present position of efficiency and utility. Projectors have been largely used for naval and military purposes, for night observations, and signalling, the latter operations being mainly carried out on a semaphore or Morse code system. An early type of projector designed for night signalling by use of a semaphore system is illustrated in fig. 1, using a lamp with vertical carbons, as against the more modern lamps with horizontal carbons and flashing shutter. The construction of the lamp and body is characteristic of the early projectors; modifications are made with regard to the front, which allows of the direct issuance of the light-rays, the barrel is provided with an octagonal pyramidal reflector placed in the path of the light-rays, and having the apex of the pyramid facing the light. The sides of the pyramid are arranged to make an angle of 45° with the base. The effect of such an arrangement is that the light falling on the reflector is split up into eight beams, which are caused to travel in a direction at right angles with the original beam. The beam which travels vertically downwards not being required in practice, the corresponding reflector is omitted, so that seven beams are formed corresponding to the seven positions of the semaphore system. The beams of light are operated by doors or shutters on the external shell, which cover up the corresponding apertures, usually fitted with a concentrating lens to cause the rays to issue in a parallel beam. The doors or shutters can be worked electrically from a distance, or by hand by a suitable arrangement of levers. Many arrangements of mirrors have been devised for operating a system of semaphore signals as described above. Provision has also been made for injecting into the beams of light jets of steam, smoke, water, or vapour, with a view to rendering the beams more clearly defined.

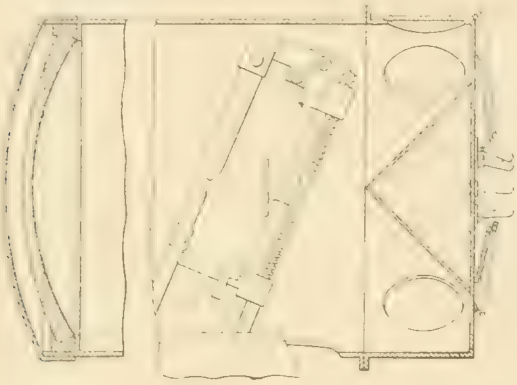


Fig. 1.—Early Form of Projector with Flashing Shutters.

The optical part of a projector being obviously of great importance, considerable attention has been given to various forms of mirrors, the most efficient and recent being the parabolic mirror, constructed of crystal glass, or, more recently still, of metallic construction, other notable forms of mirrors being the Mangin, aplanatic, and spherical. It is not strictly true, in the case of the latter, that all rays parallel to the axis meet at a point (the focus), and this irregularity (which is found in lenses also) is known as "spherical aberration." If the pencil of rays is small they may practically be supposed all to pass through the focus, but for wide pencils this is only so in the case of parabolic mirrors; hence their use for projectors. Parabolic reflectors were used as far back as 1763 for lighthouse illuminations by a Mr. Hutchinson, of Liverpool. These mirrors were formed of small facets of silvered glass made up as nearly as possible to a parabolic curve.

The most important improvement from an optical point of view has been the substitution of the gilded metallic mirror for the silvered glass mirror, either Mangin or parabolic. In the production of good metallic reflectors it has been necessary to overcome numerous difficulties, notably those incidental to the design and construction of special machines for working up the parabolic metal pieces, as machines formerly used for glass mirrors could no longer be employed. After working up, the mirror should be polished carefully, and covered with a fairly thick deposit of gold, all of which presents difficulties corresponding to the dimensions of the mirror. Experience has shown that gold-coloured metallic mirrors in clear weather give results comparable with glass mirrors, and as soon as the weather becomes foggy the gilded reflectors are superior to silvered glass. The advantage of metallic mirrors, from a military point of view, are incontestable. They present, besides a complete resistance to variations of weather and temperature, the advantage of withstanding shocks from gun fire, and they can be pierced by bullets without the intensity of the beam being sensibly diminished. A further advantage in favour of metallic mirrors is that of weight, they being considerably lighter than glass mirrors. The weight of a 26-in. metallic mirror is approximately 30 lb., whereas that of a glass mirror of the same size is about 165 lb. The employment of metallic mirrors also permits of much shorter focal lengths than are permissible with glass mirrors, owing to the intense heat generated, which would result in blistering the silver on the mirror, or even breaking the glass if in close proximity. Having found that, especially with horizontal carbons, the central zone of the mirror is practically useless, a central aperture is made in the mirror with a view to rendering more efficacious the ventilation of the silvered surface (in the case of glass mirrors); this also facilitates the manufacture, and enables the mirror to better resist air pressure due to the discharge of heavy guns. Mirrors, whether of metallic construction or of crystal glass, are usually fixed to the body of the projector in an easily detachable frame, to allow of rapid inspection and cleaning operations.

One of the earlier methods of focusing a projector lamp was to move the mirror in relation to the arc, the mirror being mounted in a movable frame or carrier arranged to move parallel with the axis of the projector. The later, and more approved method, is to move the lamp in relation to the mirror. This is usually accomplished by having the lamp mounted on guides or runners and attached to an adjusting screw or handle, by means of which the lamp can be moved in either direction at will. This arrangement has the advantage of rapid manipulation, and it can also be used to produce a divergent beam. This is obtained by varying the relative distance between the arc and reflector, which can be done by a few turns of the handle supplied for that purpose, the movement changing the light from a straight beam to a widely-divergent beam, or *vice versâ*. A much more effective method lies in the use of dispersion lenses, sometimes called "divergers," which consists of strips of plano-convex glass, set in a suitable frame for slipping over the front of the projector, or arranged to swing across the beam of light. The rays in passing through these strips are first converged, or brought together, and then, as the rays cross, they spread out again, and continue to spread indefinitely. The effect when placed in front of a searchlight is to spread the light out in the shape of a partly-opened fan. The light is spread out horizontally, but not vertically. The light when thus spread is not so penetrating as a parallel beam. Many forms of dispersion lenses are arranged in a separate ring or mounting, which, when required, has to be fixed over the main glass door. This has always been a troublesome operation, and after being used a few times the usual practice has been to put the dispersion lens door carefully away and never use it again, notwithstanding the great convenience resulting from its use. A novel method of fixing dispersion lenses inside the barrel has been adopted on some projectors of American design. The lenses in question are arranged in two semi-circular brass rings so pivoted that they can be swung round a vertical axis. On the top of the barrel are provided two brass handles, by means of which the lenses may be swung into position or out, as desired. This takes but a few seconds, and the front door need not be opened. The dispersion lenses when out of use lie in a vertical plane parallel to the beam, and, being of very small section, do not interfere with the efficiency of the beam to any appreciable extent. The usual angles of divergence for, say, a 24-in. projector are 16°, 20° and 30°, other angles being easily obtainable for special requirements. Modifications in the dispersion lenses meet the requirements of the Suez Canal regulations, which stipulate that all ships traversing the Canal at night by means of searchlights shall project a beam of light forward which shall have a shadow in the centre of 5° divergence.

The bifurcated beam thus required has been produced in several ways, some designers preferring a system of metallic strips or shutters placed in front of the dispersion lenses, while others prefer a series of prismatic lenses.

Flashing Gear.—This can generally be brought under one of two classes—internal or external. The internal flashing shutters were mostly used in conjunction with the vertical carbon lamp, and were usually in the form of a plate or disk of suitable shape arranged to intercept the rays of light between the arc and the mirror.

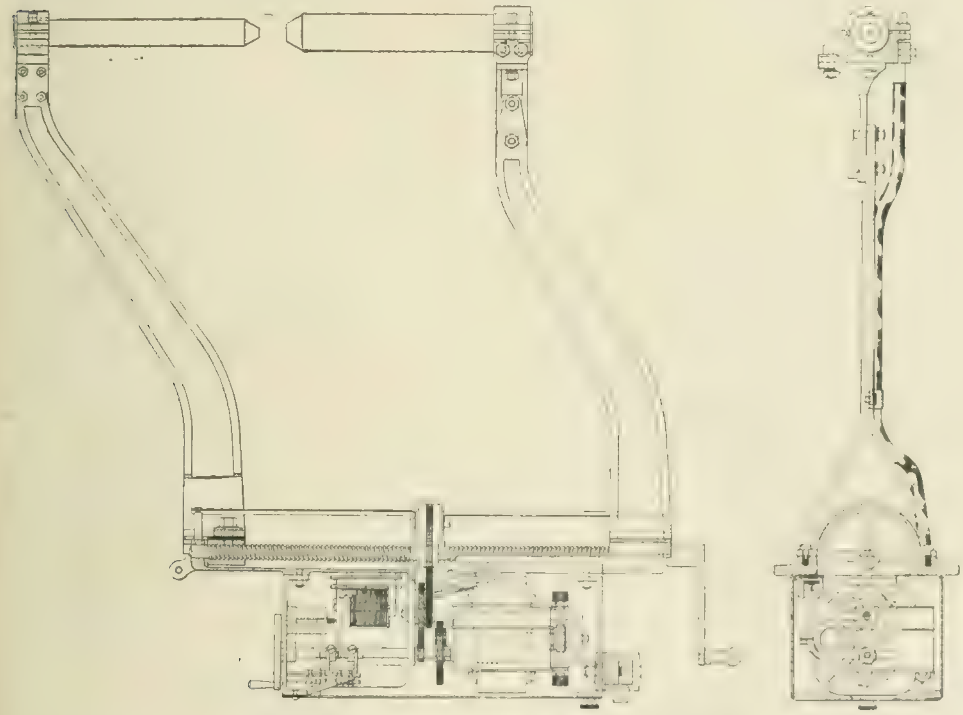


Fig. 2.—Motor-driven Projector Lamp.

Flashers of this type had numerous drawbacks, the most prominent being the formation of shadows in the beam when the flasher was out of use. These shadows were caused by the flasher plate or its fixings coming within the cone of rays thrown on the mirror by the arc, so that the efficiency of the beam was materially affected. Also the more general use of projector lamps with horizontal carbons makes it difficult to design any really good arrangement of internal flashing gear. The external flasher, consisting of a series of Venetian shutters in front of the door, entirely eliminates his trouble.

Projector Lamps.—The earlier types of projectors nearly all used a lamp in which the carbons were in an inclined position; the result was that the carbons, carbon-holders, and supports caused very bad shadows in the beams of light. The horizontal carbon lamp is now almost universally adopted for projectors. The use of this type of lamp materially adds to the efficiency of the projector, in that there are no bad shadows produced on the mirror. The lamps are usually of the differential type, operated by a shunt and a series coil, much in the same way as an ordinary vertical arc lamp, the feed mechanism necessarily being modified to suit the requirements of a horizontal position. The carbons are fed by means of a screwed rod having a right and left-hand thread, and actuated by means of a shunt coil through suitable pawl mechanism. Motor-driven projector lamps have been in use, mostly on the Continent, for some 15 to 20 years. An illustration of a motor-driven projector lamp is shown in fig. 2.

(*To be concluded.*)

AN ELECTRICALLY-CONTROLLED CANAL BRIDGE.

Acting conjointly, the Corporations of Glasgow and Clydebank have had constructed over the Forth and Clyde Canal, at Dalmuir, a swing bridge which is claimed to be the first bridge in the world where the whole of the functions of opening and closing the bridge and the road, and controlling and safeguarding the vehicular, pedestrian and waterborne traffic, are performed electrically by one man operating from one position. The bridge consists of a single swing span constructed of steel, with a roadway 20 ft. wide between the girders and two footpaths, each 5 ft. wide, carried on brackets projecting outside the main girders. A double line of tramway is laid on the roadway, and the overhead tramway conductors are carried by light girders with supporting columns on either side of the bridge.

It was at first thought to be impossible to operate the gates, locking bolts, bridge bolts, jacking gear, runaway points, and signals electrically, and a system of mechanical bell-cranks and levers was suggested, similarly to other swing bridges. Obviously a bridge so arranged would have required a larger staff to operate it than is necessitated by the electric control system that has been adopted.

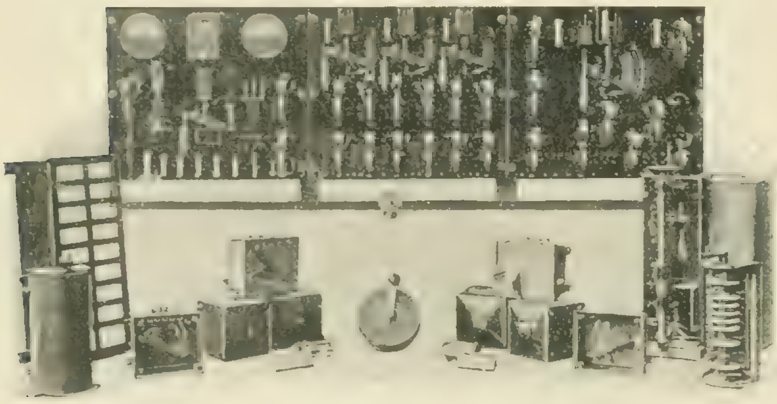
A scheme for the complete electrical operation was put forward by the Igranic Electric Company, and the obvious practicability of this scheme so favourably impressed the consulting engineers (Messrs. Crouch, Hogg & Easton) and the authorities (The Caledonian Railway Co., and the Glasgow and Clydebank Corporations) that it was decided to ask several of the most prominent electrical engineering firms to put forward electrical schemes.

Ultimately that originally put forward by the Igranic Electric Co. was adopted, this firm having had considerable previous experience in the operation of swing and Scherzer rolling bridges. The main objects of the scheme were:—(1) The safety of the public; (2) To make the bridge so fool-proof that it could safely be operated by unskilled and consequently inexpensive labour, and to arrange the operation so that only one man would be needed to do everything necessary for opening or closing the bridge and gates, and that he could operate from one position.

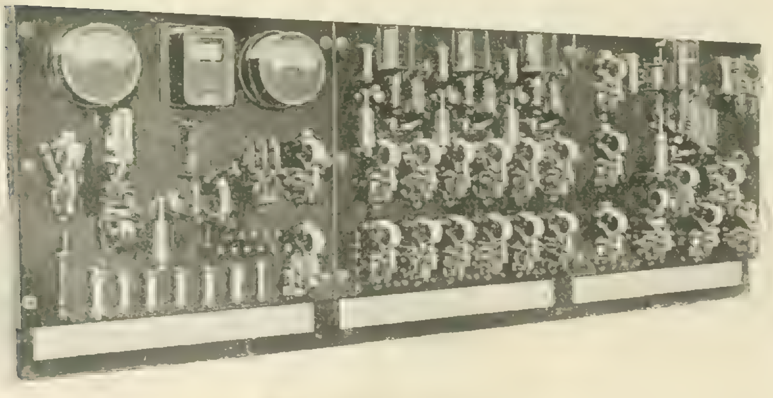
It thus dispenses with the services of two other men, who, under a mechanical scheme, would have been necessary day and night to open and close the road gates, &c. For this purpose the whole of the operations are put under the control of a small master switch in the bridgeman's cabin. This master switch is of the most simple and mistake-proof character. It consists of a small metal box having a vertical handle which is moved in one direction to open the bridge, and in the opposite direction to close the bridge. On the box are marks on each side of the centre, showing the position to which the handle should be moved for each successive operation of opening or closing the bridge. This master switch is the only piece of apparatus that has to be manually operated, all the rest of the controlling gear being automatic.

The sequence of operations is as follows:—Assuming the bridge to be closed to canal traffic. To open the bridge the operator moves the master switch handle to the first position in the direction marked "open." This first sets at "danger" a semaphore signal at each end of the bridge, and causes a loud ringing bell to sound in the road at each end of the bridge and up the side street. Until this bell has rung for a predetermined time (say 10 seconds), nothing further can be done, no matter how the operator moves the master handle. When this period has expired, it is possible, by a further movement of the master handle, to open the runaway points so that a runaway tramway car could not run on to the bridge or into the canal, but would be turned on to side lines.

Electrically-Controlled Canal Bridge at Dalmuir.



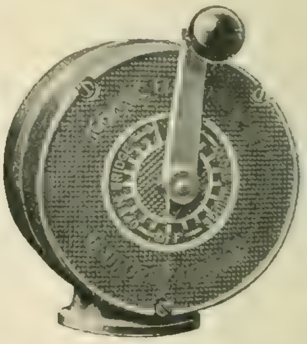
Group of Bridge Control Gear in Works.



Main Control Panel.

A further movement of the master controller handle switches the electric current from the tramway overhead wires on to the switchboard in the machinery house, so that it is available for turning the bridge, and the overhead wires on the bridge are at the same time made dead.

On moving the handle to the next notch, the road gates on the east side of the bridge are started in the closing direction, and this movement continues until the gates are within, say, 18 in. of being closed, when they automatically stop. The gates on the west side are then nearly closed in like manner, and after this it is possible to entirely close first the eastern pair of gates, and then the western. The object of this intermediate partial closing of the gates is to prevent the possibility of a child or a careless or intoxicated person being caught and squeezed between the gates. The gates, having been closed, are automatically locked in position.



Master Control Switch.

A further movement of the master handle unlocks the bridge bolt, which is used to keep the rails on the bridge in correct alignment with those on the road, and when this bolt has been withdrawn, it it possible by a further movement of the master handle to start the jacking motor so that the jack is unscrewed. (This jack is used to take the weight of roadway traffic when the bridge is closed and prevent any movement of the bridge while traffic is passing over it.) The bridge is now ready for swinging, and the master handle being moved to the next position the bridge motor starts and the bridge swings in the opening direction. When it is nearly open, it is automatically slowed up and finally stopped without any jar against the abutment, and this slowing and stopping are entirely automatic and demand no care from the bridgeman. The master handle can now be moved to the central position again ready for closing the bridge. To close the bridge the operator would move the master handle step by step in the opposite direction to that for opening. It is impossible either when opening or closing the bridge to do anything out of the proper order, no matter how the master controller handle is operated, as the various functions are so interlocked that improper or impatient operation only stops the process of opening or closing and compels the operator to confine himself to the proper method. For example, should the operator impatiently move his master handle forward to commence any movement of the machinery before the proper preceding movement has been entirely completed, he would only succeed in stopping all movement until he moved his handle back to the correct position and proceeded in the ordained manner. He is kept informed of the completion of each movement by a visible signal given automatically on an illuminated indicator in his cabin. The operator can, in case of emergency, stop any operation at any point and can even, if necessary, reverse it. Furthermore, he can at any time sound the loud alarm bell by merely pressing a button.

Every operation is performed by electrical means and the design is such that any failure of the electrical supply or any breakdown of any part of the gear can at the utmost only stop the operation of the bridge, but cannot produce improper operation and thereby lead to an accident.

A bridge on similar lines is under construction at Kilbowie Road, Clydebank, in connection with the tramway extensions from Clydebank to Drinbocher.

LEGAL.

Ruthenberg v. British Abrasive Wheel Co.

(*Concluded from page* 315.)

The plaintiff was called, and in the course of his evidence said that the insulation was not first class and suitable for the pressure which it had to withstand. He was unable to account for the breakdown. He went to the works of the defendants in company with Mr. Swinburne, the well-known electrical engineer, to make tests. They were met by Mr Strover, on behalf of the company, who told them that the asbestos cloth insulation for the water-jacket had not arrived. When the asbestos cloth did arrive Mr. Strover and his assistant proceeded to wind it round the electrodes, and bound it with what was known as broom-wire—an iron wire coated with tin. The work was not satisfactory. It was a continuous wire, and when it broke the whole uncoiled. It broke immediately they tried to put the electrodes into the jacket. They could only get two electrodes in, and Mr. Strover persisted in using a stump 18 in. long. When remonstrated with, he said he could not afford to throw the stump away. Witness saw the stump brought from the waste dump, where it had been thrown away. It was not possible to get a whole carbon in, and witness was so anxious to get the test over that he agreed to run with the stump. Witness described in detail the manner in which the test was carried out, and said that the manner in which the test was made was responsible for the failure of the furnace to work properly. Mr. Strover, when the test had been made, said the pump was no good, the furnace was no good, and he (witness) was no good. He (witness) agreed that it was useless to carry on the test under the circumstances.

On March 3rd further evidence was called in support of the plaintiff's case.

Mr. Ernest Robert Watson related the steps which had been taken by him to test the transformer. He said it was wound for a high voltage. It broke down owing to a leakage from the bottom.

In cross-examination, he said that assuming proper precautions were taken there would be nothing improper in putting it to a test of 9,000 volts.

Mr. John Pinnock, foreman at the machinery department of Tangye & Co., described the test to which he had put the "jack." He said that he had subjected it to the hydraulic test of 8¾ cwt. to the sq. in., which was equal to a carrying power of 3¾ tons.

Wm. Bishton, also employed by Tangye & Co., also gave evidence as to other tests.

Mr. Clavell Salter, K.C., in the course of his opening for the defence, said that the contract having been made, the defendants took works on the Tyne where they were going to manufacture the abrasive wheels, and waited for the furnace to come, but it was not delivered until long after the contract time, and when delivered, he contended, it was a worthless thing. A plan was submitted to Mr. Strover, and after examining it, he said in fact, "go ahead," but that could not relieve the plaintiff of responsibility. The specification sent was, in fact, for a wholly different furnace. Mr. Ruthenberg asked for £500 before delivery was complete. The defendants asked for delivery of the remaining parts, but plaintiff disclaimed any guarantee, and said that the furnace as ordered had been delivered, the other parts referred to being outside the contract. The other parts arrived in due course, and the furnace having been erected the power people required to test the transformer, and they submitted it to a fair and proper test under which it broke down. That involved a delay of 10 days for repairs, and it had stood the test afterwards and had been at work since. When the furnace was delivered it was tested, and the result was complete failure, no commercial result being obtained. With the exception of the hood, the furnace was the ordinary electric furnace, and the hood seemed to be an encumbrance rather than an advantage. It was not suggested that the furnace, as worked by the defendants, was a hopeless failure, but as supplied by the plaintiff it was.

Some evidence was called in support of counsel's statement.

On Monday, March 8th, further evidence was given for the defence.

Mr. E. G. Strover related the various experiments he had made at the works of the defendants in order to make the furnace effective.

In cross-examination, he said that on July 26th the furnace was erected, in accordance with the plans, with the exception of the electrodes. On August 26th, he said, they had an explosion, after which he took off the water-jacket. He continued working with the outer shell until September 25th, and then he took the hood off. Subsequently he made various other changes. Witness admitted that the correspondence showed that the plaintiff objected to the removal of the shell or jacket, and that he (witness) had said that it had been removed for the time being because it was in the way. He removed it before it had been tried.

Other witnesses were called, and the hearing was again adjourned. On Tuesday, after counsel's speeches, the Referee gave judgment for the defendants on the claim and counterclaim, with costs, and judgment was entered accordingly.

British Insulated and Helsby Cables, Ltd., v. Crittall Manufacturing Co., Ltd.

In the Official Referee's Court, on March 1st, Mr. Muir Mackenzie commenced the hearing of an action for the recovery of £544, the price of an electric welding machine, &c. The defence set up a counterclaim for breach of contract, the defendants alleging that in view of the contract being carried out they purchased a motor and generator and other electrical plant in connection with the welding machine, at a cost of £283. The defendants also claimed for expenses incurred in setting up and testing the machine. They contended that the machine did not comply with the specifications and description contained in the contract, and that it was totally unfit for welding casement frames. The machine, at the request of Messrs. Bullock, acting on behalf of the plaintiffs, was returned for further tests and alteration.

Mr. Greer, K.C., for the plaintiffs, said there was no dispute as to the order having been given or as to the delivery, and subject to the counterclaim the plaintiffs were entitled to judgment for the amount due. The defendants contended that as the welder had not complied with the contract they were not liable to pay for a copper and rubber cable. The plaintiffs were, said counsel, manufacturers of electric welding machinery, and they had had during the past 20 years considerable experience in that kind of work in this country. The defendants, who were makers of metal casements for windows, got their material in bars, which had to be welded together in order to form the frames. Up to the time when they purchased the plaintiffs' machine, they had welded their bars by means of gas blowpipes, which was not nearly so efficient as the process of applying heat by means of electricity. What the defendants complained of was that the plaintiffs had undertaken within a given time to deliver a machine which would weld casement metals with a minimum of errors, and this, they said, the plaintiffs' machine did not do, and that further time was allowed the plaintiffs in which to complete the contract, which they failed to do. Counsel detailed the circumstances which led up to the contract and explained that the delays complained of were brought about by matters which were outside the contract. The defendants, for instance, he said, failed to send the materials which were necessary for making the test under the contract. Another cause of delay was that there was no permanent power plant upon the works. There had been a fire on the works, and the insurance company did not approve of the temporary plant introduced. He contended that the plaintiffs had produced a satisfactory machine, and he suggested that the Referee, with experts representing each side, should visit the works and see the machine at work.

The **Referee** expressed his willingness to see the machine, after hearing the evidence, and before giving judgment.

Mr. Sidney Chas Bullock, manager of the electric fitting department of the plaintiffs' firm, gave evidence in support of the plaintiffs' case. He said that the plaintiffs experimented upon bars sent to them by the defendants in September, 1911, and explained how the welds were made, with results which proved satisfactory when they were submitted to the test of force. Where the welds did not prove satisfactory, it was owing to the parts being of different dimensions. He pointed out to Mr. Crittall that he could never expect to get satisfactory welds with bars which varied in thickness to such an extent as those that had been submitted for test.

In cross-examination as to the importance of the variation in the dimensions of the bars, the **Witness** said that where the ends of the bars did not come into close contact with the clamps, the parts did not heat equally, with the result that an imperfect weld was formed.

On the hearing being resumed on March 3rd, the **Referee** said he would like to see the machine at work, but it would not be convenient for him to visit the works until Tuesday this week, and in the meantime the evidence in support of the plaintiffs' case might be completed.

Mr. Greer, K.C., said it might not matter whether the machine was now in a complete condition, as, technically, the defendants might say they were entitled to refuse the machine because it was not demonstrated at the time; but even that would not entitle them to throw upon the plaintiffs the cost of the experiments.

Mr. Paul Bucher, manager of the plaintiffs' electric welding shop, a position which he said he had held for eight years, in the course of his evidence described the manner in which the welding was carried out in the case of a printer's chase, the machines for which he had designed and carried out himself. In that case, he said, the material was cold-drawn steel, and at the welded corners the bars were square cut. Before doing the defendants' work he had had no experience in making metal casements. The metal sent to be welded in the first instance differed from that supplied after the machine was delivered to the defendants, and the clamps previously used would not do for the material supplied later.

Clamps were very important in a welding machine, and he could only make the clamps by having the materials to be worked upon, or dimensioned plans.

The hearing was again adjourned.

On March 4th, evidence was given by Dr. Brislee, the British Insulated Co.'s analyst, as to the result of his analyses of the metal submitted to the plaintiffs for the experimental working of the machine. He said that the result of his analyses was that an excess of sulphur existed in the metal, and that that excess was prejudicial to good welding. There were other chemical constituents in the metal in addition to iron, and he was not prepared to say that the fault was attributable to any one of them alone; but for the purposes of electric welding an excess of sulphur in the metal was a fault which prevented good welding. There was an essential difference between electric welding and welding by gas. The Cable Co. were great experts in electric welding.

Mr. D. Sinclair, electrical engineer and general manager of the plaintiffs' works, said that he had occupied that position since July, 1902, and before that he was 20 years with the National Telephone Co. He had had a wide experience in all varieties of electrical machinery for many years as a buyer, and later as a seller. The turnover of the Cable Co. was in the vicinity of two millions per annum. He took no active part in the designing or preparation of the machine in question; but when the difficulty arose he received a personal letter, in consequence of which he had an interview with Mr. Crittall, sen., at which Mr. Ballock, Mr. Harris and Mr. Bucher were present. The result of the meeting was, more or less, a compromise. Mr. Crittall had refused to pay some money which he (witness) thought had nothing to do with that particular transaction. The money was overdue from another account, and Mr. Crittall ultimately agreed to pay it. Upon that the machine was discussed as well as the size of the iron used for making the frames. It was agreed that the machine should be returned to the works, and that the defendants should supply the company with samples of such iron as they could buy commercially, and the company, on their part, agreed to do all that money and skill could do to make the machine properly. He believed it was understood that a reasonable inspection of the machine would be made by the buyer in conjunction with the company's experts, and he believed that at that time both parties thought they could be satisfied.

Mr. Bucher was recalled for further cross-examination, and in answer to Mr. Colam, he said that the novelty of the process of electric welding was that by using a great amount of current in excess of the carrying capacity of the metal heat was generated and the metal melted. The process was a speciality, but there was no difference in principle between the company's process and the process which was in use by German and American firms.

On Friday, March 5th, Mr. Harry Hughes Harrison, A.M.I.E.E., was called. He said that he was engaged as engineer at the London office of the plaintiff company, with whom he had been for over nine years. He first came into communication with the Crittall Company in 1911, and previous to that date he had not made any mitre welders. He referred to a number of interviews which he had had with the defendants as to the possibility of making successful mitre welds, which ultimately resulted in the contract. After that date he had no further negotiations until June, 1913, and then it was with regard to a compromise. At that time it was pointed out to Crittalls that there were difficulties in regard to the heating, owing to the variations in the bars, and that it would be necessary to provide a modified design of clamp. Mr. Ballock had stated that he and Mr. Bucher had discussed such modification, and that they were confident it would be successful, but that it would involve a decrease in the rate of output. The amount of decrease was not mentioned, so far as he remembered, but Mr. Crittall stated that they badly wanted the machine.

Mr. Colam, K.C., in stating the case for the defence, said that while experimenting with the machine they were honestly trying to get it to work. He pointed to certain alleged defects, and said that if the defendants were captious, and were trying to get rid of the contract, they would have at once told the plaintiffs to take the machine away, instead of trying in every way to remedy the defects, and this contention he supported by letters which had passed between the parties.

The hearing was again adjourned.

Tungsten Drawn Wire.—Petition for Licence.

(*Continued from page* 315.)

Evidence was given on behalf of the petitioners.

Mr. Cecil Douglas Falcke, secretary of the Robin Electric Lamp Co., stated that the Association's list price for lamps with a voltage of 200 to 250 was 2s. 8d., and for lamps of a low voltage 2s. 2d. The Association firms issued rules for the re-sale of tungsten lamps.

Mr Cave called upon the other side to produce a copy of these rules

Mr. Walter said he did not care for the Tungsten Lamp Association. He did not produce the rules.

Mr. Cave said witness had obtained what purported to be a copy. This was handed to the Judge, together with the price lists of the "Mazda," "Wotan," "Osram" and "Ediswan" lamps, which showed that the prices were all the same.

Mr Falcke said his company gave an experimental order for lamps in squirted wire, and these were made at 1s. 4d. each for low-voltage lamps, and 1s. 6d. each for high-voltage lamps. Messrs. Siemens made lamps for them with a voltage of 105 at the price of, he thought, about 1s. 8d.

Cross-examined by Mr. Walter: His company wanted to work under the Siemens and B.T.H. Co.'s patents, but they had no process at present and were not making any lamps. His company had obtained an estimate for the establishment of a complete factory for making lamps and wire. This was about £25,000. The cash capital of his company was £10,350. The company was promoted by the R. F. Syndicate, which was then taken over by the company with its British and foreign patents for 50,000 £1 shares. Two-filament lamps might be old, but the idea of their cap was new. His company's patent cap could be fitted to the lamps made by others.

Mr. Walter: Your ingenious idea is for a clip round a lamp, to take 1s. 2d. as the cost and sell for 2s. 10d. less the discount to the trade, and net a profit per lamp of something like 1s. You now desire to come in after all the pioneer work has been done with a licence to start where others have ended?—That is not our fault.

Witness said his company intended to make lamps in all the standard voltages and candle-powers.

Cross-examined by Mr. Colefax, Witness said they rejected an offer by the Siemens Co. as wholly unreasonable, namely, 1s. higher than the list price.

Mr. Spencer Flower, a director of the petitioning company, said they would prefer to buy their drawn tungsten wire from one of the patentees, but if they got a licence they were prepared to make their own. They would have no difficulty in getting competent employés and in getting capital if the present obstacles were overcome.

Cross-examined by Mr. Walter, Witness said the original purpose of the company was to buy wire and get lamps made for them, but whether they afterwards made lamps themselves was a question of policy. It was never their intention to import lamps. Their intention was to fix the price at the same figure as lamps were being sold at. They might charge a few pence extra.

Mr. George Hookham, of Birmingham, stated that he was interested in the Robin Co., but was not a director. He had no doubt as to the practical utility of the Robin lamp, or as to the reception it would meet with at the hands of the public if it were put on the market at a reasonable price.

Mr. Joseph T. Robin, the inventor of the Robin lamp, said that in an interview with the representative of the Siemens Co., the latter said they were very anxious to get the order for making the lamps, but they had to make conditions as to the price. The Tungsten Lamp Association wanted them to impose a price of 2s. higher than the list price, instead of 1s., but as the result of negotiations, the Association agreed to reduce the charge to 1s. more than the list price. The price was fixed on the amount of the discount, but he knew that bigger discounts were being quoted to other people. The Robin Co. had several customers waiting for their lamps.

Cross-examined by Mr. Walter: His company had considered the question of importing double-filament lamps, also wire. As to what would be a fair profit, it would not be fair to sell for more than the Tungsten Lamp Association obtained, because they thought that the Association were making too much money out of their lamps.

Re-examined by Mr. Cave, who asked if he had any idea of the profits made by the members of the Association, Witness said he had the word of one of the principal directors in Berlin of the company which made the Osram lamps that the profits were very high.

Mr S. Biheller, of the firm of Weiss & Biheller, Chiswell Street, E.C., said he could get Austrian and German lamps for re-sale abroad at 6d. each. This would be the same type of lamp as was here charged 2s. 2d. for. He could compete with the Association in China and Australia by buying lamps at 7½d. each. The standard retail price for similar lamps in Germany was 1 mark 50 pfennigs.

Cross-examined by Mr. Walter: He did not sell in this country the lamps he bought at 6d. each because of the existence of the patents. In Canada they were sold to dealers at 18 cents each, and to the public at 40 cents each.

Messrs. Thomas Rose and L. J. Simon, electrical engineers, gave evidence as to the advantages of the Robin lamp. Mr. Rose said the price for drawn tungsten wire sold by the General Electric Co. in the United States was $5 per 1,000 ft.

Mr. Matthew Adams, an electrical expert who advised the petitioners on the wire patents which he had selected for inclusion in their petition, then gave evidence. Drawn wire, said Mr. Adams, reduced the cost of making up the lamps by not requiring so many joints in the filament.

What about the brittleness in the hands of the consumer?—It is less in the drawn wire than in the pressed wire. In time there is a tendency to crystallisation which tends to reduce the difference between drawn wire and pressed wire.

Have you found any country in the course of your inquiries outside the United Kingdom where the lamps have achieved so large a rise in price as in the United Kingdom?—No.

In your opinion is the price in the United Kingdom due to the merit of the lamp or other causes?—I think it is largely due to the great advertising of the people who had it in hand.

On the subject of competition, Witness said the putting of two groups into one combination restrained competition. In the competitive market royalties varied from 1 to 5 per cent. on the net selling price. He had known the royalty go as high as 10 per cent., but in a highly competitive field 10 per cent. would strangle a market.

Would the Robin lamp with tantalum have a reasonable prospect of success?—No, because tantalum has gone so much out of use that the public demand is relatively small.

Is the tungsten drawn wire important for commercial success?—Yes.

Mr. Adams, in reply to further questions, said he gave an order in Italy for drawn-wire lamps, and was supplied with six "Z" lamps and six Phillips. The lamps were shown to his Lordship, who observed that the "Z" was priced at an English equivalent of 8d., and the Phillips at about 8½d. Witness said these were the retail prices in the Italian market. As to the uses of tungsten which witness was asked about, he said he could not see why tungsten should not be used more than steel for some purposes, because it gave greater strength than steel and was non-corrodible. Tungsten wires might, for example, be used for piano strings, and if there was an industry in the wire there would be many industrial applications of it.

This closed the petitioners' case, and Mr. Cave summed it up. Whatever test, said Mr. Cave, was applied to the price of 125s. asked for the wire, that price was unreasonable, and it was wholly impossible to justify it. The petitioners were willing to take their relief on any reasonable terms, but his Lordship could not, under the Act, fix the price of the wire. They were willing to take a licence to make the wire only for the purpose of selling their lamps, upon the terms of paying a percentage on the sale price. Why should the Robin Co. not get a licence on the terms granted to the Ediswan Co.? They were also willing to import the wire and to pay a royalty upon every metre imported. The Court had never looked with favourable eyes upon combinations of the kind engaged in the tungsten wire business. They were not illegal, of course, but they were prejudicial to the interests of the public. He submitted that the petitioners had made out a case for a compulsory licence.

His Lordship intimated to Mr. Walter that he desired to hear him on the evidence that had been given.

Mr. Walter said certain sections of the Patents Act were imposed on patentees who were unreasonable, but the case contemplated by the sections had not been attempted to be made out by the present petitioners. They had put their case not on the ground that the public were in any way hurt, but that they, the petitioners, were refused a licence, and that the true construction of the sections was that anyone might have a licence under any letters patent, and that the desire of an individual to work under the patent was sufficient to justify the Court granting a licence. The petitioners' case must be put as high as that. They said they would like to have a licence under a group of patents which covered a large number of alternative methods of working, and then they would elect what they would do. There was no evidence of any existing trade or industry being unfairly prejudiced, or of any new trade or industry being unfairly prejudiced. Neither was there any evidence of any demand for the tungsten wire except by this company. The petitioners wanted to reap where others had sown by adding a small improvement to an existing invention and obtaining the benefit for themselves. They did not say under which patent they wanted to work, but they came to the Court for a general licence.

Mr. Colefax said his clients, Siemens Bros., were the owners of three patents, and the patented article in respect of each was different, because the process was different. No default on the part of his clients had been proved as regarded the manufacture of the patented article. Messrs. Siemens offered the petitioners to make their lamps on terms that were not unreasonable. The petitioners gave it out that their lamp would be a double-life lamp, and that was the basis on which they were going to conduct their business. It would be a great injustice to the Siemens Co. if the petitioners were to be put in a position of being able to come into the market, and with a lamp that was going to last twice as long as a single-life lamp and sell at the same price. The Siemens Co. therefore said to the petitioners: "We will supply you with the lamp, and all we ask of you is that you shall sell it at not less than 1s. above the single-filament lamp." That was not an unreasonable request.

His Lordship, in reserving his judgment, said that if he desired to hear the respondents' evidence, he would give counsel notice and fix a day.

R. L. Jones & Co., *v.* Orpheum, Ltd.

Mr. Verey, one of the High Court's Official Referees, on Friday March 5th, commenced the hearing of an action in which plaintiffs, a firm of electrical engineers carrying on business at Teddington, sought to recover from defendants, a Cinema Theatre Co., running picture palaces in various parts of the country, the balance of an account for electrical fittings, &c., for a theatre at Croydon.

The claim, said Mr. Woodcock, who appeared for the plaintiffs, was divided into two parts, the first two items of £50 each coming under a general contract for fitting up the theatre, a contract which provided for payments upon architect's certificates, and as to those he (counsel) contended that it was not competent for the defendants to go outside their contract. The other item of £46 11s. was for an electric motor and gear for raising the curtain, which was outside the contract work, which was to be done for £298. Specifications and an estimate were submitted by the plaintiffs, and approved by Mr. Gilbert Booth, the defendants' architect, who wrote an acceptance, the plaintiffs' undertaking being to do all the work of electric lighting and installing plant at the theatre. The work proceeded, and payments were made from time to time on certificates; but, notwithstanding the certificates, the defendants now sought to go behind them, and defended the claim on the ground that the work was not carried out according to contract, and that it was negligently and improperly performed. On particulars being applied for, they said that the motor-generators were not fixed so as to avoid vibration, the result of which was damage to the building, and noise causing annoyance to the audience. The generators, said counsel, were fixed under the supervision of the defendants' own architect, who chose the places where they were to be fixed, and he would not allow the generators to be bolted into proper cement-beds. If there were vibration, counsel contended, it could easily have been remedied, and throughout the whole of the correspondence he could find no complaint in regard to them. It was not until particulars were filed in the action that any complaints were made about vibration. Defendants further complained that the motor-generators sparked badly, but plaintiffs said that if there were sparking, it resulted from proper attention not being given to the machines. When fitted they were not sparking unduly, and were showing no signs of defect. The plaintiffs supplied Newton generators, which were the best on the market. The architect was satisfied, and there was no suggestion by him that they were not what they should be. Then the defendants said that the lighting was defective, but that was denied by the plaintiffs, who stated that any small defects were remedied at once. All the small matters complained of had been remedied, and no complaint had been made afterwards until affidavits were filed under Order 14. The work was duly passed by the local authorities, by the lighting authority, by the police, and by their own architect. There was, moreover, no condition in the contract as to the silent working of the motor. It was quite impossible, where a curtain motor was placed inside the theatre, to avoid some noise, and consequently the common thing was to have the motor placed outside. In this case the architect had to say where it should be placed, and he chose a place under the stage, although it was pointed out to him that there might be noise owing to the stage acting as a sounding board.

Some evidence was given in confirmation of the statements of counsel, and the hearing was adjourned until Monday, March 15th.

Sinclair *v.* Levinsky.

In the Shoreditch County Court on Friday, before his Honour Judge Cluer, Charles Sinclair, trading as the MacFarland Electrical Co., of 83, Camberwell Road, S.E., sued Abraham Lavinsky, of Canonbury, to recover £63 10s. for electrical goods sold and delivered for the Dalston Playhouse Cinema, Kingsland. The case had been remitted from the High Court.

Mr. A. E. Robinson appeared for the plaintiff, and the defendant in person.

It appeared that arrangements were made to build the cinema, and Messrs. Gasson, Cockerill & Co., Ltd., got the building contract. Payment had mostly been made by bills, accepted by a Mr. Davis, who made the contract, and had formed the subject of High Court actions. It was alleged that although Davis was the signatory to the contract, the real one concerned was the defendant, whom, it was quite understood, was financing Mr. Davis. The electrical goods concerned in the action, it was suggested, were extra to the building contract, and the defendant himself chose them and ordered them, together with Mr. Davis.

The Plaintiff gave evidence as to this, and said the only one he recognised in the matter was the defendant, who was introduced to him by the architect. It was true Mr. Davis was present when the goods were selected, but he appeared to be in the position of adviser, as the defendant did not appear to understand things thoroughly, but nothing was ordered except with the sanction of the defendant.

Mr. Ernest Cannell, the architect, said the defendant said he would see that the plaintiff was paid every penny. The builders refused to order the electrical fittings, as they said they were extra to the contract. Had the work gone through the builders it would have cost 10 per cent. more—their profit.

After a good deal of detailed evidence had been given, judgment was entered for the plaintiff, with costs.

A Question of Discount.

In the City of London Court, on March 5th, before his Honour Judge Rentoul, K.C., Mr. George Braulik, electrician, 8, Lambeth Hill, E.C., brought an action against Mr. E. C. Goodfellow, electrician, 28, High Street, Highgate, to recover £1 17s. 5d., being the balance of a substantial account for electrical accessories supplied. The defendant said that when the plaintiff executed his various orders it was agreed that he was to have 5 per cent. off the catalogue list in addition to 50 per cent. if he bought goods to the value of £25 or more. He put it on the order so there should be no misunderstanding. The plaintiff's representative said that they had given the defendant 50 per cent. discount, and their point was their traveller had agreed to give another 5 per cent. if the money was paid within a reasonable time, and that in their view the defendant had not made his payments within a reasonable time. Judge Rentoul, K.C., said in the absence of the traveller he must accept the defendant's description of the transaction. The plaintiff, like all other suppliers of electrical accessories, issued a catalogue charging 100 per cent. more than he was willing to take for the goods. That was done for the benefit of the innocent, but with traders like the defendant they knew they could get 50 per cent. off. It was a business matter. It was very similar in the piano trade, where people could tell their friends that they had bought an instrument listed at 100 guineas when they had in fact paid £45 for it. He went through the accounts, and in the end gave judgment for the plaintiff for 9s. 7d. and costs. The defendant subsequently returned and asked for his costs, but was informed he would have to pay the plaintiff's costs instead of receiving any for himself.

Power House Accident.—Railway Co. Fined.

At Formby, on March 3rd, the Lancs. and Yorkshire Railway Co. were summoned for a breach of the Factory and Workshops Act in connection with an accident which occurred at the Formby power house. Mr. Samuel Pope (instructed by the Mr. L. S. Holmes), appeared for the Director of Public Prosecutions, and Mr. Hyslop Maxwell (instructed by Mr. Parmiter), represented the company.

The accident, it was stated, occurred as the result of two men continuing to work at a live switchboard. According to regulations, they should have left the work until midnight, when the switchboard would be dead. They did the work on their own responsibility. When Hindley, one of the men, was on a step ladder, a cable he was carrying caught a live part of the plant. He was thrown from the ladder and severely burned. He was receiving hospital treatment, and the company were paying him compensation.

Mr. Maxwell pointed out that the company could have taken proceedings against Hindley for his action in working contrary to regulations, but they had preferred to take the responsibility for what he had done.

The Magistrate imposed a penalty of £20 and £20 costs.

Damages against West Ham Corporation.

Damages to the amount of £300 were awarded in the King's Bench Division, on Friday, before Mr. Justice Shearman and a common jury to Herbert Spicer, a baker's assistant of Leyton, against the West Ham Corporation. Last May he was driving his van along the Broadway, Stratford, when a wheel was wrenched off, it was alleged, owing to the defective condition of the tramway route. Plaintiff was thrown to the road and broke his arm, and it was said that the movement of the arm was permanently impaired. The Corporation denied the allegations on which the claimed was based.

Holbrook v. Ford.

In the City of London Court, on February 25th, before Mr. Registrar Wild, Messrs. J. Holbrook & Co., electricians, Foster Lane, E.C., sued Mr. Ford, shirtmaker, for 13s. 6d. for fitting up electric light at premises situate in Cheapside.

The plaintiffs' witness said that Mr. Ford made an application to them to fit the premises up with electric light. The work was carried out and no complaint was made. There were several applications for payment, and then Mr. Ford said he would let them have something on account. Later it was suggested to them that it was Mrs. Ford for whom the work had been done, and she had since been added to the proceedings. In January Mr. Ford came to them and told them he had nothing whatever to do with the business. That was the only evidence they had on that matter. The defendant, Mr. Ford, said he was instructed by Mrs. Ford to have the electric light put up. He (defendant) was only working as a porter for Mrs. Ford, and was getting no salary. Mrs. Ford had asked him as as favour to get the light put in. The Registrar said that the defendant went to the plaintiffs and did not say a word about Mrs. Ford being liable, but had himself given the plaintiffs the order for the work. What Mrs. Ford had said to him (defendant) was not conveyed to the plaintiffs. The defendant said what he had done was done on behalf of Mrs. Ford.

The Registrar said the defendant should have given the plaintiffs the opportunity of trusting Mrs. Ford. The defendant had made himself responsible for the work. There was no evidence in the case except what the defendant said about Mrs. Ford, and she would be struck out of the proceedings.

The Defendant said he had nothing to do with the matter.

The Registrar: You have everything to do with it. You have given the order for the work. You say you act as agent for Mrs. Ford, but inasmuch as you never mentioned it to the plaintiffs, you have made yourself responsible. It is no use your now saying the debt belongs to someone else.

Judgment was given for the plaintiffs, and an order made for payment in 14 days.

The Value of a Dog.

At the Manchester Assizes on February 26th, James Billington, travelling dealer, of Hilda Street, Moston, brought an action for damages against the Manchester Corporation, alleging that he received injuries while travelling on a city tramcar, through the driver pulling up the car suddenly. The driver of the car stated that he pulled up suddenly to avoid running over a dog. Damages of £100 were awarded to the plaintiff, and the jury expressed the hope that the driver would not suffer in any way. Mr. Justice Sankey expressed a similar hope, and counsel undertook to convey these expressions to his clients—the Corporation.

Ban on Electricity in Russian Churches.—The Eparchial Congress of Divines, having considered the principle and the practical aspect of allowing electric lighting in the churches in no case to be allowed in chandeliers, or before the sacred ikons (images), has proposed to lay a tax on the churches that use electricity, in favour of the Eparchial candle factory. The tax is to be 40 copecks (about 10d.) per lamp per year. The only lamps to be exempt from this tax are those illuminating vestibules. Cold churches, where services are only held in the summer time, will pay only half the tax.

WAR ITEMS.

American Electrical Exports.—The American "Electrical Review and Western Electrician" publishes the following particulars of the U.S. electrical exports for last December, and also for the calendar year 1914:—

The December total was slightly below that of the preceding month, and still much below that of the corresponding month in 1913. For the four classes for which the number of articles shipped is given in the Government reports, there were exported in December the following: Electric fans, 693; arc lamps, 52; carbon-filament lamps, 34,856; metal-filament lamps, 383,545.

Articles.	Dec. 1914.	Dec. 1913.
Batteries	$ 58,947	$ 45,928
Dynamos or generators ...	262,325	181,407
Fans	13,784	19,012
Insulated wire and cables ...	92,146	190,090
Interior wiring supplies, etc. (including fixtures)	54,836	52,125
Lamps—		
Arc	742	2,776
Carbon-filament	3,962	14,785
Metal-filament	64,058	21,267
Meters and other measuring instruments	21,200	—
Motors	271,192	376,122
Static transformers	62,097	134,213
Telegraph instruments (includ- wireless apparatus)	2,118	31,999
Telephones	113,627	159,030
All other	599,529	1,005,245
Total	$1,620,563	$2,233,999

The table of monthly totals for the year 1914 shows that early in the year already there was a decline month by month from the high totals of 1913, which became most marked, however, in August, the first month of the war:—

Months, 1914.	Electrical Exports.
January	$1,947,646
February	1,930,513
March	2,104,332
April	1,741,551
May	2,040,720
June	1,450,437
July	1,415,360
August	1,024,010
September	1,548,468
October	1,494,792
November	1,644,723
December	1,620,563

The annual totals for the years following 1908, when the last general export depression reached its lowest point, are:

Years.	Electrical Exports.
1908	$12,613,730
1909	13,027,550
1910	17,001,126
1911	19,355,536
1912	23,212,813
1913	28,197,363
1914	19,963,115

American Electrical Industry: Its Opportunity.—"In every industry the business leaders are realising that an emergency exists. Methods and policies are changing. The overworked word "efficiency" which rolled so smoothly from the tongues of many for several years, has come to have a new meaning. We all know that intensified production and efficiency in the shop and in the office have been, to a great degree, matters of a conversational character. To-day men are more than ever earnestly seeking better ways of doing business, and it is a part of every business man's creed that it is along the lines of intensified production and increased efficiency of operative movements that increased profits lie. Business men are planning ways and means to-day that either because of conservatism or fear would have received but scant consideration only a short time ago. The dearth of raw materials forced upon us by the European war, which has deprived us of easy and economical access to many things regarded as indispensable in the fabrication of many materials, has quickened the impulse of the American inventor and manufacturer, and new industries are springing up where it has heretofore been considered impossible to make a safe investment, to say nothing of gaining a decent livelihood. The necessity for quickly establishing new industrial relations and a better understanding of manufacturers in general of the economy and refinement of control of electrical energy, are attracting the brightest minds of aggressive manufacturers in every line of commercial activity to the use of electrical apparatus. . . . The present crisis is the opportunity of the electrical industry. As our factories become busier and busier there will be a greater demand for motor-driven apparatus, for other electrical appliances, and as the busy plants work up to their normal capacity the greater will become the demand for controlled power. As the necessity for night work comes on the desirability of the use of electricity as a medium of illumination will become more and more apparent. Any material prosperity which may come to other industries means a tenfold increase in the prosperity of those having to do with the generation of electrical energy and the manufacture and distribution of industrial electrical appliances."—"Electrical Review and Western Electrician."

An Appeal for Belgian Refugees.—Seventy little Belgian orphan children whose home (the Cathedral Orphanage) in Malines was burnt to the ground by the Huns, arrived in England, via Holland, in charge of their matron and Canon de Weerdt, in a pitiable plight. A place of refuge was found for them at "Highfield," Hendon, near London. "Highfield" was formerly a high school for girls, but it is now the property of the International Correspondence Schools, who purchased it the month before the war as a site for new headquarters for the Schools. The military authorities accepted the I.C.S. offer of the premises for accommodating wounded soldiers, but the claim of the seventy little ones was more immediately pressing and the buildings were placed at the disposal of the Reverend Mother of La Sagesse Convent, which is near by, as a Home for Refugees, for twelve months at a rental of one shilling per annum, the upkeep of the grounds and the other incidental expenses of the estate being undertaken by the directors of the I.C.S. The story of how the necessary furniture was got together, how the continuous flight from Belgium brought heavy demands, increasing the number in the home to 175, including 90 orphans, how all of these have been and are being fed and clothed, and the children taught and trained, how supplies have run perilously short, and how urgent is the need for assistance in order that the merest necessaries may be provided—all these things and more are told in a pamphlet issued by the I.C.S. The claims of Belgium are common to all Englishmen, and we pass on the appeal of the Reverend Mother and the Sisters of the Convent, heartily commending it to the generosity of our readers. One way in which support may be given is by purchasing tickets for a special matinee of "A Country Girl" that Mr. George Edwardes has kindly consented to give at Daly's Theatre on Wednesday, March 24th, for the benefit of the Home. These may be obtained from Mr. Edgcumbe Brighten, at the I.C.S. Offices in Kingsway.

The Swiss Aluminium Co.—The Chairman of the Neuhausen Aluminium Industry Co. has now made a definite statement setting forth the purely Swiss character of this undertaking, whilst the shareholders have unanimously sanctioned an alteration in the company's statutes expressing the Swiss nature of the enterprise in a more definite form. Why such steps should be deemed necessary is explained by the fact that the French Government has placed under compulsory administration—sequestration according to the Chairman—the company's subsidiary in Marseilles, which bears the title of the Société Francaise pour l'Industrie de l'Aluminium. The Chairman, in the course of the declaration made at the recent annual meeting, emphasised that the undertaking is a purely Swiss company which was formed 26 years ago, and still remains under the same chairmanship and the same management, and by far the greatest number of the shares have been in Swiss ownership for many years past. The company has lodged a protest against the action taken by the French Government, and hopes, with the support of the Swiss Federal Council, to secure the removal of the sequestration of the French branch company. Colonel Huber, the chairman, is reported to have further stated that the rumours circulated that the company was a German undertaking emanated from former French partners and collaborators who wished to injure the enterprise on the pretext of patriotism. However that may be, we note from the reports published in the German newspapers of the company's meeting that an addition of three Swiss had been made to the board of directors, which now consists of nine Swiss and six—not Germans but "foreigners." If, then, no addition had been made to the board, the number of "foreigners" would have still been equal to the Swiss. It seems unfortunate that the number of native Swiss has not been in a majority for years past.

Japan and Australia.—"The Sydney Morning Herald" states that Japanese Trade Commissioners were in Australia in January with the object of forming a stronger bond of commerce between the two nations. The head of the delegation, Dr. J. Miura, who is secretary to the Department of Commerce of the Japanese Government, interviewed some of the directors and heads of departments of business firms. Dr. Miura intends to stay in Sydney for two months, after which he will visit Melbourne, Adelaide, Tasmania, and New Zealand. His object is to interview the officials of the various State and Commonwealth Governments. The other members of the delegation, Messrs. F. S. Nakagawa, N. Matumora, and K. Hishida, are all business men in a large way in their own country, and they are at present getting into touch with the heads of the big business houses in Sydney. Mr. Matumora stated that he intended to investigate conditions and find out what was wanted. His firm were large general importers and exporters. They would take in Japan almost anything that Australia could offer. Till recently they had been importing large quantities of machinery from England, but this was now obtainable only in limited quantities. The market in Japan was dull, and they were looking farther afield for trade. He saw great possibilities for a market in Australia for glassware, which they could produce in unlimited quantities in Japan.

Board of Trade Assistance.—In connection with the special arrangements which have been made in the Commercial Intelligence Branch of the Board of Trade for dealing with enquiries, a list of goods which firms in this country have intimated that they are prepared to suppy is now ready, and may be obtained on application to the Director of the Branch at 73, Basinghall Street, London, E.C. The Branch has also issued List No. 9 of articles which enquirers desire to purchase.

Electric Lighting Engineers.—A Cardiff paper says that on March 3rd the Second Reserve Electric Lighting Companies of the Glamorgan Fortress Engineers left Cardiff for Milford Haven. They numbered 61 and were under the command of Captain Courtis, the other officers being Lieut. E. P. Rees and Lieut. Price.

Bradford Electricity Employés' Wages.—The Electricity Committee of the Bradford Corporation recently passed a resolution advancing the wages of engineers in the employ of the department by 3s. per week and reducing their hours to eight per day.

Roll of Honour.—Private John Horrocks, who has died at Blackpool, where he was in training, was formerly employed by the Lancashire Dynamo and Motor Co., Trafford Park, and representatives of the firm attended the funeral last week.

Private Walter Haynes (19) formerly in the employ of the Salford Tramways Department, has been killed in action.

On January 23rd, Private H. Dixon, of the 1st West Yorkshire Regiment, was fatally shot by a German sniper. He was a reservist, and prior to the war was employed as a conductor on the Leeds tramways.

BUSINESS NOTES.

Trade Announcements.—Messrs. T. Wainwright and Sons, Ltd., electricians, have removed from 257 to 329, Lord Street, Southport, their old premises being required for demolition.

The London and Rugby Engineering Co., Ltd., have removed to 36 and 37, Queen Street, E.C., which will also be the London address of The Rugby Lamp Co., Ltd., and Messrs. Jas. Proctor, Ltd. Their telephone number "City 5252," and telegraphic address: "Cleodora, Cannon, London," remain unchanged.

Russia.—H.M. Consul-General at Moscow reports that a firm in that city wishes to purchase, from United Kingdom manufacturers, electrical fittings and appliances. The firm is a large concern. Further communications should be addressed to the British Consulate-General, Moscow.

Bankruptcy Proceedings.—Albert Whiteley, electrical and mechanical engineer, Tudno Works, Tudno Street, Llandudno, Carnarvon.—The public examination of this debtor took place at the Magistrate's Room, Bangor, last week, when the statement of affairs showed an estimated deficiency of £310. The failure was due to want of capital, loss of money in former partnership and to the giving of long credit. The debtor stated that he commenced with borrowed capital, and had never been able to repay the loans. When in partnership he and his partner drew out about 25s. a week. He made more than that as a workman. There were now no remaining liabilities of the partnership. When he commenced to trade on his own account he had about £50 worth of stock and borrowed about £40. Altogether he borrowed about £150 from his mother, which was still unpaid. He had borrowed other sums. He sublet part of his workshop for £10 a year. It cost him £8 plus rates and taxes. He used to obtain a fair amount of contract work apart from cinema contract work. He had kept two men regularly, and had to pay their wages whether he had work or not. He borrowed some of the money to pay a specified creditor. He had no account to show what profit or loss he had made. He claimed a substantial balance of an account against a cinema company, and an independent engineer had been called in who had not yet given his report. His claim was for £142. Of late he had drawn £2 a week out of the business, which, however, could not really afford it. He had intended to offer a composition, but that idea fell through. The examination was closed, the Official Receiver remarking that the debtor had given every help in the elucidation of his affairs.

Geo Driver & Son, electrical and mechanical engineers, Hythe Road, Willesden Junction, N.W.—Receiving order made March 5th on creditor's petition. First meeting, March 23rd; public examination, April 22nd, both at Carey Street, W.C.

For Sale.—Walthamstow U.D.C. have for disposal one 160-kw. and one 133-kw. vertical Westinghouse gas engines, direct coupled to 460-volt D.C. generators. Tenders by March 24th. Particulars are given in our advertisement pages to-day.

Catalogues and Lists.—Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Two new cards—one a postal card and the other a folder. The former gives prices of Royal Ediswan drawn-wire lamps; the latter gives fuller information, prices and illustrations of the same lamps. Both bear in colour a new Ediswan pictorial design for war time, the object of which is to emphasise that the lamps give a strong and penetrating light, and, we suppose, will stand anything. A publicity novelty in the shape of a small blotter has also been received.

Jackson Electric Stove Co., Ltd., 38, Blandford Street, London, W.—Two price cards (Nos. 9 and 10) with illustrations and brief particulars of their electric grills and breakfast cooker respectively.

General Electric Co., Ltd., 67, Queen Victoria Street, E.C.—Leaflet No. H 1,858, illustrating and describing Magnet portable electric cookers, models A and B.

The St. Helens Cable and Rubber Co., Ltd., Warrington.—Booklet giving the actual experience of users of cab-tire sheathed cable, with other information. The uses referred to include the wiring of chemical works, outdoor cranes, collieries, dye works, galvanising tanks, ironworks, lavatories, soap works, stables, and many other difficult situations, such as motor-cars, lifts, &c.

The Edison and Swan United Electric Light Co., Ltd., 123-125, Queen Victoria Street, E.C.—Leaflet relating to Ozonair apparatus, to which a display has been organised at the above address, machines being shown suitable for a variety of domestic and business purposes.

Book Notices.—The February number of the *Journal* of the Tramways and Light Railways Association contains extracts (including table matter) from the Board of Trade return respecting the working of tramways, light railways and railless trolley systems for 1913-14; also interesting excerpts from the report of the London Traffic Branch of the Board of Trade.

Annuaire de l'Electricite. Paris: *La Lumière Electrique.* Price 4 fr.—This is the second edition of a very useful publication, containing a mass of information relating to the electrical industry in France. More than half the volume consists of a list of towns and villages which have a supply of electricity, with the name of the supply authority, particulars regarding the supply, and the tariff. Hamlets of a few hundred inhabitants are included, and we notice one of only 29.

Other sections deal with traction, electricity companies, public bodies and societies, legislation relating to electricity, educational institutions and *personnel*, the electrical Press, and electrical manufacturers. The work is very complete, and should prove useful to many who have business relations with our Ally.

The Relay Automatic Telephone Co., Ltd., of Marconi House, London, have issued a booklet describing the system devised by Messrs. Betulander and Palmgren, of which an account was given in the Electrical Review of July 10th, 1914; the method of operation of the numerous relays upon which the system wholly depends for its action is difficult to follow, but in this booklet excellent diagrams are given, showing the successive operations clearly, with explanatory letterpress, and illustrations of actual apparatus. The revolutionary character of this system, as compared with all previous automatic systems, and the importance of the new departure thus made, were emphasised in our pages at the time of its introduction.

Universal Electrical Directory (*J. A. Berly's*). 34th Annual Edition. London: H. Alabaster, Gatehouse & Co.

Trade with Canada.—In accordance with the practice that has been established for H.M. Trade Commissioners in the British Self Governing Dominions to visit the United Kingdom officially from time to time, so that manufacturers and merchants may have the opportunity of consulting them on any matters connected with their business, or of obtaining information as to the possibilities of extending their trade, it has been arranged that H.M. Trade Commissioner for Canada (Mr. C. Hamilton Wickes) shall shortly pay an official visit to this country. H.M. Trade Commissioner's visit is particularly opportune at the present time, when United Kingdom manufacturers are attempting to capture trade hitherto done by German firms in Canada, and it is anticipated that a very large number of firms will wish to take advantage of this opportunity to consult him. Among the matters in regard to which he is prepared to give information and advice are the appointment of agents, methods of marketing and distribution, terms of payment, names of probable buyers of British goods, statistics of imports, and rates of Customs duties, in Canada.

Mr. Hamilton Wickes will attend first at the offices of the Commercial Intelligence Branch of the Board of Trade in order to meet representatives of those firms who may be able to see him in London, and afterwards he will visit such trade and industrial centres in the provinces as it may appear most advantageous to visit in view of applications that may be received from firms in or near those centres, and from Chambers of Commerce.

In order that appointments may be satisfactorily arranged, firms who may desire to have an interview with Mr. Wickes are requested to make their applications as soon as possible. Such applications should be addressed to the Director, Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C. The reference number C.I.B. 10732/15 should be quoted.

British Trade with Nigeria.—Mr. C. A. Birtwistle, Commercial Intelligence Officer in Nigeria, the Correspondent of the Board of Trade for that Colony, who is now on a visit to England, will attend at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C., on Wednesday, Thursday and Friday, March 17th, 18th and 19th, between the hours of 10 a.m. and 5 p.m., and will be pleased to see, by appointment, British manufacturers and traders who may desire to consult him regarding trade conditions and openings in Nigeria. Applications for appointments with Mr. Birtwistle should be made promptly to the Director of the Commercial Intelligence Branch as above.

Exhibition. — Messrs. Ward & Goldstone are exhibiting a large range of their British-made electric pocket lamps, torches, cycle lamps, novelties, &c., at the Toy Fair and Market, which opens at the Agricultural Hall, Islington, on March 16th. Purchasers of these lines will be welcomed at Stand No. 74.

Dissolution.—Parker & Jubb, electrical engineers, King Street, Wakefield.—Messrs. P. Parker & S. Jubb have dissolved partnership. Mr. E. A. Fowlie, of 15, King Street, Wakefield, will attend to debts.

Exhibition Postponed.—The Shipping, Engineering and Machinery Exhibition, which was to have been held at Olympia last September, and was postponed on account of the war, is to be further postponed until August and September, 1917.

LIGHTING and POWER NOTES.

Australia.—The Taree (N.S.W.) Municipal Council proposes to establish an electricity undertaking in the town, and an inquiry was to be held into the question of borrowing money to finance the scheme.

The Campbelltown (N.S.W.) Municipal Council has decided to recommend the ratepayers to adopt electricity for street lighting, and has resolved to obtain expert advice with regard to the cost of the installation.

The Tenterfield (N.S.W.) Municipal Council proposes to borrow £6,200 for the purpose of establishing electricity works.

The Warwick (Queensland) Municipal Council has adopted the report of the Government hydraulic engineer on the Canning Downs water scheme; the energy for pumping purposes is to be obtained from the Warwick Electric Supply Co.—*Tenders.*

Bacup.—Public Lighting.—The T.C. is substituting electricity for gas lighting on the Todmorden Road.

Barnet.—Workhouse Lighting.—In view of further information, the B. of G. has decided to reconsider the question of producing its own current for lighting the workhouse, with a view to the supply being obtained from the North Metropolitan E.P.D. Co.

Batley.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £6,500 for electric cable extensions in the districts of Healey, Staincliffe, Carlinghow and Bradford Road West.

A Sub-Committee has been deputed to consider tenders for transformers and switchgear, and also to report as to the provision of sub-stations, &c., in connection with the proposed cable extensions.

Blackburn.—Restricted Lighting.—The order for reduced lighting which has now come into force, affects the public arc and tramway lighting, while outside shop lighting is prohibited.

Bexhill.—Coal Prices, &c.—The T.C. has decided to pay the contractors an additional 1s. 6d. per ton over the contract price for the supply of coal to the electricity works. The Electricity Committee has reduced the public lighting account by £51 for the three months ended December last owing to the restricted lighting. It was stated that instructions had been given for further reductions in the lighting of the streets.

Bradford.—The Electricity Committee has decided that, pending the settlement of the wages question between the Federated Employers and the Amalgamated Society, and commencing immediately, a 15 per cent. war bonus be paid to the mechanics, smiths, fitters and other workmen in the electricity department.

Electric Cooking.—An official inspection of the electric cooking installation at the Kursaal (Queen's Hall), by the members of the Council, took place on Tuesday evening.

The Lord Mayor occupied the chair at the dinner which followed, and which was cooked electrically.

In the course of the evening, Mr. R. S. Downe, on behalf of the Brompton and Kensington Accessories Co., Ltd., who supplied the installation, referred to the advantages of electric cooking, and to the up-to-date character of the Kursaal equipment, which is designed to provide a table de hôte dinner for 500 persons. In an ordinary middle-class house, he said, the cost of electric cooking would not exceed $1\frac{1}{2}$d. per head per day, with energy at 1d. per unit. In the B. and K. electric restaurant the energy used did not exceed ⅔ unit per head, and if they had 250 meals a day, he would guarantee that the energy for cooking would not exceed ½ unit per head. Amongst the apparatus installed are a central range fitted with Bain Marie and four ovens, a circular steamer, fish frier, grill and water urns. In the ground floor café a carving table and hot cupboard, tea urns, a toaster, cooker and hot-water geyser are provided, while further apparatus is fitted in the middle café. Electrically-heated towel-rails are provided in each of the cafés, these and a geyser for the wash-bowls having been supplied by the British Electric Heater Co., Glasgow.

The Corporation has appointed the Chairman of the Electricity Committee and the Town Clerk to represent it on a Joint Committee of representatives of West Riding County Boroughs, who have lodged petitions against the Yorkshire Electric Power Bill, to watch the interest of the combined authorities.

Burton-on-Trent.—Rate Relief.—A sum of £4,000 is to be appropriated from the electricity and gas departments in aid of the rates, subject to the approval of the Council.

Cahirciveen (Kerry).—E.L. Scheme.—A public meeting was held during last week to consider a proposal for the electric lighting of the town. Mr. E. L. Cantwell, of the Ampere Electrical Co., explained the scheme, and a Committee was formed to canvas the district.

Canada.—Amongst the contracts reported to have been placed in connection with the war is one for the supply of 300 electric heaters for use in the trenches.

Chertsey.—The Ascot District Gas and Electricity Co. has informed the R.D.C. that it has been decided to reduce the price for current in the whole district of Ascot to 6d. a unit, flat rate, for lighting purposes. The consumers in the Woking area would thus be entitled to the same terms.

Continental Notes.—Norway.—As previously reported, the order for the six generators and turbines for the new power station, Rjukan II, of the Norwegian Hydro-Electrical Co., was placed with the Allmana Svenska Elektriska A/B, and these are the largest hydro-electric sets in the world. The work of installation has now been going on for some time, and the first generator was recently run on trial. The result showed a maximum capacity of 18,900 KW.

Before the war there were rumours that the Norwegian A/S for Electrochemical Industry was carrying on negotiations with the Government for the purchase of energy from some large waterfalls at Hemnas, in Ranen, belonging to the State. Ranenfjord is situated about on the same latitude as the Polar Circle. Last year the company bought two large deposits of limestone in the neighbourhood, and negotiations for a third one have been completed, thus providing materials for the future manufacture of nitrates or kindred products. As the company occupies a strong financial position, it is not improbable that the district, in a few years' time, may be turned into an industrial centre like Rjukan. The available energy of this district is roughly estimated to amount to more than 200,000 H.P.; a portion of it will, no doubt, be reserved for the electrical smelting of iron ore, and for a projected electrical railway from Trondhjem to Bado, but there will still be sufficient left for the nitrate industry or the electrochemical industry.

A new company—the A/S Blaafjeldene—has been formed to acquire the water rights of the River Blaaelven, in the province of Sondhardland in Western Norway, which will produce 100 000 H P. The company has also bought a large area of ground at Indre-Motre, suitable for sites for the future electrical works and factories, and an application for the necessary concession has been submitted to the Government. The capital of the new company is £27,800, which, however, will be increased when the concession is in order.

The Faaberg Municipality, in the neighbourhood of the town of Lillehammer, has decided to take up a loan of £5,500 for the purpose of distributing electrical energy among the inhabitants.

At the well-known tourist centre of Balestrand, in Western Norway, an electrical station, deriving power from two small rivers in the neighbourhood, has been built.

The parish of Raade, near Fredrikstad, has decided to erect a sub-station to be supplied from the Kykkelsrud works—which supply Christiania—and to distribute energy in the neighbourhood.

The parish of Skaanevik has recently secured the water rights of the Lia River, in Motre, and will develop 5,000 H.P., which is sufficient to cover the requirements of the district.

The authorities of the Province of Akershus, to the north of Christiania, have purchased the large Renaafos, which is a waterfall capable of delivering 25,000 electrical H.P. The price was £55,000, and it was originally intended to develop the fall at once, but this may be deferred owing to financial difficulties. The province of Akershus has a population of 130,000, and some of the parishes have no supplies of energy as yet. The project is not connected with any large industrial enterprise, as the whole amount will be needed by the population at the rate of ¼ H.P. per capita.

Cuba.—The following persons have been granted permission to install electric generating and lighting plant in Cuba:—Senores Maristany and Florez Estrada, at Campo Florido, Province of Havana; Senor Galvani, in the town of Antilla, Province of Oriente; Senores Pollo and Herrera, at Coliseo, Province of Matanzas; and Senor Cuesta, in Arroyos de Mantua, Province of Pinar del Rio.—*B. of T. Journal.*

Darlington.—Proposed Loan.—The T.C. has decided to make application to the L.G.B. for sanction to a loan of £13,000 to meet the expenditure for mains, services and transformers during the next three years.

In answer to the Corporation's representations, the L.G.B. has extended the period for the repayment of a loan of £9,500 for mains, services and transformers, from 15 to 25 years, and in respect of another loan of £1,690, half to be paid in ten years (the original period fixed), and the other half in 20 years.

Dover.—Railway Supply.—The T.C. has concluded an agreement with the South-Eastern and Chatham Railway Co. for a supply of current to the new Pier Station. The Council will supply up to 15,000 units a year at 4¼d., and beyond that at 3½d. per unit.

Dublin.—The City Electricity Committee has agreed that no commission be paid to canvassers bringing in orders unless with a guarantee from consumers to use £5 worth of electricity annually for five years.

The Chairman of the Dublin (Electric) Tramways Co., replying to statements made at the last Corporation meeting as to the relative charges for electricity in Dublin and Cork, says the Cork Co. supply power to private users in some cases as low as ¾d. per unit, while the charge for tramway power is still lower—viz., ·61 of a penny. The average price for light and power in Cork is 1·95d. per unit against a Dublin average of 2·99d.

Eastbourne.—New Turbine Plant.—The T.C. has adopted the recommendation of the Electricity Committee to purchase a 1,250-KW. Ljungstrom turbo-alternator, at a cost of £5,800.

Fleetwood.—School Lighting.—The Education Committee has decided to light a new school by electricity, and the U.D.C. is to be asked to extend its mains for the purpose.

Fowey.—E.L. Scheme.—The T.C. has referred to the Lighting Committee a communication from Mr. H. O. H. Wenman, of Wolverhampton, regarding an electricity scheme for the town. He offers to establish the works, and to supply electricity at 6d. per unit, the Council to have the option of purchase at the end of 14, 21 or 28 years.

Gillingham (Kent).—The T.C. has asked the Chatham T.C. to consent to Gillingham laying E.L. mains in the borough of Chatham, such consent to cover future cases, on the understanding that as soon as the mains for the Kent E.P. Co. are laid in the locality, the Council will cease to supply current. The Chatham Council recently refused a similar request.

Glasgow.—Gas Firing.—A Joint Committee of the Electricity and Gas Committees has under consideration the question of providing appliances for the gas firing of boilers at the generating stations, and the extraction of the tar, &c., from the coal carbonised. It has been decided to arrange for a joint experiment with the Maclaurin process, as the same type of apparatus used in that process is also used for the production of smokeless fuel. The electricity department is in a position to use the gas during experiments for firing the boilers at the generating stations where the plant will be installed.

Grimsby.—The T.C. last week, by 17 votes to 16, decided to postpone the new battery scheme for six months.

Heywood.—L.G.B. Inquiry.—An inquiry was held on March 5th respecting the application of the Corporation for permission to borrow £12,460 in connection with the arrangement whereby a bulk supply of electricity is to be taken from the Bury Corporation. The inspector announced that the L.G.B. was acting in conjunction with the Treasury, and that no borrowing powers would be sanctioned during the war except under extraordinary circumstances and for work required to be done to execute Government contracts. Everything that was proposed to be done would have to be shown to be absolutely necessary. The electrical engineer stated that several local firms were executing Government contracts and had applied for electricity for power purposes.

India.—On February 1st, the Commissioner in Sind opened the central generating station of the Karachi Electric Supply Corporation at Karachi.

Kingstown.—E.L. Scheme.—The U.D.C. has received application for immediate payment of £3,067, the amount of the arbitrator's award in connection with the promotion of the electric light scheme.

It is estimated that the cost of the transfer of the undertaking will be about £5,000; the Electric Lighting Committee recommends that the Council should now formulate an electric lighting scheme, and apply to the L.G.B. for the necessary loan.

Leeds.—L.G.B. Inquiry.—On Friday last an inquiry was made into the application of the Corporation for power to borrow £25,000 for further electrical plant.

At a meeting of the City Council last week the question was raised of the permission which had been given to the Yorks Electric Power Co. to supply electricity in various parts of Rodley; it was pointed out that if the Corporation ultimately found itself in a position to provide the supply, the company would be bound to withdraw.

Llandudno. — Proposed Loan. — The U.D.C. has applied for a loan of £1,720 for additional plant, &c., at the electricity works.

London.—L.C.C. Loans.—The Treasury has intimated that it is undesirable to incur capital expenditure at the present time, and has asked that applications for sanction to loans of £28,000, including £5,000 for Battersea B.C. and £10,000 for Hammersmith B.C., both for electricity purposes, should be reconsidered. Pending a definite statement from the Treasury, the Council is withholding advances to local authorities, and is postponing the completion of loans already agreed to.

Hackney.—The Electricity Committee reports as to the negociations with the trustees of Messrs. Allen & Co. in the action, Allen & Co. *v.* the B.C., and recommends as a basis of settlement that the Council make payment to the trustees of £1,090 and £350, the latter sum being in lieu of returning the plant taken over by the Council; also payment of 17 guineas on insurances paid by the trustees.

The Special Committee of the B.C. appointed to consider the subject of the accountancy at the electricity department recommends that no alteration be made in the present system of dealing with the accounts of the undertaking, but that the annual stocktaking be carried out by independent stock takers in future, and that professional accountants having experience in the audit of electricity accounts be employed each year to conduct a commercial audit of the accounts of the electricity department, independently of the L.G.B. auditor.

London Electricity Supply.—The Special Committee of the L.C.C. reports that it has had under consideration the situation created by the fact that the proposed Bill will not be proceeded with in the present session, with a view to deciding whether or not it would submit any further proposals to the Council in the matter.

Fulham.—As owing to abnormally low tides difficulty has been experienced at the electricity works in obtaining sufficient water for condensing purposes, a survey is to be made of the river bed near the works.

Loughborough.—Electric Heating and Cooking.—The T.C. has discussed at some length a report by the electrical engineer on the subject of electric heating and cooking supply, and has adopted a tariff of 12½ per cent. on the rateable value of the house, plus ¾d. per unit. In opposing this decision, the chairman of the Gas Committee suggested that it was a plot to get hold of the gas heating and cooking, intimating that there were 4,000 gas stoves in the town, representing £15,000, and he could not think the Council would be so foolish as to throw that amount away. Nevertheless the Council, as reported, decided to be "foolish," and give electricity consumers the opportunity of adopting electric heating and cooking.

Manchester. — Barton Scheme. — Owing to the Treasury withholding sanction to the raising of new capital, the carrying out of the Barton extension scheme will be delayed. It is understood that the Committee will endeavour to commence the work in the coming year.

Middleton.—Public Lighting.—A scheme has been approved for lighting Long Street and Rochdale Road by means of 14 half-watt lamps.

New Zealand.—The lighting returns of the Wellington City electricity department shows that for the nine months ended December 31st last 297,834 more units were sold than in the corresponding period of 1913.

The scheme of the Dominion Portland Cement Co. to obtain power from the Wairua Falls, for a modern cement mill at Tikorangi, on the south shore of the Whangarei Harbour, is making rapid progress, and the mill is expected to be working in September next, with an initial annual output of 60,000 tons; the whole project involves a capital expenditure of £200 000.

The contract for the pipe lines and turbines has been placed with Messrs. Boving & Co., the erection of these on the site will be carried out by Messrs. G. Fraser & Sons; two 1,500-H.P. generating sets are being installed, but the station is planned for four such units. The transmission will be worked at a pressure of 22,000 volts.

The transmission line from the river to the company's works has been completed, and a branch line from the works to Whangarei is expected to be completed this month, making a length of transmission line of 22 miles. The Whangarei Council is starting its electricity scheme, and the lighting of the town is expected to be complete in May.

Nuneaton.—The T.C. has decided to carry out a modified scheme for the supply of current to the Stockingford district, at a cost of £1,750, for mains. The scheme will, for the first few years, entail a loss of £140 a year, but it is estimated that after three years' working the extension will show a profit.

Pembroke (Co. Dublin).—The Council has decided, in view of the increase in capital and other charges, and the prospect of a further rise in the price of coal, to make a 5 per cent. temporary increase on electric light accounts for 1915-16.

Sheffield.—Mr. W. J. Howard, mains engineer in the electric supply department, has devised a special system of power transformer protection. It has been adopted by a firm of electrical switchgear manufacturers on royalty, and 40 of these protective devices have been installed on the Corporation apparatus, resulting in a saving of capital expenditure.

The Corporation has been recommended to petition against the Yorkshire Electric Power Bill. The L.G.B. has decided to issue the prov. order applied for by the City Council to amend the "Sheffield Electric Lighting (Transfer) Act, so as to enable the Corporation to erect shops in connection with the proposed new offices in Bow Street. The Electric Supply Committee proposes to extend mains in various parts of the city, at a cost of approximately £4,950.

Shipley.—Textile Driving.—The U.D.C. has concluded an agreement with Messrs. Frank Hartley & Co., woolcombers, to supply current for an electric drive throughout their works. The firm will be the Council's largest power consumers.

Skelton and Brotton.—The U.D.C. has decided that in cases where installations for the E.L. are provided by firms on the instalment system, the instalments due shall be collected by the Council's collector when calling for payments due to the Council.

St. Anne's.—Public Lighting.—The chairman of the Electricity and Lighting Committee and the electrical engineer are to prepare a report upon the lighting of the Ashton Gardens.

In a report submitted to the U.D.C. this week, it was stated that the consumption of electricity for heating purposes showed a steady increase under the stimulus of the reduced price and more efficient heaters. The increased consumption for industrial purposes is also regarded as satisfactory in view of the limitations to that demand in the resort.

Stafford.—A Special Committee, which has had the matter under consideration, has been unable to make any recommendation as to constituting separate Committees for gas and electricity. The Council has asked for a further report.

Wimbledon.—The Electric Lighting Committee has decided to hire out electrical irons at a charge of 1s. per quarter.

Walsall.—It is proposed to adopt revised scales of charges for energy for power purposes; for D.C. or low-pressure A.C. the price will vary from 1½d. per unit for under 500 units per quarter to 1¾d., with discount, for over 3,750 units. For bulk supply to factories the price will range downwards per KW. per quarter from £1 10s for over 20 KW. demand, plus ·35d. per unit. Special bulk supplies of alternating current will be given at prices ranging from 1·1d. to ·55d. per unit based on consumption and load factor. For electric vehicles, 1½d. per unit will be charged off peak, minimum 2s. 6d. per charge. The B. of T. has sanctioned the alteration of the system of supply from D.C. to A.C.

Waterloo.—Linking-up Proposal.—The Liverpool District Lighting Co., Ltd., is applying to the B. of T. for sanction to make a connection between its cables and those of the Bootle T.C. at the boundary at Seaforth, in order to provide a duplicate supply in case of emergency, and has asked for the U.D.C.'s consent. The Council has referred the matter to a Committee, with power to act.

Wolverhampton.—The Corporation Electricity Committee has decided that the sum of £2,215 in aid of the improvement rate be included in the Finance Committee's estimates for the ensuing financial year.

TRAMWAY and RAILWAY NOTES.

Bradford.—The Tramways Committee has instructed the general manager to pay full wages to any Bradford tramway employés discharged from the Navy or Army owing to disablement received on active service, until such time as the question shall have been dealt with on general principles applicable to the entire Corporation services.

The new railless trolley route from Forster Square (City), to Bolton Woods, *via* Canal Road, is now completed and awaiting Board of Trade inspection.

Road Maintenance.—The Joint Street, Drainage and Works and Tramways Sub-Committee has recommended that some annual contribution, on a basis to be determined later, be made by the Tramways Committee to the funds of the Street, Drainage and Works Committee, without prejudice to the position of either of the Committees concerned, in respect of the extra expenditure found to be necessary for the maintenance of roads on railless trolley vehicle routes in the city.

Bury (Lancs.).—At the T.C. meeting last week it was stated that owing to the war the receipts of the Corporation tramways showed a falling off of £150 a week, and the allowance to members of the staff who had joined the Army or Navy was £30 a week, which might be increased at a later date. These two items alone would take nearly £10,000 per annum, so that while the war continued the tramway undertaking would have as much as it could do to make both ends meet.

Doncaster.—The T.C. has sanctioned an expenditure of £5,300 on additional tramcars, and £1,800 on enlargement of tram sheds.

Glasgow.—A Special Committee of the T.C., consisting of the conveners and sub-conveners of all standing Committees, has been appointed to consider an application for an advance of wages by sections of employés in every Department of the Corporation's activities. In the tramway department the application is on behalf of all workers, excepting motormen and conductors, tradesmen at Coplawhill car works, set dressers, paviors, timekeepers, ticket inspectors, controller men at respective car depôts, and foremen and clerks at head office; and in the electricity department, all employés excepting bricklayers, masons, foremen and meter inspectors.

Leeds.—Third-Party Insurance.—The City Council has signified its approval of a suggestion that the Corporation should itself undertake the risks in connection with third-party insurance in regard to the tramway undertaking. During the last three years the cost of the third-party insurance through insurance companies has cost over 1s. per 100 miles as compared with the former payment of 6d. for the same distance. If the Corporation took the risk itself it would be able to save at least £3,000 per annum.

The Watch Committee has decided to purchase tokens from the Tramways Committee to be supplied to the special constables of the city in order that they may use the cars to convey them to and from points of duty without payment.

Tramway Extensions.—The tramway department has completed the extension of the Guiseley line to the White Cross Hotel, near Menston, an addition of nearly a mile, and also the new depôt at the end of the line. Good progress is being made with the installation of the railless traction system into Wharfedale, and it is expected that cars will be running to Otley and Burley by May or June.

Leicester.—Year's Working.—According to the statement of accounts of the tramway undertaking (including electric supply by direct current for power purposes) for the year ended December 31st last, the receipts (including interest on reserve fund investments) in excess of working expenses, and the cost of repairs and maintenance, amounted to £53,288. The interest and sinking fund charges, income-tax, bank interest, and allowances to employés on service in H.M. Forces amounted to £42,066, and sums amounting to £10,741 have been applied for various purposes, leaving a net balance of £479 to be carried to the district fund. The receipts in excess of working expenses and the cost of repairs and maintenance of the Aylestone electric lighting undertaking for the same year amounted to £22,712. After payment of interest and sinking fund charges there remains a net surplus of £7,643, which it is recommended should be carried to the district fund in relief of rates.

London.—The Highways Committee of the L.C.C. reports that the total safe working overload capacity of the plant at the Greenwich generating station, excluding No. 2 reciprocating engine, which will shortly be dismantled, is 39,000 kw., and with the 3,500 kw. additional supply about to be obtained from the London Electric Supply Corporation, the total capacity is 42,500 k.w. The present load on the station plant is 32,000 kw., so that the capacity of the spare plant will amount to 10,500 kw. The Committee recommends that, in order that more spare plant may be available and additional cars may be run, a further reserve supply of about 4,000 kw. be obtained from an outside source. The cost is estimated at £11,800 for cables, ducts, &c.

Musselburgh.—Strike.—Much inconvenience was caused last week by a strike of the drivers and conductors of the Musselburgh District Electric Tramway Co.

Sheffield.—In addition to the £2,000 paid annually into the tramway special purposes fund, the Tramways Committee of the Corporation has resolved to pay an additional £600 for the years ending March, 1915 and 1916, out of the tramway accumulated surplus fund.

Swinton.—The Swinton branch of the Amalgamated Association of Tramway and Vehicle Workers has decided to apply for an increase of 15 per cent. in wages on account of the higher cost of food. There are about 200 members in the branch, all of whom are employed by the South Lancs. Tramway Co.

Walsall.—Year's Working.—The accounts of the tramway undertaking for the year ended December 31st last show a profit of £2,478, after deducting £368 in respect of the final instalment of cost of alterations and extensions at the Birchills depôt; £271 in respect of balance of cost of alterations and extensions at tramway offices on the bridge, and £1,000 in respect of contribution in aid of rates of 1914. Working expenses during the 12 months amounted to £21,821, or 7·267d. per car-mile (as against 7·209d. in the previous year), made up of £8,509 in respect of traffic expenses; £5,670 for power expenses; £4,314 for general repairs and maintenance, and £3,325 for general expenses. Traffic revenue brought in during the year £33,310, or 11·094d. per car-mile (as against 11·007d. in the previous 12 months), which, with sundry other items, brings the total revenue up to £34,089. The Council is recommended to appropriate the net profit as follows:—£2,000 in aid of the rates, and £478 towards the cost of the siding in St. Paul's Street and Darwall Street.

Wolverhampton.—Rate Relief.—The Tramways Committee has allocated £4,018 to the borough rate from the profits of the tramway undertaking in respect of the financial year ending March 31st next.

TELEGRAPH and TELEPHONE NOTES.

Accrington.—The automatic telephone system installed at Accrington was expected to come into operation last week-end. The work has been carried out by the Automatic Telephone Manufacturing Co., of Liverpool, who have recently completed automatic exchanges in several places abroad, and have in progress similar equipments for Leeds, Portsmouth, Blackburn, Paisley, Newport, and Chepstow.

Cable Rates Reduced.—The Pacific Cable Board announces that the telegraphic rates to and from New Zealand will be reduced as from April 1st next. The ordinary rate, now 3s. per word, is reduced to 2s. 8d. per word. and the deferred ordinary rate, now 1s. 6d. per word, to 1s. 4d. per word. The "Week-end" rate, now 15s. for 20 words and 9d. for each additional word, is reduced to 13s. 4d. for 20 words and 8d. for each additional word. There are also reductions in the rates to Suva (Fiji) and Norfolk Island, and in the rates between Canada and New Zealand.

China.—The coast wireless telegraph stations at Woosung and Canton, completed for working last summer, have now started regular service; similar stations at Foochow and Hankow are expected to be completed within the next few months. The stations are all of the same construction, each being provided with two masts of a height of 200 ft., giving them a range of 700 nautical miles by day and at least 1,300 nautical miles at night.

Guernsey.—The balance-sheet of the Guernsey States Telephone Department for 1914 shows a total revenue of £7,530, and an expenditure of £6,761, including £2,066 depreciation and sinking fund payments, and £876 for interest on capital; the net profit for the year was £769. The total capital outlay on construction account was £49,154, provided by a loan of £32,000 raised in 1905 (of which £3,251 has been repaid), and £17,154 taken from the reserve funds, which, including this amount, stand at £21,944. The number of subscribers' lines at the end of 1914 was 1,772, and the total of all kinds 2,162, with a mileage of 1,508 miles of overhead line and 1,050 miles underground, showing increases of 62 and 235 miles respectively. The number of calls in the year was 1,571,721, an increase of over 200,000. The net profit in 1913 was £763.

Hull.—The City Council has instructed the Telephones Committee to make a thorough investigation with regard to the unsatisfactory working of the telephone system, which, in Hull, is the property of the Council. It was alleged that the tariff had been greatly increased, and that the service was most inefficient; in defence the inefficiency complained of was ascribed to the loss of a large number of skilled men through the outbreak of war. and to stormy weather.

Telephone Tariffs.—It is reported that in present circumstances the Government has decided to postpone the introduction of revised telephone rates.

Wireless Control Ship.—According to the *Journal Télégraphique*, the United States Government has equipped a vessel with apparatus for quickly measuring wave-lengths; it will cruise in the Atlantic and will ascertain whether wireless stations conform to the rules relating to the wave-lengths that they must use. It has been noticed during the past year that the regulations are often neglected. The control ship will also take steps to prevent the emission of alarm signals in cases that are not urgent, as has often happened.

Wireless on Aeroplanes.—It is reported from the front that a number of our aeroplanes carry wireless apparatus with which they are capable of signalling to their headquarters, and that it has been found possible. as the result of a wireless signal from the air. for the artillery to locate and hit a moving object before it could reach shelter.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeenshire.—Tenders wanted for electric light work at new parish church, to be erected at Cults, Aberdeenshire.—A. M. Mackenzie & Son, Architects, 313, Union Street, Aberdeen.

Australia.—Melbourne.—March 16th. White Wheatstone receiving tape, for Postmaster-General. See "Official Notices" February 5th.

Sydney.—March 23rd. One 150-ton electric revolving floating crane for Naval Dockyard, Sydney. Particulars may be seen at the Board of Trade Commercial Intelligence Branch in London, and a cabled price will be admissible.

Balls Bridge (Dublin).—March 15th. U.D.C. Twelve months' supply of electrical stores. Specification from the Town Hall.

Belfast.—March 15th. Twelve months' supply of stores for the Tramways and Electricity Committees. See "Official Notices" February 19th.

Burnley.—March 22nd. Electricians' work for the B. of G. Forms, &c., from Mr. J. S. Horn, Clerk, Union Offices.

Carlisle.—March 31st. Corporation. Twelve months' supply of painting materials, oils and general stores. Forms, &c. from City Electrical Engineer, Victoria Viaduct.

Darlington. — March 18th. Corporation. Twelve months' supply of (10,000 tons) small, rough small, or single nut steam coal. Forms, &c., from Electricity Works, Haughton Road.

Dundalk. — March 23rd. U.D.C. Twelve months' supply of stores for the Electricity Department. See "Official Notices" March 5th.

Halifax. — March 26th. Electrical fittings for six months, for the B. of G. Mr. A. T. Longbotham, Clerk, 4, Carleton Street.

Hounslow.—March 15th. Electric light fittings and telephone maintenance at isolation hospitals, Mogden and Dockwell, for Richmond, Heston and Isleworth Joint Isolation Hospital Committee. Mr. F. C. Greville-Smith, Clerk, 213, High Street, Hounslow.

Hove. — March 26th. Corporation. One 500-KW. mixed-pressure steam turbine, complete with D.C. 230/285-volt generator and surface condensing plant; also a battery of 115 accumulators. See "Official Notices" March 5th.

Hull.—March 20th. Corporation. Six or 12 months' supply of coal for the Tramways Committee. Forms, &c., City Engineer's office.

Kirkcaldy.—March 22nd. Corporation. Twelve months' supply of brass castings, pitch, iron castings, &c., for the Electricity and Tramways Committee. Forms of tender from Mr. O. F. Francis, Burgh Electrical Engineer.

Liverpool.—March 12th. Electrical fittings for a year for the Select Vestry.

London.—L.C.C.—March 16th. Reconstruction of three miles of single-line tramway on the underground conduit system. Specifications, &c. (£5), from Chief Engineer, County Hall, Spring Gardens, S.W.

The Highways Committee recommends that tenders be invited from selected firms for the provision and laying of additional cables, in connection with the Council's tramways.

HORNSEY.—March 16th. Meters, cables and stores, &c., for the T.C. See "Official Notices" February 19th.

WANDSWORTH.—March 15th. B. of G. One month's supply of electrical fittings, for the Wandsworth Union. Forms of tender from the Clerk, Union Offices, St. John's Hill, S.W.

Londonderry. — March 13th. Corporation. Engine-room stores, carbons, meters, bitumen. fuse-boxes.

New Zealand.—WELLINGTON.—April 30th. Supply of a three-unit exciter set, and 1,600-KW. generator for the Lake Coleridge Hydro-electric scheme. Specifications from the Public Works Office, Wellington.

Rugby.—March 15th. 10,000 tons of peas, beans, D.S nuts, for the directors of the British Thomson-Houston Co., Ltd. Particulars from Mr. W. J. Terry, Supervisor of Purchases.

South Shields.—March 12th. Twelve months' supply of engine-room stores for the electricity works.

Spain. — March 27th. Spanish Post and Telegraph authorities, Madrid. Concession for the establishment and working for a period of 20 years of a telephone exchange in the town of Guardiola (province of Barcelona).

The municipal authorities of Zwigena (province of Almeira) have recently invited tenders for the concession for the electric lighting of the town during a period of 20 years.

Swindon.—March 13th. Corporation. Twelve or six months' stores for Electricity and Tramway Departments. See "Official Notices" February 19th.

Swinton and Pendlebury.—March 19th. U.D.C. Cables, joint-boxes, bitumen and joint-box compound. See "Official Notices" March 5th.

Transvaal. — BETHAL. March 25th. Municipality. Supply and erection of generating and pumping plant and overhead electric distribution system. Specifications from the consulting engineer, Mr. H. Hancock, P.O. Box 62, Klerksdorp (deposit £1 1s.).

Walthamstow.—March 24th. U.D.C. E.H.T. and L.T. switchgear and cables. See "Official Notices" to-day.

Warrington.—March 16th. Motor, cables, and E.H.T. feeder panel, for the Electricity Department. See "Official Notices" March 5th.

Wigan.—March 16th. Corporation. Supply of stores for the Electric Light Department. See "Official Notices" March 5th.

Wrexham.—March 17th. Meters, oils, coal, &c., for the Corporation Electricity Department, for a year. Borough Electrical Engineer, Willow Road.

CLOSED.

Australia.—The following contracts have been placed:—

Perth (W.A.) Municipal Council.—
  Switchgear (to replace the A.E.G. switchgear).—British Westinghouse Electric & Mfg. Co., Ltd., £7,250.
Melbourne City Council.—
  7,230 yards of single conductor lead-covered cables.—Glover & Co., £2,319.
Victorian Railways Department.—
  25 battery signal machines.—Aust. General Electric Co., £925.
P.M.G.'s Department, Queensland.—
  8,750 Siemens Obach dry cells.—Siemens Bros. Dynamo Works, £954.

—*Tenders.*

Bacup.—The Electricity Committee has accepted the tender of Mr. G. L. Adamson, Rochdale, for wiring and fitting the Market Hall, shops in Lordship Street, municipal offices, Sanitary Inspector's offices, public conveniences and fire station; and that of Messrs. Macintosh & Co., Ltd., for rubber cables.

Bridlington.—The T.C. has accepted the tender of Mr. George Robinson for electrical work on the New Spa.

Burton-on-Trent.—The tenders of Mr. R. B. Barratt for 5,000 tons of fine slack, and of Messrs. Marriott & Co. for 1,000 tons, have been accepted by the T.C. Electricity Committee.

Bury (Lancs.). — The Borough Insurance Committee has accepted the tender of Mr. John Jardin, Bury, for installing the electric light at their premises.

The Electricity Committee has accepted the tender of the Bolton Stone and Concrete Co. for the construction of a reinforced concrete retaining wall at the Chamber Hall power station.

Colchester.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for carbon and metal-filament lamps for the Corporation tramways for 12 months, has been accepted.

Darlington.—The T.C. has accepted the tender of Messrs. Fraser & Chalmers, of Erith, for a 3,000 KW. turbine and Siemens alternator.

Dartford. — The U.D.C. has accepted the following tenders for coal for the electricity works:—

John Hudson & Co., Ltd.—178 tons of South Hetton, £1 3s. 8d. per ton.
E. J. & W. Goldsmith, Ltd.—200 tons of Rubbly Culm, 15s. 4d. per ton.
Bradbury, Son & Co., Ltd.—120 tons of 1½-in. Nailstone, £1 per ton, and 800 tons of 1½-in. nutty slack, £1 1s. per ton.

Elland.—The U.D.C. has accepted the tender of Mr. Newsome, for 1,000 tons of Hodroyd engine nut coal for the electricity works, at 12s. 10d. per ton.

Gloucester. — The T.C. has accepted the following tenders for coal for the electricity works from March 15th to August 15th:—

Park Colliery Co.—1,000 tons of rough small steam, 15s. 10d. per ton.
Mr. E. Jarrett.—500 tons of No. 2 High Delf, 15s. 3d. per ton, and 300 tons of Yorkley steam, 15s. 6d. per ton.

Llandudno.—The U.D.C. has accepted the tender of Messrs. Browett, Lindley & Co. for an engine for the electricity works, at £780; and that of the Electric Construction Co., Ltd., for a dynamo, at £425.

Liverpool.—The following tenders have been accepted for annual supplies to the Electricity Supply Department:—

Metal-filament lamps.—Pope's Electric Lamp Co., Ltd.
Carbon-filament lamps.—Edison & Swan Co.
Cast-iron troughs and boxes.—E. Wilson & Co.
Brass and copper castings.—Gallie Bros.
Insulated cables and wires.—Liverpool Electric Cable Co., Ltd., and St. Helens Cable and Rubber Co., Ltd.
Stoneware troughing, insulators, &c.—O. Cooban; J. E. Beard & Co., Ltd.; Callender's Cable Co., Ltd.; J. Bourne & Son; Liverpool Building Material and Cement Co., Ltd.

The following have been accepted for annual supplies to the Tramways Department:—

Tramcar motor equipments.—Dick, Kerr & Co., Ltd.
Steel gears and pinions.—British Hele-Shaw Patent Clutch Co., Ltd.
Iron castings.—Miller & Co., Ltd.; Moston Malleable Castings Co., Ltd.; and E. Wilson & Co.
Rubber goods, &c.—L. Andrew & Co.; Avon India-rubber Co., Ltd.; Hellewell & Co.; North British Rubber Co., Ltd.; New Liverpool Rubber Co., Ltd.
Oils, paints, &c.—Anglo-American Oil Co., Ltd.; Atlas Lubricating Co., Ltd.; Baxendale & Co., Ltd.; Bowring Petroleum Co., Ltd.; British Petroleum Co., Ltd; John Matthews & Co.; R. R. Minton & Co., Ltd.; Motor Benzole Co., Ltd.; Price's Co., Ltd.; Joshua Rea & Sons, Ltd.; W. H. Samuel & Co.; Siddall & Co.; J. & J. Taylor & Co.; W. R. Taylor & Co., Ltd.; Taylor's Automatic Disinfector, Ltd.; United Alkali Co., Ltd.; Wilkinson, Heywood & Clark, Ltd.; and Wm. Wright & Sons, Ltd.
Varnishes and special paints.—Lewis Berger & Sons, Ltd.; Meredith and Co.; Naylor Bros. (London), Ltd.; Sanitary Paint Co., Ltd.; and Wilkinson, Heywood & Clark, Ltd.
Lubricating oils and greases.—Vacuum Oil Co., Ltd.; Matthew Wells and Co., Ltd.

The following have been accepted for annual supplies to the Lighting Department:—

Wrought iron lamp standards, brackets, &c.—A. B. Dalzell & Co.; Ashmore and Co.; Killick & Cochran.
Cast-iron lamp columns and plugs.—Killick & Cochran.

Messrs. Stewarts & Lloyds, Ltd., are to supply steel steam-pipes for connecting the boilers at No. 2 station, Lister Drive, with those installed at No. 1 station.

London. — WOOLWICH. — The following tenders have been accepted by the B.C. Electricity Committee:—

Ferguson, Pallin & Co.—Switchboard extension, £62.
Babcock & Wilcox, Ltd.—Two steam boilers with chain-grate stokers (duplicate of present installation), £7,126.
G. & J. Weir, Ltd.—Feed pump, £195.

HACKNEY.—The Electricity Committee has received the following tenders for pipework and valves for the 5,000-KW. turbo-alternator:

J. Spencer, Ltd.	(recommended)	£1,060
Brightside Foundry & Eng. Co., Ltd.		1,497
Babcock & Wilcox, Ltd.		1,335

Meter Contracts.—The Llandaff and Dinas Powis R.D. Council and the Rhymney Valley and General Electric Supply Co. have both placed 12 months' contracts for single-phase meters with the Electrical Apparatus Co., Ltd.

West Ham Corporation has renewed its contract with Messrs. Venner & Co. for Chamberlain & Hookham A.C. meters for a further 12 months. Messrs. Chamberlain & Hookham, Ltd., have also received the Winchester contract for D.C. meters for the coming year.

New Zealand.—The Public Service Tender Board has accepted the following tenders :—

50 miles of twin-twisted insulated wire.—P. R. Baillie & Co , £582.
7 000 dry cells for telephones.—P. R. Baillie & Co., £271.
1,000 table telephones.—B. L. Donne, £2,483.

—*New Zealand Shipping and Commerce.*

Sheffield.—The Electric Supply Committee has resolved to accept the following tenders in connection with the extension of the Neepsend power house :—

Stirling Boiler Co., Ltd.—Water-tube boilers, mechanical stokers, superheaters, economisers, pipework and all accessories, £31,153.
George Longden & Son, Ltd.—Extensions to the engine room and boiler house, new switchrooms and stores, £21,799.
Thomas Smith & Sons.—50-ton overhead electric travelling crane, £2,102.
Gilbert Heathcote & Co.—Roof principals and supports, £3,658.

The Committee has also resolved to extend the contract of Messrs. A. Reyrolle & Co., Ltd., for E.H.T. switchgear at Neepsend, to provide the additional switchgear required in connection with the extensions of plant now in hand, at £5,311, based on the original contract prices; also the contract with the same firm for the supply and delivery of E.H.T. sub-station switchgear to provide for 30 additional panels, at a total cost of £3,604, based on the schedule price in the original contract. The following tenders have been accepted by the Health Committee for supplies of electrical fittings :—

General Electric Co., Ltd.; Tasker, Sons & Co.; I.R , G.P. & Telegraph Works Co., Ltd.; David Ashton & Co.; Thomas A. Ashton, Ltd.; C. Macintosh & Co., Ltd.

Southampton.—The Corporation has extended its present contract for A.C. meters with the British Thomson-Houston Co., Ltd., of Coventry, for another 12 months.

Stretford.—The U.D.C. has accepted the tender of the General Electric Co , at £79, to supply 500 yards of ·2 sq. in. cable.

Torquay.—Owing to the difficulties and delays to navigation on the coast, the Town Council has agreed to pay an extra 2s. per ton over the original contract price for any future supplies of coal by Messrs. Renwick, Wilton & Co.

Tunbridge Wells.—The T.C. has accepted the tender of Messrs. T. Bates & Sons for the construction of a reservoir for the new cooling tower at the electricity works, at £547.

Walsall.—The T.C. has been recommended to accept the tender of Messrs. W. A. Stevens, Ltd., at £5 546, to supply four double-deck and two single-deck petrol-electric 'buses to the Tramways Department. The tender of Messrs. Woodall, Duckham & Co. is further recommended, at £19,845, for the construction of 20 vertical gas retorts with electrically-driven plant.

Watford.—The Electrical Engineer has been authorised to purchase 200 meters from the Electrical Apparatus Co., to be taken when required during a period of two years.

Windsor.—An offer by the Windsor Electrical Installation Co. to install duplicate pumps and motors, to be electrically driven, at the waterworks, for the sum of £1,100, and to take away the existing No. 5 Hayward-Tyler pump, allowing £100 for the same, has been accepted by the Windsor T.C. Each of the new pumps is to be of the Rees Roturbo pattern, with a capacity of 60,000 gallons per hour, to maintain a pressure equivalent to 200 ft. head. The company's estimate also includes the laying of necessary mains to connect with both Slough and Windsor power stations. For his advice and assistance the company's engineer (Mr. Farrow) has been thanked by the Corporation.

Wolverhampton.—The Corporation Tramways Committee has accepted the tender of the United Electric Car Co., Ltd., amounting to £818, for vestibules, staircases, &c., for 18 cars.

FORTHCOMING EVENTS.

Institute of Marine Engineers.—Friday, March 12th. At 8 p m. At Tower Hill, Minories. Annual Meeting.

Physical Society of London.—Friday, March 12th. At 8 p.m. At Imperial College of Science, South Kensington. Papers on "The Estimation of High Temperatures by the Method of Colour Identity," and "The Unit of Candle-power in White Light," by Messrs. C. C. Paterson and B. P. Dudding; and "The Relative Losses in Dielectrics in Equivalent Electric Fields, Steady and Alternating (R.M.S.)," by Mr. G. L. Addenbrooke.

South-Western Polytechnic Institute.—Friday, March 12th. At 8 p.m. At Manresa Road, Chelsea, S.W. Presentation of Prizes and Certificates.

Greenock Electrical Society.—Saturday, March 13th. Visit Messrs. Mavor and Coulson's Works, Glasgow.

Thursday, March 18th. At 7.45 p.m. At 21, West Stewart Street. Paper on "Suction Gas Plant," by Mr. E. P. Duckworth.

Royal Institution of Great Britain.—Saturdays, March 13th and 20th. At 3 p.m. At Albemarle Street, W. Lectures IV and V on "Recent Researches on Atoms and Ions," by Sir J. J. Thomson, F.R.S.

Institution of Post Office Electrical Engineers.—Monday, March 15th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "Telephone Economics—Open Construction," by Mr. H. A. Smith.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, March 17th. At 7 30 p m. At the University, Edmund Street. Paper on "Electric Cooking, Mainly from the Consumer's Point of View," by Mr. W. R. Cooper.

Royal Society of Arts.—Wednesday, March 17th. At 8 p.m. At John Street, Adelphi, W.C. Paper on "The Industrial Uses of Coal Gas," by Mr. H. M. Thornton.

Institution of Mechanical Engineers.—Friday, March 19th. At 8 p m. At Storey's Gate, S.W. General Meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 19th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General Meeting.

Association of Mining Electrical Engineers (West of Scotland Branch).—Friday, March 19th. At Royal Technical College, Glasgow. Paper on "The Use and Abuse of Oils in Connection with Electrical Plant," by Mr. T. C. Thomsen.

Electro-Harmonic Society.—Friday, March 19th. At Holborn Restaurant. Smoking Concert.

Association of Engineers-in-Charge.—Saturday, March 20th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C.

NOTES.

Electro-Harmonic Society.—The last smoking concert of the season will be held at the Holborn Restaurant (King's Hall), on Friday, March 19th, at 8 o'clock p.m., Sir John F. C. Snell presiding. The preliminary programme is as follows :—Tenor, Mr. Joseph Cheetham; baritone, Mr. Tom Kinniburgh; elocutionist, Mr. Ernest Meads; humorist, Mr. Fred Curtis; entertainer, Mr. Foden Williams; entertainer at the piano, Mr. Finlay Dunn, and, by desire, a small professional orchestra from the London Symphony Players; conductor, Mr. Charles Woodhouse (the King's Private Band). At the piano, Mr. Bernard Flanders, A.R.A.M.

Another Tramcar Ticket Case.—For refusing to produce a tramcar ticket, W. J. Crockett, of Kingston, was fined £1 and £2 5s. 6d. costs at Kingston, on March 3rd. The *Standard* says that he did it "for the public" because of the annoyance to which they were subjected, and he declared that he would carry the matter before the High Court.

Charge of Stealing.—At the West London Police Court last week, A. Pamington, electrical engineer, Newcastle Row, Clerkenwell, and T. Bamyard, sales manager, were remanded on bail on a charge of being concerned with Raoul de Redon (in custody) in stealing and feloniously receiving on February 16th certain X-ray tubes and apparatus, which were described to the Court as the property of the West London and Royal Free Hospitals.

Foreign Trade. — The February Figures. — The following are the electrical and machinery figures given in the official returns for February :—

	Month of February.	Inc. or dec.	Two months, 1915	Inc. or dec.
	£	£	£	£
Imports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	69,078	— 74,122	125,943	— 1[illegible],768
Machinery ...	573,533	— 70,344	1,191,937	— 51,831
Exports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	173,870	— 84,348	443,763	— 68,176
Machinery ...	1,285,868	—1,747,746	2,949,350	—3,471,999

New Association: Electric Supply Executive Staffs.—A Committee has been formed of the following chief assistant electrical engineers of undertakings in Greater London, namely :—Messrs. Baron, St. Pancras; Bowden, Hackney; Macalister, Islington; Richardson, Marylebone; Thompson, Battersea; and Young, Stepney, with a view to forming an Association on the lines of the Associated Municipal Electrical Engineers of Greater London. The chief object of the proposed Association will be to endeavour to fill the want which has long existed for an Association which will encourage an interchange of ideas, foster mutual interests, and generally create a better understanding between the executive staffs of different electric light undertakings. Previous attempts have been made towards the incorporation of the chief assistants in the parent Association, and the formation of an Association of their own, but, unfortunately, without success. Now that a Committee has been formed, however, it is to be hoped that their endeavours will be crowned with success, and that the Association will, eventually, hold a position second only to that of the parent body.

Hungarian Aluminium Oxide.—It is stated that the Neuhausen Aluminium Industry Co. has concluded a contract with the Bihar Forest Industry and Lime Kiln Co. for the delivery of 50,000 tons of aluminiferous rock (bauxite) per annum as from March 1st, 1915. The latter company, which was originally formed by the Liége firm of Lamarche, possesses a rope railway, five miles long, which ends in the bauxite district, where arrangements have been made for mining on a large scale. The rope railway joins the Grosswardein-Vaskop local railway, with which the Neuhausen company has also entered into a freight agreement. A certain amount of the production of bauxite is to be treated in Hungary, whilst the balance will be exported, apparently to the Swiss company's new works on the Rhine. This action has partly been suggested by the impossibility of obtaining further supplies of bauxite from France in consequence of the war.

Fatalities.—Sheffield.—According to the *Sheffield Telegraph*, a boy named Walter Carley, aged 15 years, while putting up a new switch on the premises of a relative, a pork butcher at Attercliffe, on 5th inst., received a shock which proved fatal.

Pontymister.—An inquest was held on March 4th as to the cause of death of Joseph Grinnell (32), at Pontymister Works. The evidence showed that while Grinnell and another (G. E. Buck) were in a 10-ft. excavation, Buck in regulating a suction pipe received an electric shock and was thrown on his back. His feet came in contact with the pipe and he was held by the current. He called for help, and Grinnell came to his assistance. A witness found the two men, and received a slight shock in pulling Grinnell away, but the latter was quite stiff and did not speak again. Witness said he did not realise the risk that he was running by catching hold of the deceased with bare hands. Artificial respiration was tried for 25 minutes. The foreman, as reported in the *South Wales Daily News*, said that the accident was due to the pipe becoming electrically charged, and Benjamin Thomas, who connected the motor, said it would have been impossible to insulate the pipe, but a rubber pipe might have been put down. The verdict was to the effect that deceased was accidentally killed by a discharge of electricity whilst going to the help of another workman.

Abertridwr.—A Cardiff paper reports that an 8-year old boy, named Preece, climbed on the roof of a power station, caught hold of the electric wires, and was killed.

Feeder Reactances.—Feeder reactors are now being installed in the generating station of the United Electric Light and Power Co., New York City. Only two reactors are being employed in each three-phase circuit. The units, which have 3½ per cent. reactance, are porcelain-clad and mounted vertically in pairs to economise in space. The current rating of the feeder cables is 300 amperes. Besides these reactors there are also 18 per cent. units connected between the 'bus sections, which are designed to carry 2,000 amperes. Further resistance to surges is offered by each generator's inherent reactance, which is about 7·5 to 8 per cent. The rated full-load current for each generator is 1,387 amps. per phase.—*Electrical World.*

Liquidation.—British Prometheus Co., Ltd., Birmingham.—A meeting of creditors is called for March 25th, at 12 o'clock noon, at 26, Corporation Street, Birmingham.

New Electric Clock at Birmingham Post Office.—The G.P.O. are adopting electric turret clocks, when public clocks are required in their buildings, on account of the advantages they offer as regards uniform time-keeping, and the saving on maintenance. Messrs. Gent & Co., Ltd., of Leicester and London, have supplied the first of these clocks purchased by the G.P.O., which has now been erected at the G.P.O., Birmingham. The type selected by the Post Office Engineers is that known as the "Waiting-Train," which is a speciality of the firm mentioned.

The new clock is fixed on the bridge which connects the new portions of the G.P.O. buildings to the old. The dial is 5 ft. in diameter, and is provided with 12 distinguishing marks in lieu of the ordinary Roman numerals, as advocated by the late Lord Grimthorpe. It is arranged for internal illumination, which is provided by electric lamps within a reflector which is disposed behind the dial and is the full diameter of the latter.

The small amount of current required for operating the "Waiting-Train" movement is taken from the accumulator in the building, which has been installed for general purposes. The mechanism is under the constant control of a master clock, the control being effected by the half-minute impulses, in a simple manner, which dispenses with contacts or additional batteries.

The hands of the clock are exposed directly in the open, and therefore a clear reading of the dial is obtained under all conditions, the absence of a covering glass eliminating sun glare and reflection which at some part of the day might prevent the reading of the time. The great power of the "Waiting-Train" movement renders a covering glass unnecessary, the power developed by this mechanism being in direct proportion to the load put upon it, so that the hands cannot be stopped by snow or the most severe gales. Many public clocks were stopped, or others were affected, by the heavy gale that swept over the metropolis a few weeks ago, even Big Ben being half an hour slow.

The largest electric clock in the world, on the Royal Liver Building at Liverpool, which is driven by the "Waiting-Train" movement, has kept time with unfailing accuracy since it was first started on Coronation Day, 1911. The heaviest gales of wind and snow have never affected its time-keeping qualities, despite the great length and weight of the hands required by dials considerably larger than that of London's largest clock, Big Ben

Copper.—The diminution in visible supplies during February, 1915, as shown by Messrs. H. R. Merton's statistical circular, was 750 tons, and in English supplies 775 tons. European arrivals from North America amounted to 16,604 tons, slightly less than during December last. Spain and Portugal supplied England and France with 2,381 tons, a quantity seldom equalled in peace times, and considerably above the 1913 average. A heavy supply was also drawn from countries not individually classified, equal to a fairly good month before the war. Chile shipments were below average, and Australian, though above the quantity for the four preceding months, was not up to average. Total deliveries, at 28,861 tons, exceed those for August, October, or November last by a considerable amount.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following are the Council's nominations for the vacancies which will occur on the Committee of the Western Local Section:—Chairman, Mr. D. E. Roberts, Cardiff; Vice-Chairman, Prof. D. Robertson, Bristol. Eight nominations to fill five places on the Committee: Messrs. A. J. Abraham, Aberdare; M. T. Evans, Bristol; R. H. Fletcher, Llanishen; W. W. Hughes, Swansea; A. C. McWhirter, Cardiff; W. G. Heath, Plymouth; C. W. Salt, Torquay; A. L. Stephens, Bristol.

At the monthly meeting of the Scottish Local Section, held at Edinburgh on Tuesday last, the paper on "Automatic Protective Switchgear for Alternating-Current Systems" was read by Mr. E. B. Wedmore.

The Students' Section discussed the "Applications of Electrical Engineering to Warfare," on March 3rd. Section (*a*) "Communications," was opened by Mr. P. R. Coursey, who said that fire and flashlight signalling had long ceased to be utilised as a means of official communication, and the applications of electrical engineering had enabled great strides to be made towards the ideals of speed and secrecy. In the present war electrical means of communication were being employed to an enormous extent by all the nations involved, five main types of electrical apparatus being used, as follows:—Wireless telegraph, Wheatstone automatic telegraph, Morse sounder, vibrator telegraph and field telephone, the last two being generally combined in one apparatus. Mr. Coursey gave brief descriptions and illustrations of the most general types of military apparatus. Mr. Smith-Rose referred to the difficulties of reception of wireless messages on aeroplanes on account of the noise of the engine. Mr. Emtage suggested that it might be possible to detect the approach of Zeppelins and submarines by picking up their ignition sparks by wireless receivers; and also described the pneumatic headpiece "shock-absorbers" worn by airmen, which at the same time served to deaden the noises due to the engine, and facilitated wireless reception.

The chairman (Mr. Duddell) said that the great objection to modern methods of communication was that they all gave too much information to the enemy, and in many cases dispatch-riders were proving to be a more secret means of communicating intelligence.

Section (*b*), "The Firing of Mines and Explosives," was opened by Mr. S. Killingback, who said that the advantages of electrical means for firing mines might be briefly summarised as convenience, greater reliability, remote control, simultaneous firing of several charges. Mines and explosives might be fired either by accumulators or by the portable hand-operated service dynamo. The standard types of electric fuses and detonators required a current of about 0·8 ampere for fusing. Mr. Heslop said that the chief field for electrical firing of mines was for harbour protection, as reliable connections and cables could then be laid. The ordinary time-fuses were generally satisfactory in other cases.

Section (*c*), "Searchlights and Projectors," to be opened by Mr. E. L. M. Emtage, was adjourned to March 31st next.

At the meeting of the Yorkshire Local Section on Wednesday last, a paper was read by Mr. W. R. Cooper, on "Electric Cooking: Mainly from the Consumers' Point of View." The same paper was to be read last night in London.

National Association of Colliery Managers.—In a paper on "The Electric Safety Lamp in Mines," read to the Association in Edinburgh, on Saturday, Mr. John George, Cambuslang, pointed out that it had to be admitted that the first cost of flame lamps was lower than that of electric lamps, but first cost was not everything; with the reduced light furnished by flame safety lamps it was nearly impossible to keep coal clean, and, in many instances, managers had to pay for dirt when they ought to be getting coal. Then owing to the same cause they were always liable to have falls of roof and sides. There was no doubt that the number of electric lamps in daily use in the mines was increasing by thousands every year, one firm alone having 75,000 lamps in daily use in the pits.

Edison and Benzol.—Mr. T. A. Edison is said to have turned his attention to the problem of recovering benzol from coke-making plants; it is reported that he is engaged on the construction of a plant for that purpose in accordance with his own designs, at Johnstown, Pennsylvania, adjoining the by-product coke ovens of the Cambria Steel Co.

Russian Trade.—*Apropos* of the references to this subject in our leading columns to-day, we are in touch with a French engineer of considerable experience, who speaks and writes Russian fluently, and has business relations with Russia: his services are at the disposal of any reader who is desirous of establishing trade with that country.

Educational.—A well-equipped laboratory for electrotechnical work was recently opened at the Madras College of Engineering, which can now provide courses of instruction up to the highest standard demanded for engineering work in India.

Appointments Vacant.—Engine driver and switchboard attendant (30s.), for Royal Holloway College, Englefield Green, Surrey; junior shift engineer (25s.), for Heywood Electricity Works; fitter (36s.), for Royal Holloway College, Englefield Green, Surrey; a cable engineer is wanted by a company which intends erecting works for the manufacture of vulcanised rubber cables. See our advertisement pages to-day.

Electric Vehicle Charging Stations.—We learn that the General Electric Co., Ltd., have been appointed official manufacturers to the Electric Vehicle Committee of the standard design of illuminated box sign for charging stations and for garages where charging facilities are provided. The sign, wired complete, with terminal box, and arranged for bolting to the face of a wall, or supporting from the usual type of bracket, is made in four standard sizes. The two standard sizes, 30 in. square and 18 in. square, each size with either a single or double face, are those recommended by the Electrical Vehicle Committee. This sign is also the subject of a leaflet, No. F. 1,887. The frame and case are of stove-enamelled iron, black outside and white inside, and the panels are of duplex glazing, formed of a front sheet fired with red and white permanent colours, backed by a sheet of clear glass. The advantages of this method of glazing are:—Bright colours which show well both by day and night; strength; and smooth surfaces on both sides of the panel, which keep clean longer and are easily cleaned.

Action Against the Marconi Co.—For some days past Mr. Justice Avory and a special jury have been occupied with the hearing of the case of J. W. Hamilton *v.* Marconis' Wireless Telegraph Co., Ltd. The plaintiff, who acted as defendant's sole agent in Australia and secured a number of important contracts there, claims damages for wrongful termination of his engagement. The company has a counterclaim for damages. The hearing stands adjourned.

Patents and Alien Enemies.—Application has been made to the Board of Trade by the Manchester Armature Repair Co. to avoid or suspend the following patents:—10,457/06, granted to Hopfelt; 2,711/10, 20,634/10 and 9,941/11, granted to the Specialfabrik für Aluminium Spulen und Leitungen G.m.b.H.; and 27,651/12 granted to Loewenthal. The hearings are fixed for March 23rd.

For Sale.—Salford Corporation invites tenders, by March 22nd, for the purchase of storage battery, booster, two balancers and electric motors. Particulars are given in our advertisement pages to-day.

Black Smoke Offences: Electrical Cable Manufacturers and War Orders.—Two electrical cable manufacturers having works in Manchester were amongst a number of defendant firms summoned at the Manchester Police Court on Wednesday for permitting emissions of black smoke from their works' chimneys. A representative of one of the firms suggested that the local Sanitary Committee (who authorise these prosecutions) should allow more latitude under the present exceptional circumstances. They were busy on army contracts, and their difficulties were added to by the fact that they had been, owing to enlistments amongst the men, compelled to find fresh firemen. They had had five firemen in one month, and the man they had now was not satisfactory.

A similar representation was made in the second case, but fines and costs were, nevertheless, imposed in each case.

Pocket Torches.—According to a note in the *Evening News*, a British-made battery, as good as the German article but at a lower price, called the "Diehard," is now available for pocket torches. This battery, we may add, is made by Messrs. Signum, Ltd., of 46, Kingsway, W.C.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Under a scheme for the re-arrangement of the staff of the Walsall electric supply department, the following and other alterations are proposed:—Management staff—(1) C. W. COOKSON, now chief clerk and collector, to be accountant and collector at his present salary; (2) D. MILLS, second clerk (now £104 per annum), to be appointed chief clerk, at £130 per annum, increasing by £10 annually to £150 per annum. Distribution staff—(1) a meter tester and installation inspector to be appointed at £2 2s. per week, rising to £2 10s. per week; (2) E. EYNON, senior sub-station attendant, to be temporarily sub-station foreman, at £1 17s. 6d., rising to £2 2s.; (3) new sub-station attendant to be appointed at (probably) 30s. per week; (4) the wages of sub-station attendants, G. ALRIDGE and J. STOKES, to be advanced by 2s. 6d. per week each. Sales department staff—(1) the canvasser (MR. H. HOPKINSON) to be sales engineer and canvasser, at £2 7s. 6d. per week, an increase of 5s. 6d. per week. The question of appointing a separate canvasser has been deferred for three months. The immediate annual increase in salaries and wages under the proposed re-organisation is £438, a large proportion whereof is in respect of new work which will be self-supporting.

MR. J. ELLIS and MR. V. A. WOODLAND have resigned their appointments as shift engineer and meter inspector, respectively, at the Watford electricity works. Increases in the salaries of the undermentioned employés at the electricity works, are to be made as follows:—J. E. WALLEY, mains engineer, £145 to £170 per annum; W. MIDDLETON, shift engineer, £90 to £100 per annum, rising by annual increments of £5 to £110; E. E. POPE, shift engineer, ditto; F. H. JOHNSTONE, meter inspector, 30s. to 35s. per week. The Electricity Committee has been given authority to select candidates and make appointments in all vacancies coming under its notice up to and including £100 per annum.

MR. J. H. PARKER, on leaving the Greenock electricity works to take up his position at Croydon, was presented by the staff and employés with an electric floor standard and shade. Mr. F. H. Whysall, chief engineer, made the presentation.

MR. C. CRANDON has resigned his appointment as switchboard attendant at the Tunbridge Wells electricity works in order to take up an appointment at the Chelsea electricity works.

Woolwich T.C. on March 3rd increased the salary of MR. S. H. PENNING, deputy electrical engineer, by two equal instalments of £15, to a maximum of £250 a year; and that of MR. C. HOBSON, charge engineer, from £130 to £140.

Lancaster T.C. has appointed MR. J. B. PATTERSON, works superintendent at the electricity works, as assistant engineer, he to be paid £3 3s. per week whilst the electrical engineer is absent on military service.

Rotherham T.C. has appointed MR. J. R. LILLEKER, who has been on the staff for 14 years, as assistant electrical engineer, at a salary of £200 a year. He succeeds Mr. J. Williams, who is now electrical engineer and tramway manager at Erith.

Maidenhead T.C. has appointed, out of over 150 applicants, MR. WILLIAM EDWARD CLARET, of South Tottenham, as station superintendent at the electricity works, at £175 per annum.

MR. H. F. WRIGHT, of the Dover Corporation electricity staff, has resigned, and his successor is MR. BYLES, an old student at the works.

MR. H. H. PARTINGTON, who was appointed to the sub-station superintendent vacancy at Salford, has now decided to remain with the Scottish Central Electric Power Co., Falkirk.

Tramway Officials.—The Plymouth Tramways Committee has recommended the appointment of MR. C. R. EVERSON as tramways manager, at a salary of £500 a year and house, for three years from November 9th, 1914, with an option to extend the term for a further period of a year, the compensation to which Mr. Everson is entitled to be suspended whilst he holds the office.

The Darlington T.C. has appointed MR. FRASER, of Kilmarnock, as tramway traffic manager.

General.—The foremen of Messrs. Howard & Bullough, presented MR. G. W. SOMERVILLE with a smoking cabinet suitably inscribed, and a gold mounted walking stick, as a token of esteem, on his resignation of the position of chief electrical engineer at Globe Works last week. The presentation was made by Mr. James Arrowsmith, the oldest foreman. Mr. Somerville had previously been presented with a suit case and military hairbrush by the men employed in the firm's electrical department. He is now interested in the Unity Wood and Iron Co., Padiham, and is also in practice as a consulting and inspecting engineer.

We are informed that Mr. R. T. Durran, an English director of the Allgemeine Elektricitäts Gesellschaft, Berlin, and its English and foreign subsidiary companies, who was responsible for the organisation and management of the A.E.G.'s large foreign business, returned to this country from Germany some months ago. We understand that Mr. Durran's departure from Germany was made possible by the assistance of Dr. Rathenau and Mr. Deutsch, the heads of the A.E.G.

MR. V. T. TAYLOR, who, we understand, is well known in South African electrical circles, has recently returned from the St. John Del Rey Gold Mines, Brazil, and has taken up a position with Sir W. Armstrong, Whitworth & Co., Elswick Works, for the duration of the war.

MR. A. P. TROTTER'S official address is 8, Richmond Terrace, Whitehall, London, S.W., and not the one printed by accident in the List of Members of the Institution of Electrical Engineers.

MR. REGINALD P. WILSON is now on his way back to London after an extended visit to South America.

MR. GEORGE BALFOUR has joined the board of the Cordoba Light, Power and Traction Co., Ltd.

Obituary.—Mr. A. L. E. Drummond.—The death occurred in Newcastle-on-Tyne on 5th inst. of Mr. Alfred L. E. Drummond, manager of the Post Office telephones in the city, and formerly manager for the Newcastle District for the National Telephone Co., who was a past president of the Newcastle local section of the Institution of Electrical Engineers. Mr. Drummond was born at Scarborough in 1860. He served his apprenticeship with Messrs Crooks Roberts & Co., engineers, of Sheffield, and then went to London. In 1881 he returned to Sheffield as secretary and assistant-manager to the Telephone Exchange and Electric Lighting Co. Five years later he joined the National Telephone Co. as district manager in the Potteries. Later Mr. Drummond was transferred to Leeds, afterwards to Manchester, then to Oldham, and four years later to Plymouth. In 1902 he was appointed manager of the Newcastle district, and on the purchase of the National Company's system by the Government he continued in that position.

Mr. H. Garbutt.—We regret to hear of the death of Mr. Harry Garbutt, representative for many years of Messrs. I. Frankenburg & Sons, Ltd., cable makers, Salford, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Robert W. Blackwell & Co., Ltd. (63,446).—Capital, £250,000 in £1 shares. Return dated January 14th, 1915. All shares taken up. £1 per share [illegible] 75,007 [illegible] 10s. per [illegible] on 25,000; £87,507 paid, £149,902 [illegible] 149,993 [illegible]. Mortgages and charges: Nil.

Adelaide Electric Supply Co., Ltd. (84,209).—Capital, £[illegible] in 40,000 [illegible] 60,000 [illegible] shares of £5 each. Return dated January 5th, 1915. 43,860 [illegible] 50,000 [illegible] taken up. £5 per share [illegible] 43,860 [illegible] 24,000 [illegible] £339,025 paid. £130,000 considered as paid, 26,000 ord. Mortgages and charges: £219,572 five per cent. [illegible] 950 [illegible] shares [illegible], payable in cash, [illegible] 1915.

Burmah Electric Tramways and Lighting Co., Ltd. [illegible] £200,000 [illegible] 20,000 [illegible] 20,000 [illegible] shares of £5 each. Return dated December 31st, 1914. All shares taken up. £100,000 paid on [illegible] £100,000 [illegible]. Mortgages and charges: Nil.

E. S. Co., Ltd. (139,230). Particulars of £20,000 debentures, [illegible] February 11th, 1915, [illegible] pursuant to Section 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Creed Bille & Co., Ltd.—Two mortgages, one as collateral security, both dated February 4th, 1915, to secure £1,500, charged on land in Cherry Orchard Road, Croydon, with buildings thereon, formerly known as the Croydon Skating Rink, and benefit of building agreement relating to certain lands in Cherry Orchard Road, Addiscombe Road, Colson Road, and Cedar Road, Croydon. Holder: W. T. Bolland, 22, Colson Road, Croydon.

National Telewriter Co., Ltd.—Particulars of £15,000 debentures, created February 26th, 1915, filed pursuant to Section 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,000. Property charged: The company's undertaking and property, present and future. No trustees.

CITY NOTES.

The Mackay Companies.

The accounts for the year ending February 1st last show about the same figures as were issued last year, with the exception of operating expenses, which show an increase of $29,997, a trifle when compared with capital liabilities of $91,380,400. The income from investments in other companies is more this year by $43,601, while the cash assets are up by $117,964. We have on previous occasions remarked on the meagre nature of the accounts, which do not give a proper conception of the financial state of the Trust. To mention one instance again, it is not stated if the investments in other companies are "at cost" or "market value," and until this is stated uncertainty must exist. Nothing has apparently been carried to reserve, and in this connection it may be mentioned that last year it was stated that "reserves have been increased not so largely as in previous years, but substantially." This, taken in conjunction with the remark that the trustees have been compelled to insist on the most rigid economies in operating expenses, is not very encouraging. Notwithstanding the tendency towards lower rates, the trustees are prepared to lay a cable to compete with the Western Union in Mexico, and so cut rates still further, and the "Cuban" rate war is quite fresh in our memories. When talking about increasing rates the trustees are treading on very delicate ground, and it remains to be seen how far success will attend efforts in this direction, particularly in vew of the extension of cheap rate services by other Atlantic telegraph companies. Is the capacity of the Atlantic cables being used to the full? The volume of traffic available is enormous, and it is a question how far the policy of refusing to take night and week-end letters adversely affects the commercial lines. Of course, due allowance must be made for the existing disturbed trade conditions, which it is hoped, will soon terminate and lead to the usual brisk business.

Neuhausen Aluminium Industry Co.

The report for 1914 of the Aluminium Industrie A.G., or Neuhausen, states that favourable results were obtained, but nothing is mentioned as to the situation of the market or the influence of the war on this particular trade. The financial figures, permitting of the payment of a dividend of 20 per cent. on old share capital, as in 1913, and of 10 per cent. on new share capital, were reproduced in this journal two or three weeks ago. It appears that while the works at Neuhausen and Rheinfelden experienced no capital changes as contrasted with 1913, and those at Lend-Rauris underwent a slight diminution in consequence of the sale of a site, an increase of £124,000 took place in connection with the Vallais works, which was chiefly incurred in the Borgne water-power plant and the extension of the Rhone works. It will be possible to bring the Borgne plant in operation as soon as required. The extension of the works at Marseilles and the participation in bauxite mines have raised the capital expenditure on these from £287,000 to £485,000, but a reduction has occurred in the Goldschmieden-Trotha auxiliary company. The Neuhausen company has taken up as a new interest £68,000 in the Martius Works of Bergheim, near Cologne, which is to produce bauxite.

Hastings and District Electric Tramways Co., Ltd.

During 1914 there was a decrease in the traffic receipts of £3,141, entirely attributable to the war. The expenditure shows a decrease of £4,101, which is in excess of the falling off in the receipts. The revenue after crediting receipts from the statutory company, £19,349, and transfer fees £7, and debiting administration expenses £1,338, shows a balance of £18,018, plus £1,037 brought forward. Deducting £10,633 for interest charges, there remains available £8,421. Owing to the uncertain financial outlook in October last, the directors thought it best to hold back the interim dividend on the preference shares, but they now propose to pay a final and complete dividend of 6 per cent. for the year, absorbing £4,800; £1,000 is to be transferred to depreciation account, to write £1,500 off suspense account, and to carry forward £1,121. The installation of the Tilling-Stevens petrol-electric system on the front line has been carried out. The 17 cars required for the purpose were duly converted, and the last of them were placed in operation during the month of July, since when the system has worked satisfactorily.

Mr. Geo. Kitchin, who presided at the annual meeting held on Tuesday at the offices, 1, Queen Victoria Street, E.C., referred first to the general disturbance that had resulted from the war. This company's receipts had fallen, since the war began, by about 30 per cent. Fortunately, it had been possible to curtail the expenses; but had they gone on as they were doing up to the end of July they would have had an increase in receipts as well as a reduction in their working expenses. Up to the outbreak of the war they had an increase of £570 on their traffics, whilst the reduction of working expenses had been continuous throughout the year. The traffic receipts of the Hastings company amounted to £50,204, plus £632 for advertising, etc. On the expenditure side, a decrease was shown in each item, the total saving being £4,101. Over £3,000 of this sum was a saving on maintenance and repairs. These had now been reduced to a normal figure, the shortcomings of previous years having been made good. The total amount expended was £31,488. Bringing down the balance, £19,349, to the Hastings and District revenue account, and deducting their usual London expenses, together with debenture interest, and interest paid to bankers, and adding £1,037 brought forward, they had £8,421. It was proposed to carry £1,000 to depreciation account, which would then stand at £26,000, and to write £1,500 off the suspense account, which stood on the credit side of the balance sheet and represented legal and other expenses incurred in the installation of the petrol-electric system. These cars were working in a satisfactory manner. At first there were some difficulties with the lighting and the tanks for the petrol which were placed in the cars; but these difficulties had now been overcome; the 17 cars had been at work for several months, and they heard of no complaints from the public. The loan from the bankers of £5,500 had been reduced to £4,000. Following the promise made to them last year, they had carried the whole of the cost of their petrol-electric installation to a suspense account which they proposed to write off by steady annual payments, so as to get rid of the danger which there was of having an item standing to the credit of their journal which could not be justified. They were not yet free of the contractors, but the item which stood on the balance sheet represented the whole of the outlay which was involved in this change. In October last, when they should in the ordinary course have paid an interim dividend on the preference shares of the company, they did not consider that the position of the company would allow of their doing so, as the financial outlook was dark, and they were not convinced that the petrol-electric system which they were installing would answer; therefore they decided to hold back the preference dividend until the end of their financial year, when the final figures would enable them to see more clearly what the position was. That day they were hoping to pass a resolution authorising the payment of that dividend, though it was not proposed to send out the cheques for it until the end of the present month. At the same time, he wished to warn them that it was possible that the preference dividend might not be earned during the current year, as the figures for 1915—comparing with those of 1914—would probably for the first six months show a considerable shrinkage. They would possibly be desirous of knowing how they were situated with regard to the local authorities, and he regretted that he was not in a position to give them any satisfactory intelligence on this point. The wish of the board was, and always had been, to work amicably with the Corporation, but for some reason or other it would appear that the committee which controlled these affairs was not able to see eye to eye with the directors on any point, and was continually throwing obstacles in the way of their improving the services. Still, they could only hope that this state of things would not continue indefinitely. The Chairman referred to the death of the late general manager, Mr. Holliday, and said that as his successor they were fortunate in having to hand Mr. Edwards, who had been managing the company's affairs during Mr. Holliday's illness. They therefore appointed him general manager, and the result they saw that day was the effect of the appointment. The efficiency of the company had not suffered by the change, and the work in Hastings was well and effectively supervised.

Mr. J. C. WILLIAMSON seconded the motion.

Mr. WEBB asked if the board anticipated much reduction in expense from the adoption of the petrol-electric form of traction on the front at Hastings.

The CHAIRMAN said that last year he stated there would be an increase of expense by the introduction of the petrol-electric system, and he had no reason to alter that opinion that day. The cost of petrol would be to a considerable extent added cost, and there would also be the cost of the maintenance, which was a considerable item on the cars which were fitted for that purpose.

Newcastle and District Electric Lighting Co., Ltd.—The annual meeting was held on 5th inst. in Newcastle-on-Tyne, Sir Benjamin C. Browne, who presided in the absence of Dr. J. B. Simpson, first referred in some detail to the capital account. Dealing later with the profit and loss account, he said that the item £11,388 for wages, salaries, and rates, &c., showed an increase of £1,023, largely accounted for by an increase of £760 for rates due to a new assessment of the company's works and mains. The total gross receipts for electrical energy showed an increase of £7,514 over 1913. These receipts had been adversely affected due to the earlier closing of licensed premises and the reduction of lighting in shop fronts, &c., but this had been compensated for by the increased demand for power purposes. The gross profits for the year were £32,039, being an increase of £1,206, and the amount available for distribution was £21,293. The arrangement made with Messrs. Spencer & Sons, of Newburn, to utilise the whole of their exhaust steam had now come into force, and the directors felt confident that this would be the means of a great saving in the working costs. The dividend at the rate of 3 per cent. was approved.

Chelsea Electricity Supply Co., Ltd.—The profit for 1914 was £37,810, plus £2,766 brought forward and £2,201 for interest, making a total of £42,777. After deducting interest on debenture stock, £7,875, interim dividend on the preference shares at the rate of 6 per cent. per annum, £900, and interim dividend on the ordinary shares at the rate of 4 per cent. per annum, £4 944, £29,058 remained. It is intended to appropriate this as follows :—To credit of reserve for renewals, depreciation and contingencies, £14,420 ; debenture stock premium redemption fund, £704 ; written off cost of extinction of founders' shares, £1,089 ; written off cost of investments, £1,429 ; final dividend on the preference shares, making 6 per cent. for the year, £900 ; final dividend on ordinary shares at the rate of 6 per cent. per annum, making 5 per cent. for the year, £7,415, leaving to be carried forward £3,101. The number of 8-C.P. lamp equivalents connected on December 31st, 1914, was 314,276, an addition of 7,854 during the year, and the total number of units sold was 4,342,182, being 108,983 less than for the previous year. The annual meeting was held yesterday.

Newmarket Electric Light Co., Ltd.—During 1914 the equivalent of 1,015 33-watt lamps were connected to the mains, making the total connected 30,744 lamps. The profit on the year's working, plus £146 brought forward, amounts to £2,464, which, after providing for debenture and other interest, £733, leaves £1,731. The directors recommend a dividend of 3½ per cent., that £650 be carried to reserve for renewal of plant, and that £151 be carried forward.

Direct Spanish Telegraph Co., Ltd.—The dividend at the rate of 10 per cent. per annum on the preference shares, less income-tax, and one at the rate of 4 per cent. per annum on the ordinary shares, free of income-tax, are recommended for the half-year ended December 31st, 1914. In addition a bonus on the ordinary shares of 2 per cent. for the year 1914, free of income-tax, is to be paid.

British L. M. Ericsson Manufacturing Co., Ltd.—For 1914 the directors report that, notwithstanding the abnormal conditions of trade, the company's business continues to show a most satisfactory result. £25,000 appearing in the balance-sheet as on deposit with Aktiebolaget Stockholms Handelsbank was withdrawn on January 1st, 1915, and a corresponding amount of war loan has since been purchased. The net profit, after charging £10,906 for depreciation and £2,500 for debenture interest, amounts to £20,615, plus £6,409 brought forward, making an available balance of £27,023. After paying the preference dividend, amounting to £5,999, a dividend of 8 per cent. per annum is to be paid on the ordinary shares, requiring £8,001, placing to reserve account £6,000, and carrying forward £7,023. Annual meeting, March 17th.

Hadfields, Ltd.—In reporting upon the position of the company at December 31st, 1914, the directors propose to add £26,000 to the reserve and renewal account and carry forward £60,270. They recommend that in addition to the interim dividend of 1s. per share paid in August last, a further dividend be paid on the ordinary shares of 2s. per share, together with a bonus of 1s. 6d. per share, all free of income-tax. Mr. J. P. Crosbie, works manager, and Mr. W. B. Pickering, commercial manager, have been elected directors.

Ramsgate and District Electric Supply Co., Ltd.—Including £1,034 brought forward, the gross profits for 1914 amount to £5,070, and after allowing for interest at the rate of 5 per cent. per annum on outstanding accounts due to the contractors, and writing off the cost of creating debenture stock, there is a balance of £3,724. The directors recommend the payment of a dividend of 5 per cent., and that £1,200 be placed to the reserve account, leaving £1,524 to be carried forward.

Canadian General Electric Co., Ltd.—A quarterly dividend of 1¾ per cent. for the three months to March 31st, being at the rate of 7 per cent. per annum, on the common stock, and a half-yearly dividend of 3½ per cent. for the six months to March 31st, being at the rate of 7 per cent. per annum on the preference stock, are announced.

Hydro-Electric Power and Metallurgical Co., Ltd.—The *Financial Times* says that a meeting of the holders of the debentures is being held to-day to approve resolutions accepting allotment by the Government of Tasmania of £137,750 4½ per cent. Tasmania inscribed stock, to be paid forthwith, and to distribute the stock among the debenture-holders in exchange for the debentures held by them at the rate of £95 of the stock for each £100 debenture, and £19 for each £20 debenture.

Alley & MacLellan, Ltd.—The *Times* states that the profits for 1914, including £1,741 brought forward, amounts to £25,272. The directors have allocated £9,113 to depreciation and £10,000 to reserve, and recommend that the dividend on the preference shares for the year be paid, leaving £1,908 to be carried forward. Last year a dividend of 6 per cent. was paid on the ordinary shares.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the five weeks ended January 29th, 1915, amounted to 1,254,082, compared with 1,387,896 in the corresponding five weeks of 1914. The reason for the decrease is general slackness of business in Calcutta owing to the war.

Stewarts & Lloyds, Ltd. — After setting aside £100,000 for depreciation, dividends of 10 per cent. per annum on the preferred ordinary shares, and 2s. each on the deferred shares (making 2s. 6d. per share for the year), are recommended, placing £50,000 to reserve fund, and carrying forward £97,000.

British Westinghouse Electric and Manufacturing Co., Ltd.—The directors have decided to pay a dividend on the preference shares for the year ended December 31st, 1914, at the rate of 7½ per cent.

Automatic Telephone Manufacturing Co., Ltd.—The profit for 1914 amounts to £35,797, against £22,941 for 1913. After payment of preference dividend and writing off £10,960, as against £8,093, a dividend of 3 per cent. for the year on the ordinary shares is declared, carrying forward £5,256 against £3,218. The transfer-books will be closed from 12th to 20th instants.

International Light & Power Co., Ltd.—A dividend of 1½ per cent., less British income-tax, on the preference shares is announced for the quarter ending March 31st.

Globe Telegraph and Trust Co., Ltd.—Interim dividend, 2s. per share, free of income-tax, on the ordinary shares for the past quarter.

Altrincham Electric Supply Co., Ltd.—A dividend of 10s. per share on the deferred shares, subject to tax, is recommended.

Brompton and Kensington Electricity Supply Co., Ltd.—After appropriating to depreciation and sundry reserve accounts sums amounting to £12,121, the directors recommend a final dividend on the ordinary shares at the rate of 11 per cent. per annum, making 10 per cent. for the year, carrying forward £5,625. For 1913 the dividend was at the same rate.

City of London Electric Lighting Co., Ltd.

Capital expenditure during 1914 upon additions, extensions and replacements amounted to £61,939, making the total £2,622,813. There was written off prior to December, 1913, £566,984, and a further £21,210 has been written off in respect of buildings, plant and other works dismantled during the year 1914, so that the net expenditure at December last was £2,034,619, showing an increase of £40,729 for the year. The balances at credit of the reserve funds stand as follows:—Reserve account No. VI. £175,885, first debenture stock premium redemption account No. VII. £66,019, leasehold redemption account No. VIII. £5,088, reserve for doubtful debts £1,808, plus the amount proposed to be carried forward to 1915 £23,372, making the total £272,173. The annual profit has naturally been prejudiced by the enforced reduction of lighting and by the increased cost of coal and of all other items of production. The total revenue for the year, £303,543, including interest on investments and discounts £2,541, was £306,084. Expenses of generation and distribution were £72,065, repairs and maintenance of buildings, machinery, plant, mains and other works £11,076, rent, rates, taxes, management expenses and special charges £58,478, leaving £164,465, plus £27,837 brought forward, making a total available revenue of £192,301. Of this sum the following amounts have been distributed or provided for:—Interest on loan from bankers, consumers' deposits, etc., £3,292, interest on first and second debenture stock for 1914 £30,918, interest transferred to debenture stock premium redemption account £1,547, leasehold redemption account, interest and appropriation £288, contributions to employés' provident funds and under National Insurance Act £1,958, stores written down £138, transfer to reserve account £50,000, leaving available £104,160. After paying 6 per cent. on the preference shares for 1914, and a total dividend of 9 per cent. for the year on the ordinary shares, as compared with 10 per cent. for 1913, £23,372 is to be carried forward.

The following tables show the position at the end of 1914 and 1913 respectively, but owing to the war no true comparison can be made:—

	1913	1914	Decrease.
Gross revenue from all sources .	£314,313	£306,084	£8,229
Net revenue	174,590	164,464	10,126
Distribution on ordinary shares ...	10 per cent.	9 per cent.	

PRIVATE SUPPLY FOR ALL PURPOSES. AVERAGE PRICES PER UNIT OBTAINED

In 1911, 2.39d.; 1912, 2.37d.; 1913, 2.33d.; 1914, 2.26d.

CUSTOMERS AND CONNECTIONS (PRIVATE SUPPLY), AFTER ALLOWING FOR DISCONNECTIONS ON ACCOUNT OF REMOVALS, SUBSTITUTION OF METALLIC FILAMENT LAMPS, ETC.

	1913.	1914.	Increase.
Number of customers being supplied .	15,083	15,090	7
Number of KW. connected (including power and heating)	43,703	45,532	1,829

On February 17th, 1915, there were 46,678 KW. applied for, out of which 45,831 were connected, and the customers numbered 15,060.

TOTAL UNITS GENERATED, SOLD, ETC.
(Including Public Street Lighting.)

	1913.	1914.
Generated	33,542,870	33,906,963
Sold	29,112,618	29,182,165
Metered and used by the company ..	1,490,078	1,861,660
Expended in distribution, etc.	2,940,174	2,863,138
Maximum supply demanded .. .	19,433 KW.	19,739 KW.

The total units sold show an increase of 69,547 over 1913.

Power and heating supplies continue to show a steady increase, the total units sold for these purposes in 1914 being as follows:—Power, 11,500,946 units; heating, 2,193,827 units; = 13,694,773 units, equal to 48.6 per cent. of the total units sold for private supply. The directors mention the withdrawal of the County Council's 1914 Bill and the two London Power Bills of the present Session.

Annual meeting, March 16th.

County of London Electric Supply Co., Ltd.

The directors report that the capital expenditure during 1914 in the London districts was £145,851, making the net total in respect of those districts £2,098,549. The balance from revenue account, after deducting generation and distribution costs, rents, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries, was £164,043, plus £7,013 brought forward. Interest on the first and second debenture stock and interest on temporary loans, less income tax, absorb £44,215; there is carried to reserve for depreciation, repairs, renewals, etc., £40,000, leaving £86,841 for distribution. Interim dividends on the 6 per cent. preference and on the ordinary (5 per cent.) already paid absorbed £29,909, leaving £56,933. The directors now recommend a further dividend on the 6 per cent. preference shares and a further dividend on the ordinary shares for the December half-year at the rate of 9 per cent. per annum, less income tax, leaving £12,471 to be carried forward. The applications received during the past year amounted to the equivalent of 5,206 KW.; making the total 54,705 KW. The total units sold were 28,012,741, an increase of 2,269,418 units. The number of consumers has increased during the year from 22,315 to 24,212. In view of the lighting restrictions imposed upon the London areas by the Admiralty in consequence of the war, and which have affected the output, particularly for the last quarter of the year, the directors consider the results eminently satisfactory. The issue of 10,000 six per cent. cumulative preference shares and 6,000 ordinary shares made in March last was over-subscribed. Reference is made to the withdrawal of the two London Electricity Supply Bills that were before the present Parliamentary Session. The directors of the Bournemouth and Poole Electricity Supply Co., Ltd., have declared a final dividend on the ordinary shares at the rate of 9 per cent. per annum, making 7 per cent. for the year. The progress made by the Coatbridge and Airdrie Co. during the past year has been satisfactory.

Units generated and purchased	36,781,413
Quantity sold—Public lamps	207,692
Private consumers by meter	27,805,049
Total sold	28,012,741
Used at works	3,145,751
Total accounted for	31,158,492
Not accounted for	5,622,921
Public lamps . .	363
Total maximum supply demanded, KW.	13,700

Annual meeting, March 15th.

Bournemouth and Poole Electricity Supply Co. Ltd.

The directors' report for 1914 shows that new capital expenditure amounted to £14,553, making the total £487,549. The balance from revenue account, after deducting generation and distribution costs, rent, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries, is £41,681, plus £2,145 brought forward. Out of this, interest on debenture stock and interest on temporary loans, less income tax, absorb £9,965, leasehold and special redemption funds and interest £1,899, written off suspense accounts £21; carried to reserve for depreciation, etc., £7,000, leaving £24,941 available. Interim dividends on the 4½ and 6 per cent. preference shares, and on the 15,000 ordinary shares (5 per cent. per annum) for the June half-year amounted to £9,337, leaving £15,604. After paying the final dividends on the preference shares, a final dividend on the ordinary shares at the rate of 9 per cent. per annum for the December half-year, less income tax, is declared, leaving £3,829 to be carried forward. The total applications received amounted to the equivalent of 9,664 KW., being an increase of 874 KW. for the year. The total units sold for all purposes was 3,910,511. The Richmond (Surrey) Electric Light & Power Co., Ltd., has declared a dividend of 6 per cent. on the ordinary shares.

Units generated	5,139,370
Units sold—Public lamps	26,850
Private consumers by meter	3,883,661
Total sold	3,910,511
Used on works	3,145,751
Total accounted for	4,447,367
Not accounted for	692,003
Public lamps	161
Total maximum supply demanded, KW.	2,732

Annual meeting, March 18th.

Scarborough Electric Supply Co., Ltd.

Mr. G. Alderson Smith presided at the annual meeting, held at Scarborough, on February 27th. He referred regretfully to the death of the Secretary (Mr. John Hall, J.P.), who was one of the victims of the bombardment of Scarborough. "I think," he said, "this is the 23rd annual meeting, and at all before this Mr. John Hall was very much in evidence and always gave us all the help he could." Proceeding, the Chairman characterised the financial report as a war budget, because the war was the whole thing that influenced them. In effect, they had done very well, because after the first seven months of the year, the remaining months, when they ought to have made their large profit from the hotels and places of amusement, brought them nothing. That was where their loss had been. Practically, the amount brought forward for balance applicable to dividend on the ordinary shares this year was £3,847; last year it was £3,848. If it had not been for the war they should have had a record season. They had spent £285 more on coal. Under other headings they had also spent more. There was not only the war, but also the bombardment of Scarborough. About two hundred of their customers shut up their houses and bolted. They had great difficulty in getting in to read the meters. They had sent circulars to people asking them to send their keys or indicate where the keys were. Twenty had not taken any notice. He thought the refugees had done more harm to Scarborough than the bombardment. He moved the adoption of the report and balance-sheet, with a dividend of 2 per cent., less income-tax. This would absorb £2,000, and he explained that they were carrying £1,000 forward against whatever this year might have in store for them. They could only hope that it would be possible for lighting restrictions soon to cease.

Mr. Harold T. Ellis, seconding, said the total number of units supplied was very considerably greater than it had ever been before, and was, he thought, a record. The position brought about by the introduction of the one-watt lamp, which at first did the company considerable harm owing to its extreme efficiency, had now been about recovered by the extra connections. The increase of connections this year amounted altogether to an equivalent of 250 KW., an increase of consumers of 10 per cent. They had in front of them the prospect of the half-watt lamp, which would still further reduce their consumption until they could increase their consumers. When it came they could look forward with confidence to being in a much better position to compete against gas. He was afraid there was not much prospect of their being able to make their coal contracts next June at any cheaper rate, and one had to realise, with things as they were at Scarborough now, that their prospects for this year were not very bright.

The resolution was adopted.

The Chairman remarked that Mr. F. G. Holden, B.A., A.M.I.C.E., had been appointed secretary and manager, thus combining the two offices.

Waste Heat and Gas Electrical Generating Stations, Ltd.

The profits earned by the company during the year ended January 31st, 1915, after deducting administration expenses, amount to £39,001, as compared with £38,245 in the previous year, less £10,500 transferred to the credit of reserve account, and adding £12,110 brought forward. The profits available are £40,611, as compared to £37,710. A dividend at the rate of 8 per cent. for the year (the same as for 1913) requires £25,600, and there is to be carried forward £15,012, against £12,110. The reserve account is now £53,351, and the redemption funds in respect of plant supplied on hire purchase terms amount to £11,299. The supply of waste heat and gas and the output of electrical energy from the company's generating stations has on the whole been satisfactorily maintained throughout the year. No new generating stations have been erected since the last report, but negotiations have recently been taking place for some additional plant to be installed at Weardale Power Station with a view to the more efficient utilisation of the gas received from the coke ovens. It has also been arranged to erect some further plant at the company's Grangetown power station with the object of maintaining a greater output from that installation. These new works can be carried out at a cost within the cash resources which the company has available and should in due course yield a satisfactory increase in the revenue.

The company applied for and was allotted £10,000 of the National War Loan 1925-1928, and £3,500 was called and paid up to the date of the accounts now presented.

In November the directors made a preliminary donation of £200 to different relief funds in connection with the war, leaving the matter for the further consideration of the shareholders at the annual meeting. A resolution will accordingly be moved that the company's contribution out of the profits of the past year be increased to £1,000, to be allocated at the discretion of the directors.

The annual meeting was held on Wednesday.

W. T. Glover & Co., Ltd.

The result of the trading for the year 1914 is a credit balance of £35,397, plus £5,128 brought forward. Directors' remunerations, voted March, 1914, absorbs £1,000, and directors' expenses £59, interest at 4¼ per cent. on first mort. debenture stock £4,250, interest at 5 per cent. on second mort. debenture stock £3,712, written off investments £2,139, leaving £29,364. After deducting £4,000 as appropriation for payment to trustees of second mortgage debenture stock, it is proposed to pay a dividend of 5 per cent. on the cum. preference shares (£100,000) to 31st December, 1914, less income tax £4,615, to transfer to first mortgage debenture redemption fund £2,500, to pay a dividend on ordinary shares (£114,850) at the rate of 5 per cent., less income tax, £5,300, to transfer to reserve fund £5,000, and to carry forward £7,950.

After making the above appropriations, the redemption fund for the first mortgage debenture stock will stand at £38,000, the redemption fund for the second mortgage debenture stock at £32,000, and the reserve fund at £30,000, making a total of £100,000. The application of the Manchester Corporation to Parliament for power to purchase the business of the Trafford Power & Light Supply (1902), Ltd., was not sanctioned.

Annual meeting, March 15th.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The directors report that the connections to the company's system at the end of 1914 amounted to 231,425 h.p., an increase of 27,757 h.p. The profit for the year is £178,380, compared with £141,140, plus £6,589 brought forward, making £184,969. Interest on debenture stocks, loans, etc., absorbs £52,564, leaving £132,405. The dividend on the 5 per cent. preference shares requires £45,589, as compared with £34,375. A dividend of 3 per cent. on the ordinary shares, making with the interim dividend of 2½ per cent. 5½ per cent. for the year, requires £43,870. There is to be transferred to depreciation account £20,000, as against £15,000; £17,000 is to be put to reserve (as compared with £10,000 last year), of which £7,000 is to be treated as a further provision against possible loss on realisation of the company's investments, and £10,000 transferred to reserve account, and £5,946 is to be carried forward. The reserve now stands at £10,405, out of which the directors propose to write off part of the remaining cost of the issue of second mortgage debenture stock, £10,000, leaving in reserve account £405. The unappropriated depreciation account becomes £153,000, which is in addition to the items of £170,000 and £8,600 specifically allocated in the balance sheet. The company's plant and system have been efficiently maintained out of revenue, £74,571 having been spent thereon. The additions to capital expenditure account for the year amounted to £129,590, and represent part of the cost of extensions in progress at the Carville and Dunston Power Stations, and also to the company's general distribution system. The sub-division of the company's £5 shares into shares of £1 each was carried out during the past year.

At an extraordinary general meeting held on the 31st March last, the company's share capital was increased by the creation of 165,000 additional preference shares of £1 each, and 165,000 additional ordinary shares of £1 each, in order to acquire the shares of the County of Durham Electrical Power Distribution Co., Ltd

An offer was sent out to the shareholders of the Durham Co., inviting them to exchange their shares for shares in the Newcastle Co. on the terms agreed, and acceptances of his offer have been received from all shareholders excepting four, whose total capital holding represents £400. Certificates for Newcastle Co.'s shares have now been issued against all shares so exchanged.

In response to appeals for assistance, on the outbreak of the war, a contribution of £200 has been made to relief funds, and the confirmation of this by the shareholders will be asked for at the general meeting. The shareholders will also be asked to express an opinion as to whether a further amount should be placed at the disposal of the directors to meet other claims for assistance.

Annual meeting, March 16th.

Para Electric Railways and Lighting Co., Ltd.

During the year ended November, 1914, the company had to contend with great difficulties due to the rubber crisis and stagnation of trade in the Amazon Valley, the further depression caused by the outbreak of the war, and finally the fall in Brazilian exchange, which for many years had been steady at the legal gold rate of 16d. per milreis.

In consequence of these adverse factors the gross receipts decreased from £299,924 in 1913 to £249,891 in 1914. By close attention to economies on the part of the local management, the operating expenses were reduced from £164,261 to £132,491, the net revenue earned in Pará being, therefore, £117,400. As the accounts are based upon the legal exchange rate of 16d. per milreis, there must be deducted £5,914, being the actual loss incurred on remittances, and after providing also for the London expenses the balance of operating revenue is £106,147 compared with £128,857 in the previous year. Adding £777 interest and transfer fees received, and £19,206 brought forward, the total was £126,130, from which the debenture interest and sinking fund of £38,500, and the interim dividend paid on the preference shares, £9,600, are deducted, leaving £78,030. There is to be transferred to depreciation and renewals reserve £15,000, to contingencies reserve £10,000, a final dividend of 3 per cent. on the preference shares for latter half-year (making 6 per cent., less income tax, for the year) absorbs £9,600, a dividend of 6 per cent., less income tax, on the ordinary shares for the year requires £23,400, and £20,030 is to be carried forward.

If the rate of exchange should remain at a figure below 16d., it will be necessary to adjust the value of local accounts. This is sufficiently provided for in the contingencies reserve, which has a credit balance of £50,522. In August last, when an interim dividend on the ordinary shares would have been declared in the usual course, the directors considered it unwise to reduce the cash resources of the company in London as the general financial position was universally disturbed, exchange was low, and the difficulty of making remittances from Brazil was almost insuperable. All these conditions have since improved. During the year the capital expenditure amounted to £5,828, mainly for extensions to the lighting system. By an active campaign for new business, the number of lighting consumers has been increased, although the consumption of lighting current has fallen off on account of the domestic economies obtaining.

The sum of £5,609 charged against renewals represents the cost of completing the renewal of the underground cable system. The balance to the credit of the renewal fund [illegible] £51,545.

1913		1914	Per cent.	
23,254,258	Passengers carried ...	[illegible]	Dec.	16.8
3,172,069	Car miles run ...	[illegible]	Dec.	6.2
3,890	Consumers connected	[illegible]	Inc.	1.6
2,371,997	Units sold for lighting and power ...	2,430,734	Inc.	2.4

The directors report the death of Dr. Lucio F. do Amaral, director in Pará.

The annual meeting was held on Friday at the Cannon Street Hotel, E.C. Mr. F. Holt, who presided, said that there had been a reduction of £50,000 in gross receipts, brought about by a falling off in the number of passengers, by a more economical use of electricity by private consumers, and by the reduction made voluntarily in the rates charged to the municipality for public lighting. Against this loss they were able to set off a reduction of £[illegible] in the Pará expenses. A [illegible] corresponding approximately to the reduced car service was saved in tramway maintenance, and a saving of over £7,000 in the maintenance of the electric lighting installation was also made possible by the completion of the [illegible] and obsolete underground cables, which were very costly to repair, and other economies were obtained through the reorganisation of the staff and by the fall that had occurred in the local value of all [illegible]. It was [illegible] that [illegible] holders might think that rather than reduce the ordinary dividend they should have reduced the carry-forward or the allocation to the funds, but with this view they could not agree. Not only the cash position of the company called for prudence, but they must bear in mind that there were important factors in the [illegible] entirely outside of their control, and they therefore had no hesitation in [illegible] 10 per cent. to 6 per cent., which they proposed as the dividend on the [illegible] tions of [illegible] well and truly [illegible] them considered that the board had erred on the side of caution, then the money retained was safe and sound in the business and must come into their hands in good season. Having referred at some length to the condition of the rubber industry in the Amazon Valley and expressed the opinion that although it might be hampered at present it was not likely to be lost to the country, the Chairman said that the rate of exchange was the matter which concerned them more than anything else at the present time. At the outbreak of the war, when Brazil decided to fund the interest on her public debt payable in Europe, it was generally expected that this would have a favourable effect upon exchange and that the milreis would be maintained at or near 16d. The fall to the neighbourhood of 12d. had been a great disappointment to all the friends of that country, and might force them later on in the year to consider whether they would be justified in paying an interim dividend on the ordinary shares, or whether it would be again wiser to wait the result of the working for the full year before considering the ordinary dividend. Their position in Pará was being watched with the greatest care, and every effort was being made to work as economically as possible. The fall in the price of local labour had enabled them to change from coal to wood fuel in the power house, and they were effecting a very material reduction in the expenses at the present time on this account, which would help them to meet the reduction they were experiencing in the tramway traffic and the loss due to exchange. Strenuous and successful efforts were also being made to encourage the use of electricity for commercial and domestic purposes in Pará, and these efforts were undoubtedly helping to maintain the revenue on the electrical side of the business. They had been approached by the directors of the gas and telephone undertakings in Pará, which were operated by two English companies, with a view to some arrangement for future management. Those were much smaller concerns than their's, and they found in these bad times that the cost of their administration weighed heavily upon them. They both had to consider whether it was better for them to reduce their personnel, which would lead to a less efficient service to the public, or to maintain the efficiency of their service by combining their administrations with theirs and reduce in this way their operating costs. The services which the Pará Co. gave to the public were, they believed, quite satisfactory, and it was to the general interests that the telephone service and the gas service of the town should be maintained on the same level. That was the spirit in which they were approaching the negotiations they had in hand, and if they were able to complete them they felt sure that the city and all concerned would benefit.

Mr. E. C. Cheston seconded the motion.

The Chairman, in reply to a shareholder, said that except immediately after the outbreak of the war they had not found any difficulty in obtaining remittances from Brazil. The suggestion that they should remit their takings in the form of produce instead of gold was not a feasible one, as it would be too much like speculation.

The report was adopted.

Telegraph Construction and Maintenance Co., Ltd.

The annual meeting was held on March 4th at 38, Old Broad Street, E.C., the Earl of Selborne, K.G., presiding. The Chairman said that they would be struck by the great similarity between the accounts of this year and the two previous years. They showed that when the plant which belonged to the company was fully employed under normal conditions the results had a tendency to repeat themselves. In referring to the times having been normal, he did not forget that nearly six months of the period under review had been passed under the wholly abnormal conditions due to the war; but owing to the protection of the Navy they had been able to pursue the trading operations of the company under conditions which might almost be described as normal. How wonderful the protection of the Navy was many of their fellow countrymen did not fully realise, because they could not have its doings as frequently and as intimately painted for them in the daily press as were the doings of the Army. In some respects, indeed, he thought the operations of the Navy had been too successful, because owing to the protection it afforded the country many people wholly failed to realise that we were still in the unfulfilled crisis of the greatest war of our history. The conditions of life in the country had been too normal—business should not proceed "as usual," but should be carried on with the war in view. He was glad to say that the company had contributed to the fighting forces of the King. About 170 members of the staff and employés were taking an active part in the war, but their praise should not be confined to those who were fighting, because those who had stayed at home—many of them reluctantly—were contributing to the success of the country no less than those who were engaged in the fighting. Special praise and thanks were due to those who had remained at home as well as to those who had joined the forces. The fact that many had gone away had meant increased strain and responsibility on those who had remained at home. He thought it was greatly to the credit of the staff that they had been enabled to produce such satisfactory results. They had treated those men who had gone away with the same patriotic liberality as most companies. It would be idle to conceal from themselves that there were no difficulties in front of them. Nobody could say how long the war was going to last. He was not one of those who thought it was going to come to a speedy termination; he believed we still had a long and arduous task in front of us, and that we were by no means past the crisis of our fate. Difficulties in the supply of labour must manifest themselves not only in their own works but in the works of those who supplied cables. There were also difficulties of transit; but he sincerely trusted that those difficulties would not be increased by any differences of opinion between employers and employed, either in their own business or in any of the businesses upon which they depended. He did not think those difficulties could possibly arise if people really understood that the issue of the war was still in doubt, and that the crisis of our fate as an empire was not past. As a race we were singularly devoid of imagination—we could not see what we did not understand, and he thought the Government and the Press were somewhat to blame in the matter, because he thought the general colour given to the published reports was too favourable. Nobody who had no means of inside information would think that in this war we had had any set-backs at all. Coming back to their own company, it was interesting and encouraging to note that the shares were quoted at a higher figure to-day than they were when he became chairman five years ago, and he did not think they could have a greater proof of the solidity, stability and honesty of the business.

Sir James Pender, Bart., seconded the motion, which was carried unanimously.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

Col. R. E. Crompton, C.B., presided, on March 4th, at 148, Brompton Road, S.W., over the annual meeting. He said that in the first six months of the year they had to face loss of revenue due to the closing of the museums on account of the Suffragette outrages, and again, the strike in the building trade adversely affected the supply of electric power to this trade, and then they had the coal porters' strike, which increased the cost of coal. Still, by care and economy, and by a small increase in the selling price, they were in a fair way of showing slightly increased profits. Then came the war, and consequently heavy loss of revenue and loss of efficiency due to a number of their staff being called away. The reduction of output realised by the end of the year was about half a million units, which was 7½ per cent. of their output, but on account of their slight increase of price the loss in money earning was only 6¼ per cent., as their increase in average price per unit had been rather less than ⅛d. per unit. On the other side of their balance sheet they had effected notable savings, viz., in the case of generation and distribution £3,600, or 11 per cent.; in repairs to plant £812, or 11½ per cent.; in management £792, or 12¼ per cent. But against these savings there had been increases in items over which they had no control, such as rates and taxes. The net result has been a total saving on the costs side of £4,717, which so nearly reached their loss in revenue that they had been enabled to recommend the payment of their dividend of 9 per cent. for the year. It was unwise to prophesy, but they hoped that the loss of revenue caused by the war would gradually right itself. At the outset their customers very naturally economised in their lighting bills, and many of them remained in their country residences during the autumn. Again, the enforced darkening of the streets, of which they could not complain, would probably in the future not affect them so much as it did during November and December—the time when shop display had ordinarily a very good effect on their revenue—as now owners of shops who relied on display by artificial light were gradually finding means of improving the lighting of their interiors. They were not so anxious as they were, but he hoped the shareholders would realise that they owed their comparatively satisfactory financial results to the extraordinary hard work and devotion of their managing director, Mr. Miller, and the staff, who had worked long hours to obtain the economies he had mentioned and to supply the place of those called away for war purposes. As both the Parliamentary Bills which would have affected their interests very considerably had been withdrawn, he did not propose to say very much on the matter, which had been so greatly discussed in the Press. The London County Council Bill which offered the companies terms of absorption which would have warranted their most careful consideration, had been withdrawn, and the Companies' Bill, which was intended to some extent to supplement the L.C.C. Bill, had been withdrawn at the request of the Government. Their board had co-operated with the boards of the majority of the London companies in discussing these Bills in a manner which they considered wholly satisfactory, and which they believed would be continued if further contingencies of the same class arose. So much had been said in the Press and elsewhere by those advocating gigantic schemes of electric supply for London that he would take that opportunity of pointing out to the shareholders that most of the promises made by the advocates of these schemes were not true in the one important matter, that they promised reductions of price for electric supply which could not be realised: at any rate, so far as they affected the majority of their customers who lived in the residential districts. London had been most untruly compared unfavourably with New York, Chicago, Berlin, and other great cities, but in these cities the total cost was shown to be that of the average supply, and included the supply to railways, tramways and the vast system of power of the industrial districts. This enabled them to show a lower total average cost than in London, where the bulk of the supply still was for lighting purposes. The directors had been for years past fully aware that the only chance of reducing the average cost to their customers in these residential districts was by extending the use of electricity for purposes other than lighting. The board and management had laboured unremittingly in this direction, and the special department appointed to foster this branch of their output had made continuous progress, particularly during the past year. The general public, who in most cases were the users of electricity mainly for lighting, and up to the present to a small extent for cooking and heating, ought to know that the cost for all these purposes charged by the company had been carried out to a point far lower than that of the large cities he had named. Although it was obvious that some amalgamation of generating stations would lead to small reductions in the cost of generating taken by itself, yet the total cost of electric supply, including the many charges dealt with in their balance sheets, would not be sensibly affected. The board regretted the resignation of Mr. R. W. Wallace, who had been a director since the formation of the company. His place had been filled by the appointment of Mr. H. W. Miller as managing director, and he hoped that they would consider that the economies which had been largely effected by the staff, had justified the board's policy in this respect.

Sir H. Bliss seconded the motion.

Mr. Whitworth said with reference to the reduction of repairs, he would like to know if there had been any tendency to let the plant down in any way. As regarded cooking, he said that the Barnes local authority were actually putting electric appliances into workmen's houses, and he wanted to know if the board could give any information as to the real progress by the company in supplying for cooking purposes.

The Chairman said the board believed the plant was in better condition than any plant in London. Although there had been a reduction in the cost of repairs that year the plant was certainly in as good, if not in a better, position than last year. The installation of cooking and heating fittings into workmen's dwellings was a matter of great importance, but it did not affect their company much, as there were comparatively few workmen's dwellings in the district. What did affect them were the small households and the small shops, and it was to reach them that they started a special department, so as to bring home to them the advantages of electric heating and cooking. Progress was, however, slow, partly because unless people were experienced in its use, the apparatus was likely to break down. Still, the progress was steady.

Mr. Whitworth asked whether electricity stood as well in comparison with gas for cooking as it did for lighting purposes.

The Chairman said that, personally, he thought it did. Far greater savings were obtained than the householders as a rule realised.

The report was adopted, and the retiring directors were re-elected.

Underground Electric Railways Co. of London, Ltd.

The annual meeting was held on March 4th at Westminster Palace Hotel, Sir Edgar Speyer, Bart., presiding. The Chairman said that considering the period of exceptional anxiety and trouble, which so unexpectedly came upon the country last August, he thought the results achieved were satisfactory. It would, however, be idle to deny that he was disappointed that the hopes he expressed last year had not been entirely realised, although the reasons which militated against a more favourable showing were entirely beyond the control of the management. It was not necessary to deal in detail with the operating results of the various companies in the securities of which the Underground was so largely interested. At the outbreak of the war it was felt that no new expenditure should be undertaken for the moment by those companies, and therefore the important works to which reference was made last year should be postponed. Chief among these were the Hammersmith widening, a further arrangement of moving staircases, and the Euston and Camden Town extensions on the London Electric; certain improvements, such as the widening of the tunnels at Holborn, and the installation of escalators at Shepherd's Bush, Oxford Circus, and the Bank on the Central London Railway. The Wood Lane extension, which would connect the Central London with Ealing, had made only slow progress. The same policy had been pursued by the District Railway, which had been taken over by the Government, and which had postponed all new contracts for works that were not absolutely necessary. As regarded the City and South London Railway, the construction work in connection with the widening of the tunnels had not been started. These postponements were bound to delay the development of the properties and to some extent retard the improvement in their earnings. At the same time he was pleased to be able to tell them that the Queen's Park extension, opened about a month ago, already showed encouraging results. While the war had thus arrested necessary developments, it had had other indirect and unfavourable consequences. The price of coal, which was an important factor in the operation of those railways, had risen very considerably. The prices of other materials had shown the same upward tendency. This had been felt particularly severely by the railways, which had so far worked on a very narrow margin, and the dividends—none too large in the past—had had to be further curtailed. The distributions for the year in the case of the District II. preference stock amounted to 2 per cent. against 2½ per cent. last year; in the case of the London Electric ordinary ⅝ths per cent. against 1 per cent.; in the case of the Central London Railway ordinary 2⅝ per cent. against 3 per cent. As regarded the London General Omnibus Co., the Chairman had explained that the Government had taken over a large part of that undertaking for war purposes, and he pointed out that the figures in the company's accounts did not allow for any sums which might hereafter be received from the Government. He had further informed the shareholders that the War Office continued to take 'buses for transport service abroad, and that until some definite understanding with the Government had been reached regarding the terms of payment for the use of the London General Omnibus property it would be premature to go into any details. The London & Suburban Traction Co. began last June to pay dividends on its ordinary shares at the rate of one per cent. per annum, but owing to the adverse effects of the war the company was not able to make any further distribution. The dividend on the preference shares, however, had been paid in full. There remained the Associated Equipment Co. That company had further developed and shown satisfactory results. It was making extensions and increasing its plant to cope with the additional work thrown upon it, and it was hoped that it would continue to show good returns, although the increased price of materials which was being witnessed everywhere now was a factor which might somewhat affect the results. The revenue account showed that the income from investments, etc., amounted to £684,625; an increase of £54,809. Taking the results as a whole, and bearing in mind the exceptional circumstances under which the companies were worked for the latter part of the year, the Underground had again demonstrated its vitality and afforded proof that in normal times it could count on increased prosperity. Its subsidiary companies performed an indispensable service to London, which was rendered in the most efficient manner. For the excellence of this service they were indebted to the staff of the various companies, and foremost among them to their managing director, Sir Albert Stanley.

Lord Farrer seconded the motion, which was adopted without discussion.

Charing Cross, West End and City Electricity Supply Co., Ltd.

The annual meeting took place on March 4th at the offices, St. Martin's Lane, W.C., Mr. W. F. Fladgate presiding. The Chairman said it had been his usual custom in each year to compare the accounts under consideration with those of the preceding year, but the circumstances of the past year were so abnormal that any such comparison would be quite valueless. As regarded the West End areas, the gross earnings had decreased some £9,153 and the expenses had increased £2,811, making the net earnings for the year £72,409, or a decrease of £11,964. In July last an interim dividend at the rate of 5 per cent. per annum was paid on the ordinary shares, and as a dividend at that rate could be paid out of the available balance without in any way touching on their reserves or the carry-forward of last year, the board had considered that it was quite justified in recommending a dividend at that rate, carrying the small balance of £304 to general reserve (income account), which would then stand at a little over £7,000. They carried forward on revenue account the £18,000 brought forward from last year, and this, with the £7,000 on general reserve income account, gave them a round sum of £25,000 to fall back upon in aid of the profits for the current year. Their depreciation fund would stand at about £150,000. As regarded the City undertaking, the gross earnings, notwithstanding the war, were slightly higher than last year, but, owing to the increase in expenses, the net earnings were £2,474 lower, the net total being £66,706. This, after payment of all interest, provided £56,367, out of which to meet the preference dividend of £18,000. They were therefore able to carry forward £18,000, the amount brought from last year, and by transferring the balance, £[illegible], to general reserve income account, this would amount to the sum of £[illegible]. It was not proposed to deal at present with this account nor, as explained last year, to write anything off for depreciation. There was one item on the balance-sheet to which, perhaps, they would think he ought to refer, and that was their investments at cost. Having regard to the depreciation caused in most securities by the war they might naturally enquire as to whether these ought to remain at the same price. As, however, the whole of these investments were purchased in their own debenture stocks, there was no necessity in any way to write them down. The increase in the cost of materials and labour had been very great. For instance, the average price of coal had increased some [illegible] per cent. over last year, but he was happy to say that, by economies in working, their works costs at Bow had increased less than 4 per cent., while transmission losses had been considerably reduced. The increase in the price of coal was causing them anxiety, and should it continue there would be no alternative but to increase the price of current, a course which they would only adopt if absolutely necessary. He need hardly tell them that their business was seriously affected by the lighting restrictions. In January of this year their output was reduced by 14 per cent. in the city, and 20 per cent. in the West End, and these reductions must affect their revenue. No less than 77 of their staff had joined the colours, and the board, considering it their duty to make some provision for their dependents, were now paying at the rate of nearly £3,000 a year on this account. Last year he called their attention to a scheme which had been put forward to acquire the shares of the electric lighting companies of London and to expend a very large sum of money in building a new generating station with necessary connecting mains, etc. The board did not think the scheme was one which they could support, and a committee representing the majority of the London companies, after consulting engineers of the highest standing, agreed in their view. The scheme was shortly afterwards withdrawn. The London County Council had appointed a special committee to deal with this question, and in the autumn of last year a conference took place at which there was an interchange of views. They pointed out (as they had always done) that in the view of their engineers a gradual change was the only economical and wise course to be pursued, and that they were quite willing on fair terms to co-operate. In the result, a Bill was introduced by the London County Council, which, however, owing to the want of support by the full Council, had to be dropped. There was, therefore, no object in troubling them with any details of that Bill, beyond stating that in many respects its provisions did not commend themselves to the board. Their committee also introduced a Bill, but, having regard to the decision of the Government that no contentious business should be taken, this had been withdrawn. The committee of the companies had still been kept alive. In their view discussion among themselves and with the London County Council, and possibly the local authorities, could not but be useful, and if and when a scheme could be arrived at they would put it before the shareholders for their consideration. He and his colleagues had in no way altered their view that so far as their company was concerned they were quite content with their present position, and felt convinced that they could continue properly to fulfil the obligations imposed upon them under their provisional orders and to safeguard the interests of shareholders. At the same time, they were quite prepared, provided they were fairly met, and provided the consideration to be given to them was a fair and reasonable one, to advise the sale of their undertakings to the County Council. The Council must, however, be prepared to treat them generously and admit that the price which they were entitled to ask to-day was very different to that provided under the Acts under which their original Provisional Orders were issued. They did not admit for a moment, however, that under existing conditions (for which they were in no way responsible) London was badly served. In his view the only way in which real progress would be made would be if the Council would authorise their committee to meet that of the companies and discuss the whole question freely and unreservedly. He could not conclude without referring to the very serious times in which they were living, the seriousness of which, he thought, was only now being sufficiently appreciated. In referring to these times and the difficulties under which they were working, he felt they owed a debt of gratitude to the whole of their staff for the work which they had done, and were now doing. They must thank those who joined the colours for their patriotism, and equally thank those who had remained with them, and who had enabled them to meet the very serious position in which they were placed by the conditions under which London lived. They did not criticise what was done—they were content to believe that it was done for the best. There might be many dark days before them yet, but let them hope that the not very far distant future would bring brighter times, when the war drum would throb no longer and the battle flag would once more be furled. The pressure upon their business might be severe and the decrease of their profits serious, but they knew that it was entirely and wholly due to passing causes. The earning power of the corporation was in no way impaired, and they saw no reason why they should not look forward to the future with every feeling of confidence and hope.

Mr. J. M. Gatti (managing director) seconded the motion, and the report was adopted.

The retiring directors were re-elected, and, on the motion of Mr. Surrage, a hearty vote of thanks was passed to the directors and staff.

British Engine, Boiler and Electrical Insurance Co., Ltd.

The annual meeting was held at 24, Fennel Street, Manchester, on March 5th. According to a report received, Mr. R. C. Longridge (the Chairman) directed attention to the fact that the business was steadily expanding, the increase in revenue for the past year, as compared with 1913, being £6,625, equivalent to 6 per cent. It was pointed out that this expansion did not involve any deterioration in the quality of the business transacted, as the increased revenue was accompanied by a corresponding increase in the balance of profits, notwithstanding that the company had to meet several heavy claims in respect of breakdowns in the engine and electrical departments. The public, perhaps, did not even fully realise that although the primary function of an engineering insurance company was to make inspections and ensure safe and economical working, the company also undertook to indemnify power users in respect of material loss. It was reported to the meeting that nearly 28 per cent. of the eligible members of the office staff had joined H.M. Forces, the company taking its share of the patriotic burden by paying full salaries to the absent members and keeping open their places. In connection with the war, it was also reported that the company had been entrusted with the work of inspecting certain kinds of war material ordered from contractors. If this procedure were universally adopted the result would be advantageous to the national interests.

Metropolitan Railway Co.

The Rt. Hon. Lord Aberconway presided on February 25th at the offices, Baker Street Station, over the annual meeting. Having dealt at some length with the arrangements made by the Government with the companies, by which he considered the Metropolitan Co. had rather lost than gained, the Chairman gave particulars of some of the special work that their company had been called upon to do in the carrying of troop trains and goods trains. Notwithstanding all this extra business they had managed to keep their ordinary services running except on one or two days of exceptional pressure, and the fact that they had done this on a line that was normally one of the busiest in the country, and had done it without any mishap of any kind, afforded striking evidence of the completeness of their safety appliances, and reflected no small credit upon the officials and staff of the line. Their staff had been considerably depleted by men joining the colours. About 430 men had responded to the country's call, and seven had already fallen on the field of honour. The accounts as presented showed that the net receipts for last year, after taking into account the amounts received or receivable from the Government up to the end of December, showed an increase of £25,300, due mainly to the fact that they included a full year's takings of the Great Northern and City line, as compared with only six months of 1913. Their rents showed an increase of £6,000, which they would regard as exceedingly satisfactory, especially in view of the bad times through which they were passing. On the other hand, they had to meet increased charges in respect of the new debenture stock and loans they issued a short time ago, amounting to about £22,000, whilst their interest charges for money borrowed from the bank, etc., amounted to an extra £10,000. In 1913 they commenced to form a new reserve fund for general renewals, and placed to that fund £7,500 out of the revenue for 1913, and £5,000 which they had in suspense in respect of permanent way renewals. They proposed on the present occasion to credit that fund with a further £12,500, which was an increase of £5,000 over the amount taken out of the 1913 figures, and after doing this there was a balance left for dividend on the ordinary stock of £92,000, as compared with £113,000 in 1913. Of this amount £48,490 was absorbed by the payment of the interim dividend at the rate of 1½ per cent. per annum in August last, and the balance would admit now of a further dividend at the rate of 1 per cent., making 1¼ per cent. for the year, and enable them to carry forward £11,458, as against £8,258 twelve months ago. He was afraid there had been some misapprehension in the minds of the public as to what the Government guarantee amounted to. It had been stated that the Government had guaranteed the several companies' dividends, but this was not the case. What they had guaranteed was a certain income from certain sources reduced in a way that he explained. They had not guaranteed their net income, out of which the dividend was paid, and it therefore followed that they had not guaranteed the dividend itself. They thought it wise on this occasion, and having regard to the difficult times through which they were passing, to follow the example of other companies and to adopt a conservative policy in dealing with the revenue, and in this connection he reminded them that in the matter of reserves the company was in a stronger position to-day than it had ever been hitherto. Their electrical renewals and depreciation fund stood at nearly £67,000, the general renewals fund at £25,000, and the general reserve fund at £60,000. In December last they made an issue of £500,000 five per cent. preference stock at the price of 99 per cent., and the money was payable by instalments during the current half-year. This issue was required in order to repay temporary loans from the Bank and to provide for capital expenditure that they had in prospect. The new sub-station at Drayton Park had been completed, and since September last they had been supplying current for that section of their line from their power station at Neasden. By this means they had effected a very handsome saving in the cost of working that line, and it would interest them to know that the estimate made by the general manager at the time of the purchase of the Great Northern and City Railway of the savings that could be effected by their working it had been fully justified by the actual facts. The saving estimated was £12,000 per annum, and to-day they were actually saving at the rate of £11,900 per annum, in addition to which there would be the rent of the disused power house on the Great Northern and City Line as soon as they succeeded in letting it. The new stations at Goldhawk Road and Uxbridge Road on the Hammersmith and City Line were attracting a considerable amount of new traffic, and the escalators that had been put in at Baker Street to connect their station with that of the Bakerloo had largely increased exchange traffic at that point. The only section of the widening between Finchley Road and Wembley not yet completed was the viaduct at Kilburn. The contractors were pushing on with the work of constructing the new viaduct as quickly as possible; but there was a very serious shortage of skilled labour in the steel trade just at present, and the completion of the work was being delayed in consequence. They hoped, however, to be in a position to open the widening throughout in the coming summer. He had already referred to the extra work thrown upon the company in consequence of the war, and he would like to say how much they appreciated the way in which it had been handled by the staff. In view of the in- increase in the cost of living, an arrangement had been made by the companies generally under which the men were to be paid a weekly bonus to supplement their wages during the continuance of the present arrangement with the Government. The extra cost involved in this payment was one that, under the terms of their arrangement with the Government, they should bear, and although they had hitherto shown some hesitation in accepting that position, he thought there was no doubt they would eventually recognise that the payment came properly within the terms of their guarantee.

Sir Clarendon G. Hyde seconded the motion.

Mr. Pownall initiated a lengthy and somewhat heated discussion by attacking the board for their acquisition of what he termed the bankrupt Great Northern and City concern, and he also made a strong personal attack on Sir Clarendon Hyde, who, he said, was a partner in S. Pearson & Co., who owned the bulk of the stock of the Great Northern and City Railway. Mr. Pownall also attacked Mr. Belisha, who had been elected to the board, and declared that the shareholders were being exploited.

These attacks having been replied to, the resolution for the adoption of the report was put and declared carried by the Chairman.

The Chairman proceeded with the business of the re-election of the directors and auditors amidst considerable uproar and cries of "It was not carried."

Metropolitan Electric Supply Co., Ltd.

The capital expenditure at the end of 1914 totalled £2,228,459, an increase during the year of £56,123. A further amount of £18,632 3½ per cent. mortgage debenture stock was issued during the year. The gross revenue amounted to £215,544, a decrease of £2,061. The working expenses were £114,611, an increase of £3,294. The revenue for the first half of the year showed a satisfactory increase, but it was seriously affected during the last half by the diminution in lighting due to war conditions. That the net decrease was no greater is due to the large amount of new business obtained in the Western areas. The balance at the credit of the revenue account, before providing for depreciation, is £100,933. The directors have set aside £22,000 as an addition to the depreciation and reserve fund, which, after writing off certain items, now amounts to £532,745, carrying to the credit of the net revenue account £78,933, which, with the balance brought forward, interest and dividends on investments, and other receipts, makes a total of £90,485. After deducting interest on debenture stocks and loans, dividend on preference shares and other charges, there remains a balance of £38,795. As already announced here the directors recommend a further dividend of one shilling and sixpence per share (being at the rate of 3 per cent. per annum) on the ordinary shares, making a total for the year of three shillings and sixpence per share, or 3½ per cent. This will leave £3,795 to be carried forward. The report mentions the two London Bills that have lately been dropped for this year.

During the year new connections representing the equivalent of 51,666 25-c.p. lamps, equal to 1,550 kw., were added to the company's system, making a total connection at the end of the year of 1,138,496 lamps.

Annual meeting, March 16th.

Edison Accumulators, Ltd.

At the first annual meeting, which is being held in London to-day, the directors will submit their first report (for the period ended 31st December, 1914). This states that the work of the year has consisted largely of demonstrations, made in most of the important towns, with a view to bringing the vehicles equipped with Edison batteries to the notice of users of various classes. Although the results of this work will be apparent in future years, the directors have decided to write off the whole of the expenses thus entailed. Orders have already been obtained for upwards of 100 electric vehicles, and as the working results become better known it is confidently anticipated that large orders will result. Important establishments that have been testing delivery vans fitted with Edison accumulators have already been sufficiently satisfied with results to place further orders, and one London firm will shortly have over 50 of these vehicles in regular service. Electric trucks for the conveyance of materials and goods in works and warehouses are being tested by railway companies and others with satisfactory results. A tipping wagon to meet the requirements of the municipal authorities has been designed by the company's engineers, and orders for several of these have already been placed. A number of Edison accumulators have been supplied for automobile, omnibus, and yacht lighting, for which they are specially suitable.

Mr. Arthur L. Pearse, who was elected a director at the inception of the company, had to resign on account of ill-health, and Mr. C. W. von Roemer was elected a director in his stead.

The profit and loss account shows a gross profit from trading account, £8,980, and a net loss of £1,669, for the period.

Berlin Grand Tramways Co.

The report for 1914 of the Grosse Berliner Strassenbahn A.G., states that the traffic declined in the first seven months down to the outbreak of the war, as in the second half of 1913, in consequence of the extension of the Elevated and Underground Railway, the motor omnibuses and the municipal tramways, whilst in the later months the undertaking stood under the influence of the war and its effects upon the general economic situation. Although the early days of the mobilisation resulted in an increase in the traffic, the latter receded in the first months of the war by 13 per cent. as contrasted with the corresponding period of 1913, and by 15 per cent. in the month of December. On the other hand, the unexpected calling up of over 50 per cent. of the employés rendered it necessary for the company to at first reduce the mileage run by 25 per cent., as it was impossible to replace over 5,000 men at once. Several lines were entirely discontinued, but on those remaining the speed was increased and an additional number of trailers put in service, although the frequency of the services was curtailed by 50 per cent. A large number of the wives of employés at the front were trained as conductors—over 600—but the training of drivers was extremely difficult, as most of the instruction staff were also requisitioned by the military authorities. Nevertheless, it was eventually possible to lower the 25 per cent. restriction to 15 per cent., as compared with 1913, so that the services were equal to the traffic by the close of the year. The gross receipts amounted to £2,118,000, as against £2,288,000 in 1913, and the total expenditure was £1,300,000 and £1,342,000 in the two years respectively, the percentage of working expenses to gross receipts having risen from 58.64 to 61.37 per cent. last year. After making provision for depreciation and other charges, the accounts show net profits of £328,000 as contrasted with £468,000, and a dividend of 6 per cent. is proposed, as against 8 per cent. for 1913.

STOCKS AND SHARES.

Tuesday Evening.

Distinct improvement has taken place in Stock Exchange conditions. The change is marked more in the tone of markets as a whole than in the amount of business which comes into the House. But the latter has certainly improved during the last few days, and the disposition is to buy securities not only in the popular sections, but in some of those which have scarcely moved since the war broke out. The chief animation at the moment is in oil shares. Rubbers, however, are on the move. Many departments of the industrial section have cheered up. Under the Treasury regulations, jobbing is cramped, cabined and confined, so that a little selling or a little buying has an effect almost absurdly disproportionate.

The reason for this marked alteration is, primarily, the increased public confidence engendered by the steady passage of the Fleets up the Dardanelles. This has had the effect of bringing into the Stock Exchange some of the money hitherto locked up on deposit in the banks. United States advices, moreover, are cheerfuller, though this is not a point to be laboured, since the recovery in values on the other side of the Pond appears to have for its base a vague hope of early peace—a consummation as devoutly desirable as it is for the time being impossible of verifying, or to do more than hope for.

While affairs in the United States look better, those in Mexico are more than ever at sixes and sevens. The latest news is that the present so-called government is threatened with an army marching against it from the North. In the circumstances, therefore, it can be well imagined that the speculator may elect to put money into Mexican issues, but that the ordinarily-cautious investor eschews for the time being even those bonds which before the revolution were regarded as first-class.

Travelling further South, optimism again comes into play by reason of substantial recovery in the Rio rate of exchange. From 12½d., the exchange rose sharply to 1[illegible] 1-16d., and Brazilian Tractions responded with a further rally to 53. No appreciable change occurred in Rio Tramway bonds or others connected with this group, so far as quotations were concerned; but instead of there being free sellers in the market, the position swung round to the sellers holding back and buyers revealing themselves more plainly than they have done for some time past.

At the meetings held so far by the London electric supply companies the chairmen have naturally dwelt upon the difficulty surrounding deliveries of coal, which are more pressing than the matter of turning down London lights. The cry for Government intervention has so far evoked no sympathetic response, and the market for coal seems to be as strong as ever. The severity of the trouble may work its own remedy, because the worse the former becomes, the graver is the outlook for everything depending upon this source of heat. Oil shares, incidentally, have benefited by the jump in the price of coal, since it is assumed that when the Dardanelles are cleared and Russian oil supplies can flow freely through the Mediterranean, they will be eagerly taken for many of the uses for which at present coal is required.

Most of the figures are available in respect of the profits made during 1914 by the London electricity undertakers, and it is interesting to note how the comparisons come out against the figures for 1913. The following table analyses the results obtained by those companies whose figures are now published:—

	Gross profit Inc. or dec.	Net profit. Inc. or dec.	Reserve. Inc. or dec.	Divd. (p.c.) Amt.	Divd. (p.c.) Inc. or dec.
Charing Cross	– £10,952	– £10,483	– £1,960	5	— 1
Chelsea	+ £210	+ £210	+ £379	5	same
City of London	£9,190	– £8,858	same	9	— 1
County of London	+ £16,231	+ £15,065	+ £7,000	7	same
Kensington	– £1,204	– £1,011	+ £729	9	same
London	+ £21,106	+ £20,668	+ £11,000	4	+ 1
Notting Hill 1 shares	£296	– £325	+ £57	500	same
St. James	£5,440	£5,440	£1,140	10	2
South London	+ £1,582	+ £1,427	£884	5	– ½
South Metropolitan	+ £1,485	+ £1,862	same	nil	same
Westminster	£3,787	£3,712	+ £535	9	1

The London Company, which shows the best figures of all, had the somewhat adventitious aid of a remunerative contract from the London County Council, in consequence of the Council's electric current failing for the tramway system. Next to this, the County of London makes the best showing, its figures exhibiting improvement all along the line. It is worth pointing out that out of the gross profit of £16,231, all but £1,256 has been retained in net—a striking testimony to the management of the company and to its powers for picking up more in one direction than it has lost in others. The reports have had the effect of strengthening prices as a whole, as will be seen from the accompanying sets of Stock Exchange quotations:—

HOME ELECTRICITY COMPANIES.

	Mean price. July 27, 1914.	Mar. 9, 1915.	Rise or fall this week.
Brompton Ordinary	9⅛	8¾	—
do. 7 per cent. Pref.	8⅝	8⅜	—
Charing Cross Ordinary	5¼	4¾	—
do. do. do. 4½ Pref.	4¾	4⅛	+ ⅛
do. do. City Pref.	4⅜	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅞	4¾	—
do. 4½ Deb.	96½	92	—
City of London	16	14½	+ ¼
do. do. 6 per cent. Pref.	13½	12¾	—
do. do. 5 Deb.	116½	113	—
do. do. 4½ Deb.	100½	98	—
County of London	12	11⅛	+ ⅛
do. do. 6 per cent. Pref.	12	11¼	—
do. do. 1st Deb.	102½	99	—
do. do. 2nd Deb.	101½	97	—
Kensington Ordinary	7½	7¼	—
London Electric	1 7/16	1¾	+ ¼
do. do. 6 per cent. Pref.	6 1/16	6 1/16	+ 1/16
do. do. 4 Deb.	92½	87	—
Metropolitan	3½	3⅛	—
do. 4½ per cent. Pref.	4 7/16	4	—
do. 4½ Deb.	97½	96	—
do. 3½ Deb.	83	80	—
St. James' and Pall Mall	9⅝	9 xd	—
do. do. do. 7 per cent. Pref.	7	6⅝	— ⅛
do. do. do. 3½ Deb.	81½	80	—
South London	8 1/16	8	—
South Metropolitan Pref.	1¼	1⅛	—
Westminster Ordinary	8⅜	7⅞	— ½
do. 4½ Pref.	5⅛	4¾	—

HOME RAILS.

	Mean price. July 27, 1914.	Mar. 9, 1915.	Rise or fall this week.
Central London, Ord. Assented	83	76	—
Metropolitan	37½	29	+ ⅛
do. District	21¾	17	— ¼
Underground Electric Ordinary	2½	1¾	—
do. "A"	7/6	6/-	—
Income	88	80¼ xd	+ ¾

TELEGRAPHS AND TELEPHONES.

	Mean price. July 27, 1914.	Mar. 9, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108½	103¾ xd	— ¼
do. Def.	23	21½ xd	+ ⅛
Chile Telephone	7⅝	6⅝	—
Cuba Sub. Ord.	8½	8½	—
do. Pf.	16½	15½	+3
Eastern Extension	12⅝	12¾	—
do. 4 Deb.	97½	97 xd	—
Eastern Tel. Ord.	130½	127	—
do. 3½ Pf.	77½	78	—
do. 4 Deb.	96½	94	—
Globe Tel. and T. Ord.	11¾	11	+ ¼
do. Pf.	12⅛	11¾	+ ¼
Gt. Northern Tel.	32½	28	—
Indo-European	59	51	—
Marconi	1 15/16	1 13/16	+ 3/16
New York Tel. 4½	101	97	—
Oriental Telephone Ord.	2 3/32	2	—
do. Pf.	1 1/32	1 3/16	—
Tel. Egypt Deb.	98	83½	—
United R. Plate Tel.	6⅝	6	—
do. Pf.	6¼	6	—
West India and Pan.	1¼	1 3/16	—
Western Telegraph	13⅝	13	—
do. 4 Deb.	98½	95½	—

FOREIGN TRAMS, &c.

	Mean price. July 27, 1914.	Mar. 9, 1915.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅞	4¼	—
do. 2nd Pf.	4¼	3⅛	— ⅛
do. 4 Deb.	91	84	—
do. 4½ Deb.	98½	92	—1
do. 5 Deb.	96	88	—
Brazil Tractions	66	53	+2
Bombay Electric Pf.	11⅝	10⅜ xd	—
do. 4½ Deb.	96	91	—
Mexico Trams	70	35	—
do. 5 per cent. Bonds	84	60	—
do. 6 per cent. Bonds	76	40	—
Adelaide Sup. 6 per cent. Pf.	5¼	5⅛ xd	—
do. 5 Deb.	104	103	—

MANUFACTURING COMPANIES.

	Mean price. July 27, 1914.	Mar. 9, 1915.	Rise or fall this week.
British Westinghouse Pref.	1¾	1 15/16	—
do. 4 Deb.	74½	72	—
do. 6 p. lien	102½	99	—
Callenders	11⅛	11¾	—
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2½	3 3/16	—
Edison & Swan, £3 pd.	3/32	14/6	+ 3/-
do. do. fully paid	1¼	2¼	+ ¼
do. do. 4 Deb.	59	65	+ 5
do. do. 5 % Deb.	63½	60	—
Electric Construction	17/32	13/-	—
do. do. Pf.	1/16	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	14½	—
do. 4½ Pref.	5	5	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	8¾	—
Telegraph Con.	38½	37½	+ ½

The fall of 10s. in Westminsters is hard to explain, except on the ground that a seller who wanted to realise his shares found them difficult to place.

Remarkable activity has been displayed in the shares of the British Aluminium Company and in Edison & Swan. The former company is said to be doing extremely well from Government contracts for aeroplane work, and that the Ediswan is also making excellent progress is generally known. British Aluminium have been as high as 25s., coming back a little to 23s. 6d. Ediswan partly-paid at 14s. 6d. are 3s. higher, and the fully-paid 2¼ are 5s. better on the week. Manufacturing issues on the whole are strong. Telegraph Constructions have put on 10s., and there are buyers about both for Henleys and Callenders.

Home Rails are a trifle firmer. Underground Electric income bonds at 80¼ show a rise of ¾. Metropolitans firmed up to 29, but Districts at 17 are a dull spot.

The feature in the Telegraph section is a brisk rise in the price of Marconis. At 1 13/16 they are 3s. 9d. up, and, following them, the preference hardened at 32s. 6d. For these improvements the market has it the company is doing splendid business, which is probably the case. Moreover, there are buyers about. It is interesting to notice that the shares are within 2s. 6d. of their end-July quotation. Globe preference and ordinary are both 5s. harder, on the declaration of the usual dividends. Cuba preference, which had been unduly depressed, recovered just as suddenly as they were put down; and the few shares which, coming to market, had the effect of dropping the price violently, have been absorbed. The Anglo group is steady, and there is no change worth mentioning in the Eastern division. In the Armament section, the leading shares hold their prices with tenacity, and Vickers hardened a few pence. The rubber market, as already mentioned, is improving. Business shows a tendency to broaden, the demand coming from the provinces as well as from London. With the fear of Continental sales removed, through the rigour of the Treasury regulations, the market is inclined to take a cheery view of the outlook, and this disposition has been underlined by the quiet buying of the best-class shares.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Feb. 24	2,468	— 455	8	5,025	— 569	..	..
Blackpool-Fleetw'd	Mar. 6	1,225	+ 4	9	2,818	+ 57	8	..
Bristol	" 5	39,104	+3,575	9	75,492	+ 7,208	80·5	..
Chatham and Dist.	Feb. 25	3,805	+ 538	8	7,648	+ 1,075	14·98	..
Cork	Mar. 4	1,709	— 90	9	3,845	— 177	54·25	..
Dublin	Feb. 26	21,569	+ 507	8	44,640	+ 2,712	9·89	..
Hastings	" 25	2,788	— 94	..	..	+ 107	19·8	..
Lancashire United	Mar. 8	6,033	— 164	9	13,421	— 197	42	..
Llandudno-Col. Bay	Feb. 26	727	+ 97	12	2,094	+ 262	6·5	..
Tyneside	" 24	1,973	+ 24	8	3,881	+ 149	11	..
Anglo-Argentine	Mar. 4	201,740	—27,332	9	454,797	—68,851	..	..
Auckland	Feb. 12	19,932	—3,620	32	167,028	+ 7,988	25·42	1·03
Calcutta	" 27	17,311	— 774	..	..	— 2,674	..	..
Kalgoorlie, W.A.	Dec.	2,905	..	52	31,824	..	..	..
Madras	Feb. 23	3,407	— 85	8	7,233	— 95	..	..
Montevideo	Feb.	80,007	—5,798	8	118,186	—19,765	..	..
Dublin-Lucan Rly.	Mar. 5	443	— 7	9	1,023	— 15	7	..

TRADE STATISTICS OF SPAIN.

The figures given below show the imports of electrical and similar goods into Spain during the year 1913, according to the official statistics recently issued. It will be observed that there is a predominance of German trade in practically every branch. The figures for 1912 are given for purposes of comparison, and notes of increases (which are very considerable) and decreases have been added :—

	1912. Pesetas.	1913. Pesetas.	Inc. or dec. Pesetas.
Arc lamps.—			
From Germany	157,000	90,000	— 67,000
,, France	25,000	18,000	— 7,000
,, Great Britain ...	10,000	83,000	+ 73,000
,, Other countries ...	10,000	11,000	+ 1,000
Total	202,000	202,000	—
Dynamos, electric motors, induction coils, resistances, transformers, etc., up to 400 kg. weight.—			
From Germany	3,692,000	5,269,000	+ 1,577,000
,, France	638,000	1.270.000	+ 632,000
,, Great Britain ...	568,000	967,000	+ 399,000
,, Switzerland	106,000	236,000	+ 130,000
,, Other countries ...	453,000	1,234,000	+ 781,000
Total	5,457,000	8,976,000	+ 3,519,000
Ditto, weighing from 401 to 2,000 kg.—			
From Germany	3,054,000	3,395,000	+ 341,000
,, France	299,000	786,000	+ 487,000
,, Great Britain ...	430,000	866,000	+ 436,000
,, Switzerland	281,000	463,000	+ 182,000
,, United States ...	397,000	890,000	+ 493,000
,, Other countries ...	155,000	508,000	+ 353,000
Total	4,616,000	6,908,000	+ 2,292,000
Ditto, weighing from 2,501 to 5,000 kg.—			
From Germany	496,000	749,000	+ 253,000
,, Switzerland	237,000	217,000	— 20,000
,, Great Britain ...	198,000	215,000	+ 17,000
,, Other countries ...	176,000	1,070,000	+ 894,000
Total	1,107,000	2,251,000	+ 1,144,000
Ditto, weighing more than 5,000 kg.—			
From Germany	4,026,000	5,634,000	+ 1,608,000
,, France	189,000	713,000	+ 524,000
,, Great Britain ...	165,000	266,000	+ 101,000
,, Switzerland	373,000	377,000	+ 4,000
,, Other countries ...	320,000	3,059,000	+ 2,739,000
Total	5,073,000	10,049,000	+ 4,976,000
Accumulators and electric batteries.—			
From Germany	104,000	60,000	— 44,000
,, France	79,000	66,000	— 13,000
,, Great Britain ...	7,000	104,000	+ 97,000
,, Other countries ...	30,000	43,000	+ 13,000
Total	220,000	273,000	+ 53,000
Cables and wires for electricity, with or without insulating material, of 1 cm. dia. or more.—			
From Germany	1,151,000	2,279,000	+ 1,128,000
,, Great Britain ...	645,000	1.096.000	+ 451,000
,, Other countries ...	249,000	362,000	+ 113,000
Total	2,045,000	3,737,000	+ 1,692,000
Ditto, less than 1 cm. in dia.—			
From Germany	122,000	296,000	+ 174,000
,, France	74,000	45,000	— 29,000
,, Great Britain ...	384,000	105,000	— 279,000
,, Other countries ...	14,000	39,000*	+ 25,000
Total ...	594,000	485,000	— 109,000

* Switzerland 2,400.

Telegraph and telephone apparatus, electric meters and parts.—			
From Germany	1,122,000	2,390,000	+ 1,268,000
,, Belgium	77,000	55,000	— 22,000
,, France	324,000	344,000	+ 20,000
,, Great Britain ...	204,000	677,000	+ 473,000
,, Sweden	119,000	90,000	— 29,000
,, Other countries ...	120,000	150,000†	+ 30,000
Total	1,966,000	3,706,000	+ 1,740,000

† Italy 83,000.

	1912. Pesetas.	1913. Pesetas.	Inc. or dec. Pesetas.
Carbons for arc lamps.—			
From Germany	94,000	102,000	+ 8,000
,, France	22,000	11,000	— 11,000
,, Great Britain ...	3,000	9,000	+ 6,000
,, Other countries ...	4,000	3,000	— 1,000
Total	123,000	125,000	+ 2,000
Electrodes.—			
From Germany	19,000	14,000	— 5,000
,, Italy	55,000	-	— 55,000
,, Other countries ...	16,000	15,000	— 1,000
Total	90,000	29,000	— 61,000
Incandescent electric lamps mounted.—			
From Germany	4,733,000	4,667,000	— 66,000
,, France	158,000	347,000	+ 189,000
,, Great Britain ...	334,000	63,000	— 271,000
,, Austria	466,000	158,000	— 308,000
,, Other countries ...	100,000	85,000	— 15,000
Total	5,791,000	5,320,000	— 471,000
Hydraulic motors.—			
From Germany	1.135.000	1.187.000	+ 52,000
,, France	127,000	244,000	+ 117.000
,, Great Britain ...	7,000	47.000	+ 40,000
,, Switzerland	278,000	829,000	+ 551.000
,, Other countries ...	16,000	5,000	— 11,000
Total	1,563,000	2,312,000	+ 749,000
Steam and gas engines (stationary) up to 10,000 kg. weight.—			
From Germany	559,000	555,000	— 4,000
,, Great Britain ...	708,000	784,000	+ 76,000
,, France	15,000	59,000	+ 44,000
,, Belgium	26,000	62,000	+ 36,000
,, Other countries ...	20,000	92,000	+ 72,000
Total	1,328,000	1,552,000	+ 224,000
Ditto, from 10,000 to 25,000 kg. weight.—			
From Germany	98.000	191,000	+ 93.000
,, Great Britain ...	25,000	153,000	+ 128.000
,, Belgium	27,000	71,000	+ 44,000
,, Other countries ...	85,000	40,000	— 45,000
Total	235,000	455,000	+ 220,000
Ditto, over 25,000 kg. weight.—			
From Germany	643,000	3,069,000	+ 2,426,000
,, Belgium	173,000	140,000	— 33,000
,, Great Britain ...	29,000	123,000	+ 94,000
,, Other countries . .	348,000	43,000	— 305,000
Total	1,193,000	3,375,000	+ 2,182,000
Cylindrical steam boilers.—			
From Germany	329,000	119,000	— 210,000
,, Great Britain ...	500,000	356,000	— 144,000
,, France	63,000	111,000	+ 48,000
,, Belgium	71,000	71,000	
,, Other countries . .	25,000	1,000	— 24,000
Total	988,000	658,000	— 330,000
Multitubular boilers.—			
From Great Britain ...	2,944,000	2,835,000	— 109,000
,, Germany	652,000	733,000	+ 81,000
,, Belgium . .	165,000	328,000	+ 163,000
,, France	633,000	621,000	— 12,000
,, Other countries	168,000	64,000	— 104,000
Total	4,562,000	4,581,000	+ 19,000

Note.—25 Pesetas = £1.

Tungsten Wire Patents.—Some time ago five German firms opposed the grant, in the name of the A.E.G., of a patent concerning the manufacture of drawn tungsten wire for incandescent lamps, but they were unsuccessful. Since then the firms have proceeded further by attempting to obtain a declaration of nullity. The German Patent Office has now rejected these claims, and maintained the patent in the form in which it was originally issued. According to this decision, lamps with drawn tungsten wire, as at present customary, can only be made by the three members of the existing patent combine—the A.E.G., Siemens & Halske, and the German Incandescent Gas Light (Auer) Co.—and their licensees, of whom the Bergmann Co. is one. It is not improbable that in view of the importance of the question to lamp makers who are outside the patent combine, the matter will be brought before the Imperial Court.

TRAINING FOR THE INDUSTRIAL SIDE OF ENGINEERING.

The paper read by Mr. A. P. M. Fleming before the Institution of Electrical Engineers at Manchester was abstracted in our last issue, the following is a report of the discussion:—

Prof. Marchant said that it appeared a physical impossibility for a man engaged in manual or other labour during the day to study effectively and secure technical education during the evening. The Westinghouse scheme was to be recommended as affording men and apprentices an opportunity of gaining some knowledge during the day time of the theoretical technique of their profession. The statement made by the author that the fitness of a man for the profession of engineering depended upon his inherent characteristic could not be too strongly emphasised; not every student who entered a college for engineering training would necessarily make an engineer. Regarding technically trained students, the main point of importance was breadth of view rather than technical knowledge. After training in fundamental principles, if a man showed any capacity at all he might carry out some logical investigation on his own account. Specialised fundamental principles combined with a certain amount of research work would produce in the end a competently well-trained technical engineer. In the matter of training, a man's point of view was of much more consequence than the facts which he had accumulated. He supported the author's view that technical men should undergo college training before works training. A boy leaving school was far better able to take advantage of college training at once rather than after spending some time in the works. In electrical engineering, with its extremely difficult technique and the considerable amount of mathematical knowledge required, this system had certainly proved best in the speaker's experience.

Mr. H. M. Mensforth said that 5 per cent. clever mathematicians would permit them to get along very well. It was the remaining 95 per cent. that required consideration. Two important points for development in the student's mind were the power of observation and sympathy with the men he would have to control. The most difficult vacancies to fill were those in the works; commercial and designing engineers were easily obtained, but men with technical education and knowledge of how to deal with labour were very scarce. Technical colleges would do a good service if the opportunities of this side of the profession were pointed out to students.

Prof. Miles Walker said the efforts of the Manchester School of Technology were mainly directed to technical training, and there was a sufficient demand for it; hundreds of men were dealt with in the day classes; but thousands in the evening classes. Men who, year after year, after their day's labour, did really good honest work three evenings per week and home lessons on Saturdays and Sundays, must possess admirable qualities. It would require an exceedingly large institution to deal adequately with trade classes, but such were desirable, and preferably in the day-time. It was hardly fair to expect the manufacturer to put aside a great part of his works for the purpose of teaching apprentices; there ought to be a national system carried out in the same way as technical instruction for engineers. Such an institution would enormously increase the efficiency of the workmen. The effect upon the moral character of the men had also to be taken into account. If from the first an apprentice was placed under the influence of a teacher who dealt not merely with the technique of the work, but also with such aspects of moral character as controlled or affected the production of the work, it would be an enormous benefit. He agreed with the "college first" system. If possible, the student should have a year at the works, where he could be taught discipline and have to rough it with other workmen, but this year should be an extra, and should not be deducted from the subsequent college training.

Mr. J. L. Paton (Headmaster, Manchester Grammar School) said that every boy who started in the works should, if capable, have a chance of rising to the top positions. Statistics had shown in connection with the cotton trade that over 50 per cent. of the heads of firms and departments had risen from the ranks, and the vitality of our cotton industry was largely attributed to this fact. In the Navy every man was taught; even a stoker, signed on for a short period, was taught something about the running of engines and kept in touch with English literature. The result was that such a man could always find work on the termination of his period of service in the Navy. A wise man might lay down exactly on what lines a problem was to be solved, but its solution depended upon the hearty concurrence and co-operation of every unit concerned, and in the engineering trades these units included the unskilled labourer.

Mr. A. J. Cridge said discussion on this subject always brought out two lines of complaint: first, the superficially educated state in which young people of both sexes were allowed to leave school; and, secondly, the lack of co-ordination between employers, employés, and educational authorities. Modern methods would probably give better results in the near future. Co-ordination did not exist to the extent that it should between employers and educational authorities. He advocated the sandwich system of training. On account of the physical strain, works teaching was preferable to evening school work, and whilst nothing had been said about correspondence tuition, this would appear to demand more concentration than a young apprentice could give, principally because he had not been trained to give it. Whilst it seemed wrong to exalt the commercial man at the expense of the engineer without commercial experience, it was not right to despise commercial ability. It had been suggested as an argument against training apprentices in works that they moved to competitors who had the benefit of the training. The only reply to this argument was that an employer could not expect a man to serve him for life solely because he had trained him; the man must be properly paid to be retained.

Mr. Eustace Thomas thought that the two things insufficiently distinguished in technical training were understanding what was being done, and doing it. Ninety-five per cent. of the people in engineering work had to do things. Probably the quality which made a man a foreman or manager was his power of influencing other people and getting things done without disturbance. It seemed as though the more people studied, the more they killed off that power. He thought the problem would be solved by practical men getting in touch with the boys associated with the technical schools and working out means whereby the engineering instinct could be fostered at the same time as there was instilled sufficient technical training to make it useful all round.

Dr. G. W. Worrall said it was pleasing to note that the author regarded the character of the man as of at least equal importance to his skill, but, unfortunately, manufacturers did not exert themselves very much to maintain the high standard which they expected in their apprentices. It was to be hoped that the ideals set forward by the author would soon be accepted by firms, as a general complaint amongst university men was that their scientific knowledge was exploited by manufacturers and they were given work in the design office or on the test-plate where they would be most useful to the manufacturer without regard to their future. He had in the course of his business seen many youths quite unsuitable for engineering blocking the way of better men, and it was lamentable to see young men on the test-plate with ambition and ability to rise to the top, receiving less remuneration than labourers simply because, as one manager expressed it, the work was "unproductive." Schemes of education were useless if not accompanied by proper remuneration. Germany, with all its educational advantages, had tens of thousands of young men holding diplomas and university degrees who were draughtsmen in receipt of a mere pittance, and after hearing so much of Germany's fine system it was surprising to find how little the individual man benefited.

Mr. J. Collinge strongly advocated night schools, and considered that men willing to work all day and then attend school in the evening were men of character and likely to achieve success.

Mr. J. W. Lord said a junior technical school had been opened at Newton Heath, Manchester, to provide for boys of 15 or 16 who intended to enter some branch of the engineering trade. They would at first be artisans, but there was nothing to prevent their rising to the class designated as the "technical class." The difficulty of establishing trade schools was greater than was generally imagined on account of the great variation in trades in the district.

Mr. A. N. Howarth expressed admiration of the Westinghouse system and said that the boys were quick to appreciate the advantages which the present journeyman was unable to obtain in his apprentice days. In the case of apprentice draughtsmen, shop training was essential, and in later years this works training was reflected in the common-sense simplicity of their drawings. A point of advantage in the apprentice school was the close relationship between the management and the boys. Their different characters and temperaments could be studied with a view to their ultimate positions.

Mr. R. W. Paul (in a communication) said that the necessity for the better trade instruction of electrical craftsmen had long been felt and was emphasised by the present crisis; a good deal of the delay in supplying the needs of our fighting forces might have been obviated if such instruction had been systematically adopted in years past. Even in normal times there was no longer an adequate supply of all-round mechanics, like those of twenty-five years ago. Any person responsible for engaging mechanics for highly-skilled work must be impressed with the limited trade knowledge and abilities of the majority of applicants; on new and unaccustomed work expensive mistakes and wrong methods caused much economic waste. Generally the best craftsmen and most successful leaders had learned their business in small shops, where adaptability and all-round skill were required. The Westinghouse Co. was setting a splendid example to those firms who had not hitherto taken their full share in the training of the workers, on whom their success largely depended. The effort and expense, however, should be equitably distributed among all the firms of any given trade, since the benefits accrued to all alike. The initiative must come from the employers, as it did in earlier ages, but the co-operation of the educational authorities and trade unions might reasonably be expected. The latter might assist the movement by instructing ex-apprentices to prefer employment in those shops where the apprentices were properly instructed. Apprenticeship was necessary for the craftsman, as distinguished from the operator or machine-minder; the functions of technical colleges and evening institutes, as at present constituted in England, bore little relation to the training of craftsmen. In his own works a shop had been equipped for instructional purposes, and the apprentices were no longer encouraged to attend evening classes. He hoped that the firms engaged in the electrical trade might soon confer together to promote definite and systematic trade training in their branches.

Mr. **Fleming**, in reply, said that a young man who had risen from evening schools had most excellent qualities. Unfortunately, the rate of educational mortality among evening men was fearfully high, the numbers at the start and finish being very different. The weeding-out of men unsuitable for engineering work was most important. Research work was excellent during training if utilised to develop the men along useful lines. He agreed as to the importance of getting sound men rather than highly educated men. Mr. Mensforth had spoken of the use of technically-trained men on the works side of the organisation. Such men were required to have sympathy with the workmen and to be able to understand and handle workmen. Possibly the man for the works was born rather than made. Really good men were wanted and there were excellent possibilities for the right men. The junior technical school was a promising movement, and another school was to be started at Openshaw (Manchester). The works school afforded an unrivalled opportunity of getting in touch with each boy in the works, of seeing his worth, encouraging him and giving him every opportunity to rise if he had the ability.

ELECTRICITY APPLIED TO MINING.

By C. P. SPARKS, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *February 25th*, 1915.)

(*Continued from page* 341.)

The following are the consumptions of low-pressure and high-pressure steam per kilowatt-hour when working under mixed-pressure conditions:—

	Lb. of Low-pressure Steam	Lb. of High-pressure Steam	Vacuum (Bar.–30 in.)
Full load	20	... 6.4	... 27.5
¾-load	20.6	... 3.6	... 27.65
½-load	40	... —	... 27.9

The latest application is at Bargoed, where the exhaust from three main winders, a steam compressor, and fan is utilised. Owing to the considerable back pressure on the main winders with the Rateau system (2½ to 3½ lb.) it was decided to adopt the Samuelson system. The steam accumulator is of the gasometer type having a capacity of 12,000 cubic feet, the dimensions being: Internal diameter, 30 ft.; height closed, 19 ft. 2 in.; height extended, 39 ft. 6 in.

The average quantity of steam dealt with is 60,000 lb. per hour, the momentary maximum rate of flow being 160,000 lb. per hour; any excess steam not used by the turbine passes to the feed-water heater. The back pressure on the main winders never exceeds 0.5 lb.

Owing to the pressure variation being very small it is impossible in this instance to control the admission of the low-pressure steam to the turbine by change of pressure, as in the Rateau system; the supply of exhaust steam is therefore directly controlled from the steam accumulator, an oil relay valve being actuated when the former is 2.5 feet from its lowest position, which valve definitely closes the low-pressure steam valve on the turbine until a further supply of exhaust steam is available.

Exhaust steam is supplied to a 2,000-kw. 3,000-r.p.m. Fraser and Chalmers—Siemens turbo-alternator. This set supplies current into the common network. The governing is extremely good, and no difficulty has been found in changing from low-pressure to mixed-pressure steam, the interchange of load with the gas-engine plant not exceeding 100 kilowatts with the turbine fully loaded.

The condensing plant is of the jet type with a Leblanc air pump and circulating pump driven by a 160-h.p. motor at 480 r.p.m.

The following are the steam consumptions per kilowatt-hour of this plant when operating under mixed-pressure conditions:—

	Lb. of L.P. Steam	Lb. of H.P. Steam	Vacuum (Bar. 30 in.)
Full load	30		28.5
,, ,, ...	—	. 15.6	28.75

The main switchgear controlling this set is erected in the gas-engine house, the excitation and speed regulation being motor-controlled from the main switchboard through relay cables. Supplementary main switchgear is fixed in the turbine house, but this is only operated in an emergency.

The number of working coke ovens at Bargoed is 100; the average quantity of coal carbonized per week is 4,700 tons, and average output of coke 3,800 tons.

The gas-engine plant is part of Mr. E. M. Hann's scheme for dealing with small coal. The "smalls" from the Rhymney Valley are washed and mixed at Bargoed; after extracting the nuts, beans, and peas, the smaller sizes, less "duff" which is used for patent fuel, are delivered by aerial ropeway to the ferro-concrete coke-oven bunkers holding 1,200 tons.

The whole of the gas from the ovens is treated for by-product recovery. After passing through cooling towers, the tar, averaging 56 lb. per ton of coal carbonized, is extracted, this being afterwards distilled into creosote oil and pitch.

Sulphur is then extracted by oxide of iron, the iron sulphide being made into sulphuric acid, part of which is used for fixing the ammonia, something like 19 lb. of sulphate of ammonia being produced per ton of coal carbonized.

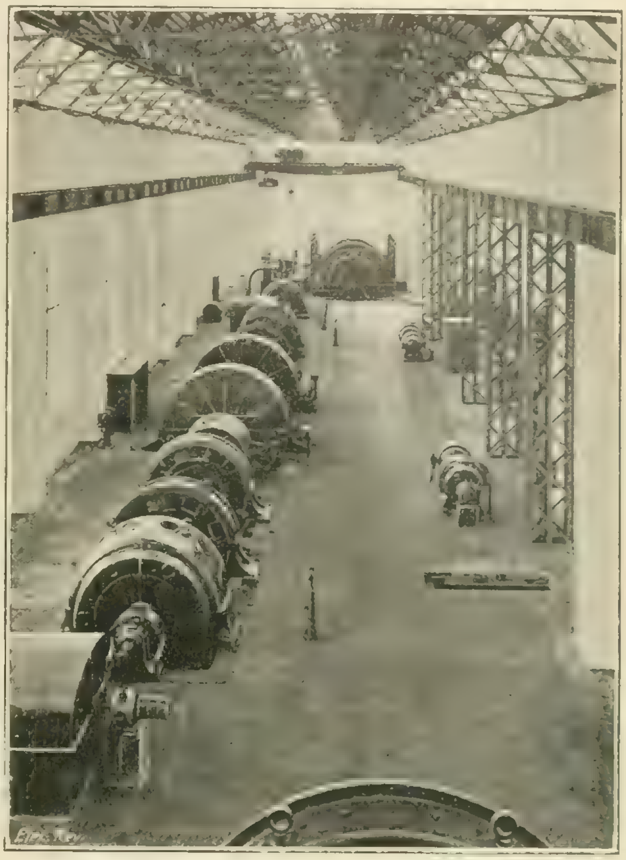


Fig. 1.—General View of Ilgner Winding Plant at Britannia Colliery.

About half of the total quantity of gas is required for heating the ovens; the balance, which is used for the following requirements, is delivered to a gasometer holding 300,000 cubic feet:—

	Average No. of Cub. ft. per Week
(1) Gas engines	12,040,000
(2) Sale to gas company	3,000,000
(3) Firing boilers	3,710,000

Analysis of Gas.

Hydrogen	56.4
Methane	20.5
Carbon dioxide ...	1.8
Heavy hydrocarbons ...	1.9
Oxygen	0.9
Carbon monoxide ...	4.7
Nitrogen ...	13.8

Thermal value 400 B.Th.U. Lower value.

Gas engines of the Nuremberg type, double-acting, 4-cycle, are direct coupled to flywheel alternators, one of 1,000 k.v.a., and two of 2,000 k.v.a. rating, running at 3,000 volts and 100 r.p.m.

The smaller set is of the tandem type and the larger sets twin tandem, developing at normal full-load rating 600 b.h.p. per cylinder.

Cylinders [illegible] in. × [illegible] in. stroke.
Weight of flywheel of 2,400 b.h.p. sets 70 tons.
Diameter of shaft of 2,400 b.h.p. sets [illegible] in.

These plants were originally worked at average loads of 700 and 1,400 kilowatts. The combined maximum load for one large and one small set is 2,300 kilowatts, the usual practice being to run one large gas engine continuously and the smaller gas engine during the day shift.

When working at these loads, the cost of repairs was found to be unduly high on cylinders, pistons, piston rods, and exhaust valves, and since 1912 the plants have been worked at average loads of 600 and 1,200 kilowatts, the combined maximum load being 2,200 kilowatts. Since modifying the rating of this plant, the life of pistons, piston rods, and exhaust valves has increased, and no cylinders have been cracked.

Tests showed that the heat consumption of the 2,000 k.v.a. sets was:—

At full load ... 12,800 B.Th.U. per kw.-hour
At half load ... 20,400 ,,

In order to utilise the surplus gas to the best advantage, electric pumping was adopted simultaneously with the erection of the gas-engine plant, and by providing high-power pumps and increasing the size of lodge rooms it was found possible to confine the hours of pumping to from 8 to 12 per day at the Elliot Pit. The gas-engine plant thus supplies the general colliery demands during the day and the main pumping at night.

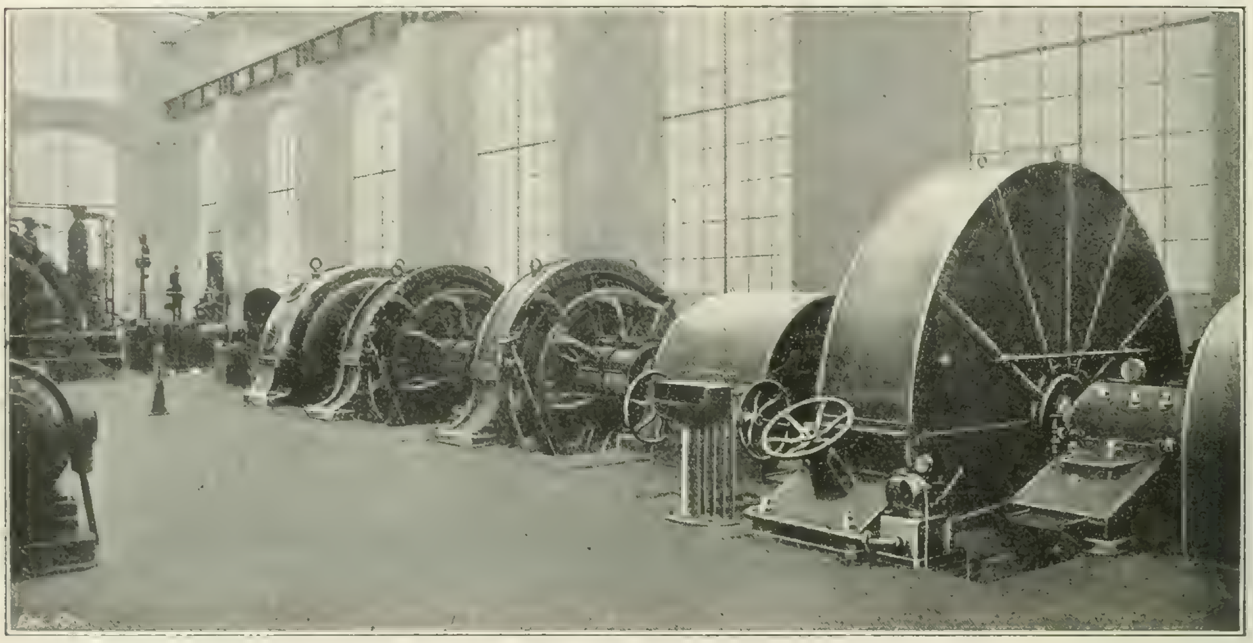


Fig. 2.—One of the Ilgner Converter Sets.

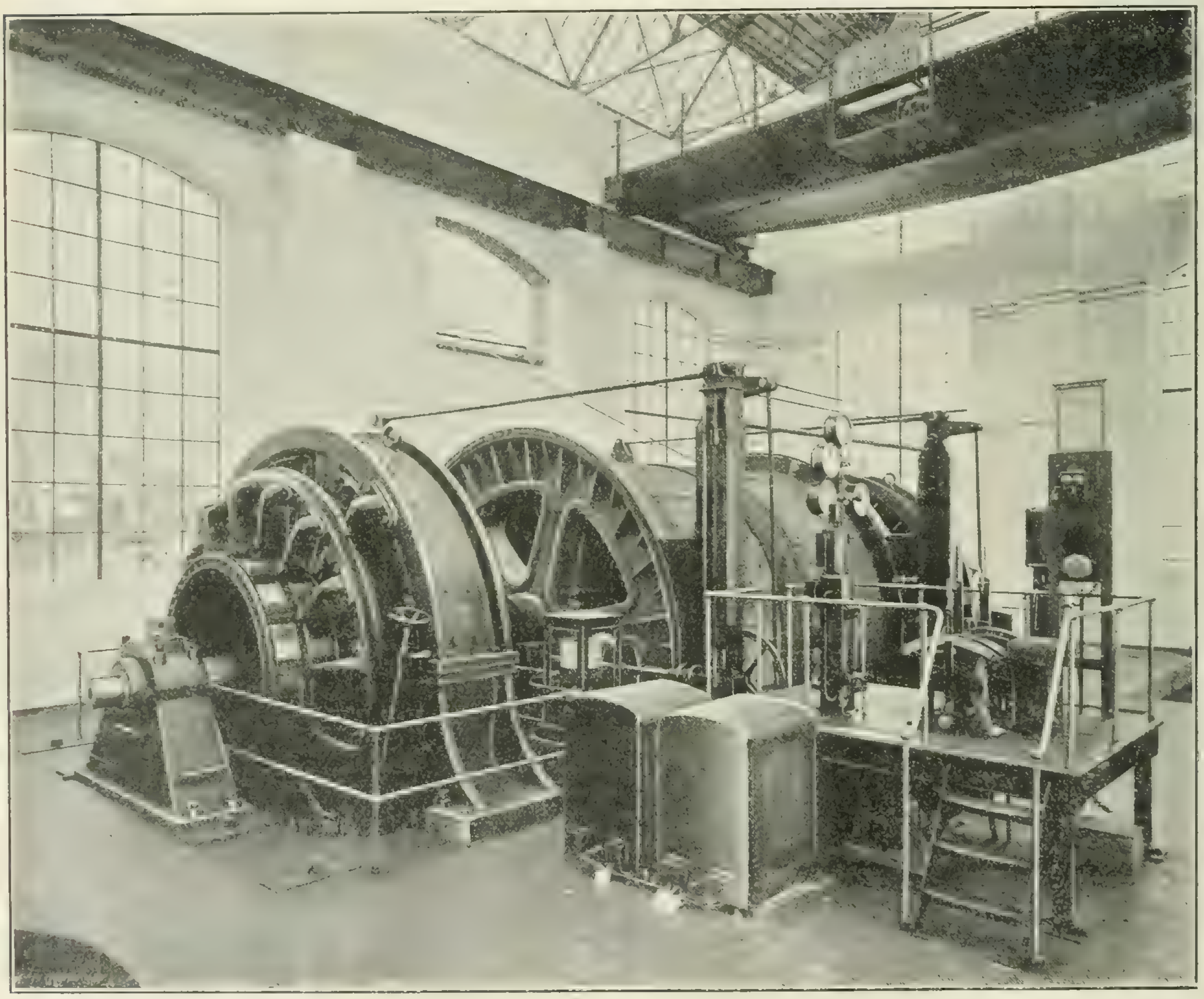


Fig. 3.—Siemens Electric Winder.

With an output of 14 million units per annum and a maximum load of 2,200 kilowatts, the annual load factor of the gas-engine station is 72 per cent.

No general statement can be given as to the total fuel consumption, as in the case of the Powell Duffryn Company 14 million units are generated by coke-oven gas, about 14.5 million by exhaust steam, and the balance of 21.5 million by live steam.

In the case of the Aberaman Collieries, the weekly coal consumption, operating on a station load factor of 47 per cent.,

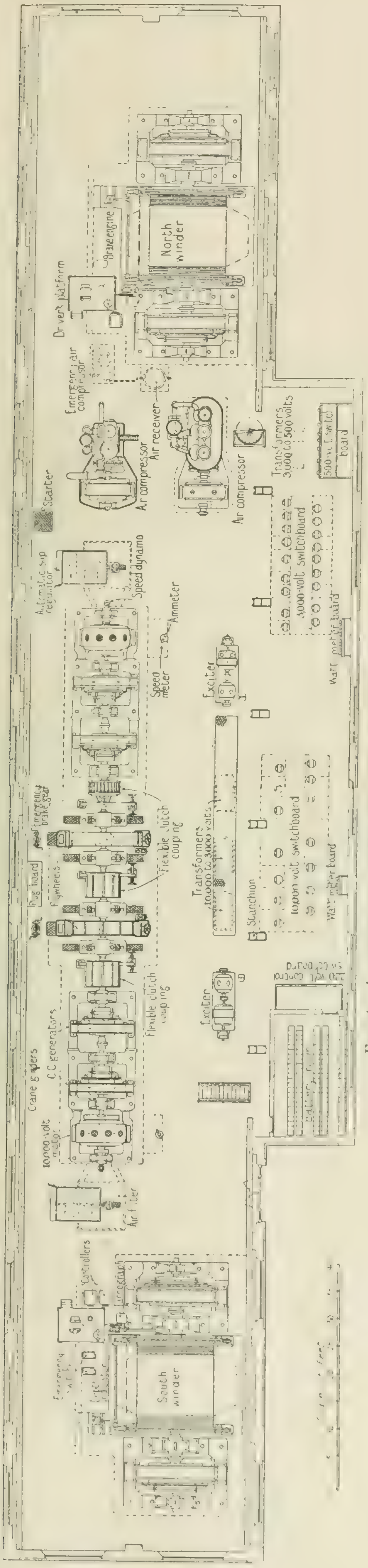


Fig. 4.—Arrangement of Electric Winding Plant at Britannia Colliery.

is 2.9 lb. of fuel (one-third washed "duff" and two-thirds grains), the average calorific value as fired being 12,600 B.Th.U.

The comparative heat consumptions per watt-hour for the gas and steam stations are:—

	Load Factor	Average No. of B.Th.U. per Watt-hour
Gas ...	72 per cent.	18.0
Live steam ...	47 per cent	36.5

Winding Gear.—The Britannia pits of the Powell Duffryn Co. are equipped with two main winders, supplied by Messrs. Siemens, the mechanical parts being by Messrs. Fraser & Chalmers. Each winder has a parallel drum 14 ft. in diameter, for use during the sinking period, designed to form part of the final drum 14 ft. to 22 ft. of cylindro-conical type, and is coupled direct to two motors, rated to develop as a maximum 4,300 horse-power (figs. 1 to 4).

The 10,000-volt 3-phase supply is converted to continuous current by two Ilgner converter sets, designed for a winder duty as under:—

Depth of shaft	730 yards.
Output of coal per hour ...	360 tons.
Net load of coal per wind ...	6 tons.
Diameter of rope	2¼ in.
Max. speed of rope	72 ft. per sec.
Unbalanced load	13 tons 2 cwt.
Time of wind	45 sec.
Time of each complete cycle ...	60 sec.

Each converter set is capable of supplying one main winder (fig. 3), and consists of an induction motor, two continuous-current generators, and a 30-ton flywheel. When the colliery is further developed a third (spare) Ilgner set will be added.

The two sets are erected in line, with three needle-type flexible couplings, combined with friction clutches, between the wheels and converter sets, so that the two flywheels can be run together with either converter set, the two sets being 100 ft. in length over all.

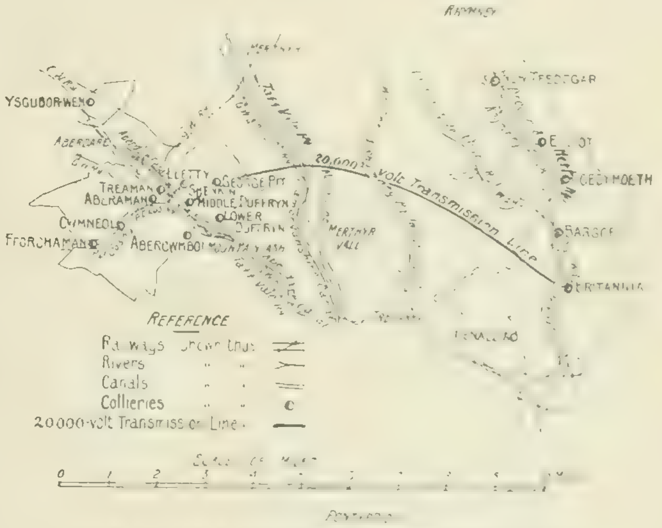


Fig. 5.—Plan of Powell Duffryn Collieries.

Owing to the proximity of the winder house to the shafts, special care was taken in the design of the foundation. The main foundation consists of a reinforced concrete girder.

During the sinking period one converter set was used for both winders, each of its generators supplying one motor on each winder. As the 10,000-volt supply was not available at the commencement of the sinking, the induction motors were supplied at 3,000 volts, their stator circuits being temporarily connected in mesh; the motors then each developed a maximum of 750 B.H.P., being designed for full-load output, when star connected, at 10,000 volts.

The motors are of the enclosed self-ventilating type, drawing air through dry-air filters and discharging it direct into the winder house.

Continuous output ...	1,750 b.h.p. each.
Power factor at full load	88 per cent.
Efficiency ...	93.5 per cent.
Temperature rise	[illegible] degrees C.
Speed	492/425 r.p.m.
Maximum slip	15 per cent.

When the main winder is working at full duty raising six tons of coal per minute, the input of the Ilgner set will average 1,300 KW.

The speed of the motor is controlled by series transformers in the motor circuit, the secondaries of the transformers supplying [illegible] liquid resistance in the rotor circuit. The maximum slip-ring voltage is 700 volts.

Each set of [illegible] designed for a maximum output of 3,500 kilowatts, the continuous rating being 2,100 kilowatts.

Pressure per machine, ± 600 volts; efficiency, 93.2 per cent.; temperature rise, 40 degrees C.

These machines are of the 8-pole type fitted with inter-poles and compensating windings and double ventilated commutators of [illegible] ft. diameter.

Each flywheel is a solid steel casting weighing 30 tons, in a planished steel casing.

Diameter, 12 ft. 6 in.; width of rim, 30 in.; stored energy at max. speed, 31,000 ft.-tons.

The bearings are water-cooled, ring-lubricated. Auxiliary pressure lubrication is supplied, by motor-driven pumps, from an overhead tank, and is used when starting up and during the summer months.

Each winding drum is coupled direct to two motors, one on each side (fig. 4). These machines have 16 poles and are fitted with interpoles and distributed compensated windings. The commutators are of 7 ft. 3 in. diameter, built in two parts with ventilating channels between them. Each motor is rated to have a maximum output of 2,150 horse-power, the continuous rating being 1,300 B.H.P. The voltage at the armature terminals varies from 0 to ± 600 volts.

Speed, 62 r.p.m.; efficiency full load, 92 per cent.; temperature rise, 40 degrees C.

The excitation for the fields of the winding motors and of the variable-voltage dynamos is supplied by one of two 80-KW. 220-volt motor-generators, fitted with boosters. An accumulator of 60 KW. capacity on the half-hour rating is also provided.

The battery floats on the exciter system, so that in the event of an interruption of the main alternating-current supply, a wind could be completed by means of the stored energy in the flywheels.

The connections to the control board are arranged so that any two of the four dynamos can be run in series with the two motors of either main winder. The winding motors are controlled by varying the excitation of the generators, the main circuit never being opened.

The control gear consists of three levers:—

The main control lever controlling the excitation of the generators supplying the winder.

The working-brake control lever.

The emergency brake.

These three levers are interlocked with each other in such a way that full current cannot be applied to the winding motor while the brake is "full on," and also the brake cannot be applied whilst the full current is flowing in the motor. An interlock is also provided so as to prevent the trip gear of the emergency brake being reset unless the main control lever is in the "off" position and the brake control lever in the "full on" position.

The main control lever, which is connected to the main controllers and depth indicator, is controlled by cams on the latter so that the winding motor cannot be accelerated beyond a predetermined rate. Should the driver neglect to operate the control lever, the winding motor is automatically retarded and brought to rest.

The brake control lever is connected to a cross shaft which is coupled to the operating valve on the brake engine.

The emergency brake is applied by either of the following means:—

1. By hand.
2. By the current failing.
3. By the air pressure failing.
4. In the event of overwind by either cage.
5. In the event of excessive overload on the winding motor.

The drum shaft is of 24 in. diameter and 3 in. bore, with journals 22 in. × 40 in. The shaft is forged with solid half couplings at each end for coupling to the motor shafts, the couplings being fitted with cross keys to relieve the bolts of the shearing stresses.

The drum is fitted with two sets of post brakes, the brakes being capable of pulling up and holding at any point in the shaft a lowering load of 8 tons.

In addition to a hand-operated band brake, each flywheel is provided with an electromagnetic brake acting on the rim of the wheel and capable of bringing the converter set—with one flywheel—to rest from full speed in 8 minutes. The time taken by the same set to come to rest when running free is about one hour.

During the sinking period each winder was operated by one motor, the drums being of 14 ft. diameter. The loads consisted of men, rubbish, building material, and water, the maximum unbalanced load being 8 tons.

On completion of the sinking to 750 yards, operation was continued with the 14-ft. parallel drum with one motor raising two trams of coal or rubbish.

Following the partial opening-out of the colliery, as the cylindro-conical drum could not be erected for some months, a balance rope has been fitted on the winder with the 14-ft. drum, thus enabling one motor to raise four trams of coal (6 tons). Working under these conditions with 19 winds per hour and a winding time of 80 seconds, the number of kilowatt-hours taken by the Ilgner set average over one hour is 3.7 per ton of coal wound.

On completion of the cylindro-conical drum, when winding 390 tons of coal per hour, the input into the Ilgner set will be 1,360 units per hour, or 3¼ units per ton of coal wound from 750 yards.

(*To be continued.*)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Homonolith.

We have received from Mr. H. Sloog, of 51, Anson Road, Cricklewood, N.W., a sample of "Homonolith," in which material his works are now prepared to supply all kinds of turned articles, polished or otherwise, at low prices. The substance is intended to replace "Galalith" in every way; the specimen is a black rod possessing considerable strength, and cutting like bone; when held in a flame it burns with difficulty.

Weights and Measures Computer.

An ingenious instrument has been devised by Lieut. F. Sexton-Snowdon, of 22, Henrietta Street, Covent Garden, W.C., to save labour and ensure accuracy in converting the value of goods offered in the currency and measures of one country into the equivalent value in terms of those of another country. The device resembles the familiar date indicator, and is provided with two handles, the rotation of which performs the desired operation. The range of the instrument is from ½d. to 10s. per lb., gallon or foot, but a variety of spools is being prepared to meet other requirements, the spools being interchangeable. All values are calculated to five places, on the basis of the average rates of exchange prevailing before the outbreak of war; but a table of corrections from 5 per cent. above to 5 per cent. below the basis figures is provided. Full particulars can be had from the inventor.

"Witton" Field Regulators.

The General Electric Co., Ltd., of Witton, Birmingham, have designed a small type of rectangular regulator for use in exciter circuits. This regulator, which is shown in figs. 1 and 2, consists of two parallel lines of rectangular contacts mounted on a slate base, which is carried on a strong steel framework on which is also mounted the resistance, composed of special resistance wire wound on asbestos tubes. These asbestos tubes are carried on steel supporting bars, which are bolted at both ends to the framework. The connections between the resistance wire and the contacts are solid, there being no loose wires; this follows on standard G.E.C practice for all their regulators and starters. The regulator illustrated was one of a number constructed for controlling the shunt current of the exciter for a 3,000-KW. turbo-alternator.

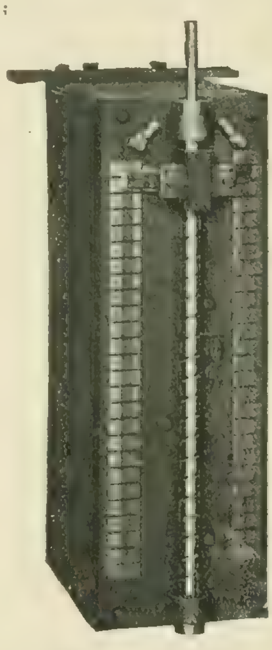


Fig. 1.—"Witton" Regulator for Exciter Control.

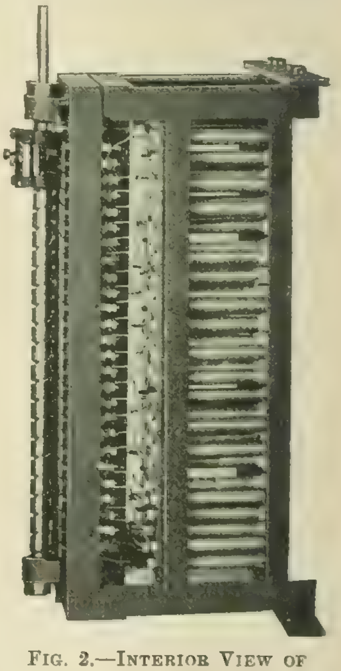


Fig. 2.—Interior View of "Witton" Regulator.

Igranic Electric Vehicle Controllers.

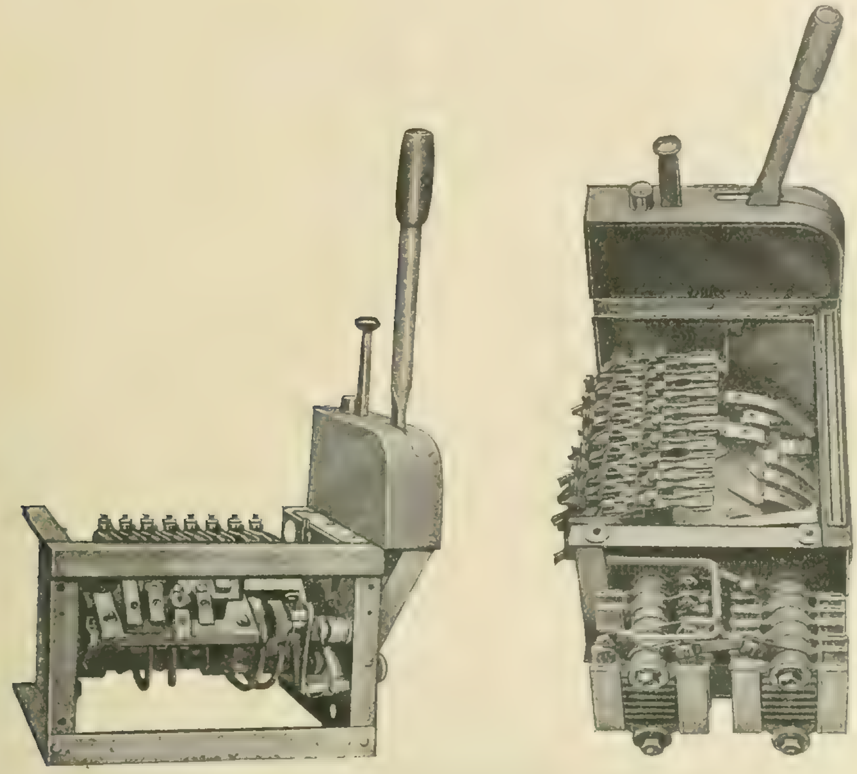
Drum-type electric vehicle controllers are made by the Igranic Electric Co., of 147, Queen Victoria Street, E.C. The pressed steel frames used are very strong, but light in weight and easily mounted; all contacts are of ample capacity, and the total voltage drop across the controller is negligible. Contact rings are made of drawn copper. The fingers are of unique design, being pivoted and pressed into contact with the drum cylinder by helical compression springs. The renewable tips of the fingers are of drop-forged copper.

This form of drum construction is one which has proved its excellence in electric crane and steel mill service. It is claimed that it is more robust, and can be operated with less effort, than other types.

The controllers are so designed that transitions of field and battery connections are made by bridging, and therefore without interruption of motor torque.

The resistances supplied are of the cast-iron grid type, and can be supplied attached and connected to the controller, or separately, as desired.

Wherever necessary magnetic blow-outs are provided on controllers for the purpose of promptly extinguishing the arc.



Figs. 3 and 4.—Igranic Electric Vehicle Controllers.

Practically all electric vehicles are operated by means of series-wound motors which have their field windings in two sections. The controllers described are designed for use in connection with motors of this type.

They are divided into two classes—the first class comprising those controllers which accomplish speed control by means of armature resistance and series field commutation—the second those controllers which are adapted for the commutation of batteries, as well as field windings, the batteries on the car being divided into two sections, and these two sections connected either in series or parallel relationship, depending upon the speed required.

Each of the two classes mentioned above can be further subdivided into those which accomplish forward and reverse control of the vehicle by means of one operating lever, and those which have a separate reversing lever.

The controller is designed for mounting under the seat for left-hand operation. The safety switch is conveniently mounted just behind the speed control lever with which it interlocks. Pulling up on this rod cuts off the current independently of the control lever. It can only be re-closed when the control lever is in the neutral position.

The first class of controller mentioned is adapted for use on those cars whose maximum speed does not exceed 18 miles per hour, while the second class is adapted for machines operating above this speed, or for slow speed machines which may be called upon to operate at greatly reduced speeds for considerable periods of time.

The single voltage controllers for moderate speed vehicles provide five speeds forward; the connections are as follows:—Motor fields in series (1) two steps of resistance in circuit; (2) one step of resistance in circuit; (3) no resistance in circuit; (4) motor fields in parallel—no resistance in circuit; (5) motor fields in parallel, shunted—no resistance in circuit.

Double voltage controllers provide five speeds forward as follows:—(1) Fields in series—batteries in parallel. (2) Fields in parallel—batteries in parallel. (3) Fields in series—batteries in series. (4) Fields in parallel—batteries in series. (5) Fields in parallel, shunted—batteries in series.

It should be noted that all five control points on double voltage controllers are economical running positions, and that on no point are any material resistance losses sustained, as is the case with single voltage controllers.

Where controllers are adapted for forward and reverse operation by means of a single lever, three reverse positions are provided, these corresponding with positions one, two and three forward.

Wherever a separate reversing switch is provided there are, of course, as many reverse as forward positions. Single lever controllers can be furnished either with or without a separate main switch. When a main switch is provided, it is so interlocked with the control drum as to prevent its being closed at any time except when the control lever is in the off position. Furthermore, when a main switch is provided it can be interconnected with the foot-operated brake in such a manner as to be moved to the open-circuit position whenever the brake is applied.

Those controllers which have a separate reversing switch are provided with a cam mechanism adapted to be connected to the foot brake lever. This cam is so arranged that whenever the foot brake is applied the reversing switch is moved positively to the open-circuit position, in which position it latches and cannot be released unless the control lever is thrown to the off or braking position. This separated interlocked reversing switch can also be connected to an operating lever on the car, and thereby made to serve as a safety switch.

Extra Heating Surface for Lancashire Boilers.

In view of the deficient heating surface of Lancashire boilers, and the present high price of coal, users of such boilers should be interested in the Adamson-Davies patent tubular extension, which has been brought to our notice by Messrs. J. P. Davies and Co., of 39, Thornbury Road, Isleworth, Middlesex. The device is illustrated in fig. 5, and remembering the fate of the cross-tubes so much in vogue 20 years ago, at first sight one might be unfavourably disposed towards it; but it is worth careful consideration.

It will be noted that the extension consists of an element of a water-tube boiler having a heating surface about half that of the flue-tube in which it is fitted: thus the extension increases the total heating surface of a Lancashire boiler by 30 to 40 per cent., and being situated in the direct path of the hot gases, its effective value is still greater. The flue is not weakened by the attachment of the extension, and there is no difficulty in cleaning the flue and tubes, as a man can pass right through the flue from end to end. The boxes are not exposed to the hottest gases, and the tubes do not accumulate scale, as all sediment is deposited at the bottom of the boiler; but a brisk circulation is maintained, and steam can be raised quickly. The arrangement is obviously free from troubles due to expansion and contraction, and the tubes can be withdrawn through the furnace if required.

It is claimed for this system that it enables a saving in fuel of 10 to 20 per cent. to be effected, besides increasing the output per boiler, so that four boilers thus equipped will do the work of five without the extension, and tests are quoted showing an improvement of 25 per cent. in fuel consumption. As many as eight boilers belonging to one firm have been successively fitted with the device, as the result of experience of its working. It can, of course, be fitted to existing boilers without difficulty.

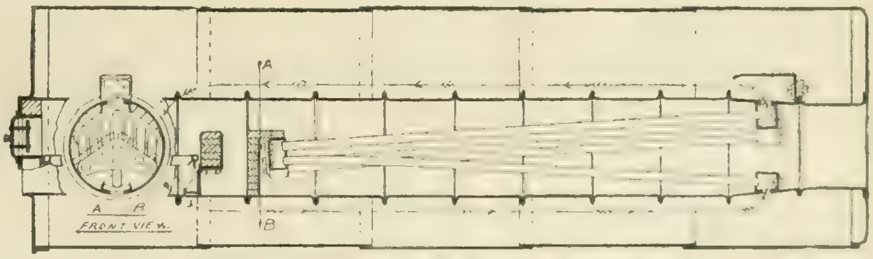


Fig. 5—Arrangement of Boiler Extension.

Rotary Pumps.

One of the most recent additions to the world of pumps is a positive rotary pump made by the New Rotoplunge Pump Co., Ltd., of 24, Broadway, Westminster, S.W. This pump incorporates a plunger action with a rotary motion, which may best be shown by the accompanying illustrations (p. 380).

The rotor, which is of steel or gun-metal, to suit the liquid the pump has to handle, revolves in a cast-iron case, with a close clearance. Arranged in the rotor is a set of cylinders, either four or six in number, set diametrically opposite each other. In these cylinders are placed the plungers—the two opposite plungers being coupled together, as shown in the views. Movement is given to these plungers, as the rotor revolves, by a steel block mounted on a pin, which is held in position by the end cover. This pin is set on a different centre to the rotor, and causes the plungers continually to alter their relative positions in the cylinders, as the rotor rotates.

One of the chief merits of the pump is that it can be used equally as well on vacuum or air-compressor service as on water. It is further an ideal pump for crude sewage, on account of the complete absence of valves. There is only one stuffing-box, which is water-sealed, and one bearing, which is lubricated with an oil-ring. The pump being absolutely positive gives an output exactly proportional to the speed, and this is usually between 500 and 1,000 R.P.M. The piston speed of the pump is kept at about 150 to 250 ft. per minute, and the bearings are designed on an extremely liberal basis.

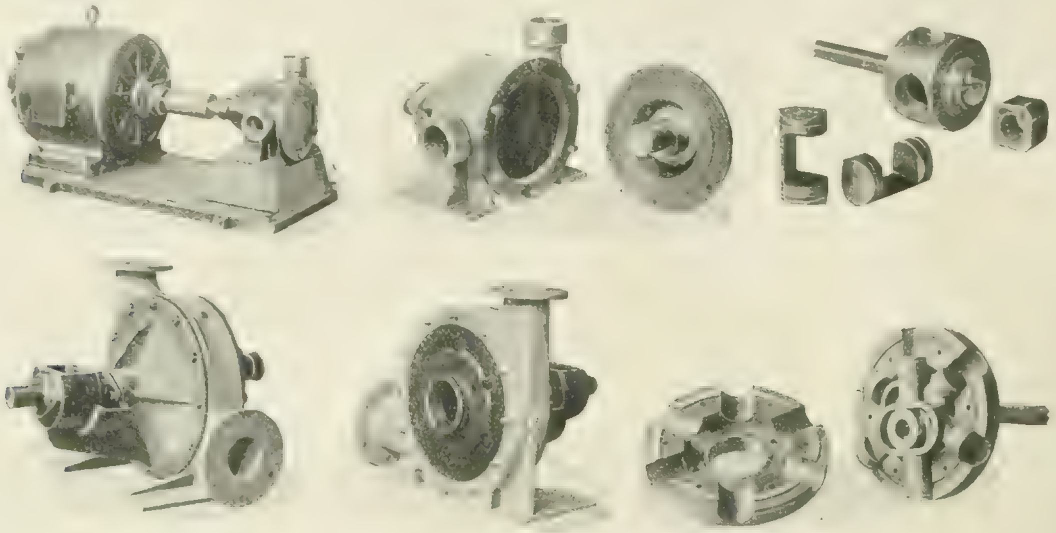


Fig. 6.—Four-Cylinder and Six-Cylinder Rotoplunge Pumps Complete, and in Parts.

The pump is constructed in sizes from ⅜ in. up to 24 in. bore, and for all pressures, and when working on a closed suction a vacuum within ·25 in. of the barometer can easily be maintained.

As regards efficiencies, these nearly always equal, if not exceed, those of a plunger pump for the same work, and the volumetric efficiencies are extremely high owing to the close clearances. A useful feature of the pump, in which it differs notably from a centrifugal pump, is that its output is simply proportional to its speed, and a high efficiency is maintained, whereas a centrifugal pump can only run with high efficiency under the particular conditions for which it is designed.

The cost of upkeep is low on account of the small number of parts, and accessibility is a strong feature, for by removal of the end cover, the whole pump is exposed, no pipe joints being removed or broken.

Mazdalux Reflectors.

The British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C., in 1912 introduced the "Mazdalux" metal reflectors, which then occupied three pages in one of their price lists. So successful have these industrial reflectors been, that the company has just issued price list No. 10,336, devoted entirely to them and the accessories used with them, and a few days ago we paid a visit to Mazda House to inspect the new types and sizes of reflectors to which it relates—and which, we note, all are (and always have been) entirely British made. The range now covers standard Mazda lamps from 10 to 1,000 watts, and Mazda half-watt lamps from 100 to 1,500 watts. An ingenious system of classification, numbering and labelling has been adopted, which enables the complete description of every reflector to be conveyed by a single catalogue number, while the directions on the label are calculated to render erection a matter of the utmost simplicity. Special attention has been given to the new caps or housings which carry the reflectors proper; according to size, these fit, or spring on to, the usual B.C. holders, or grip the skirt of the lamp cap or in still larger sizes, carry the all-porcelain lampholder inside them; in the last case, they are made adjustable by a simple device, which enables the lamp to be fixed at exactly the right height to correspond with the design of the fitting as a scientific reflector, this being verified by a sighting hole in the reflector. We illustrate in figs. 7 and 8 one of the clip type and one with the adjustment above-mentioned.

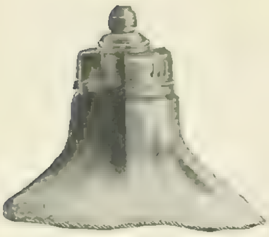


Fig. 7.—Cap sprung on Lamp Cap.

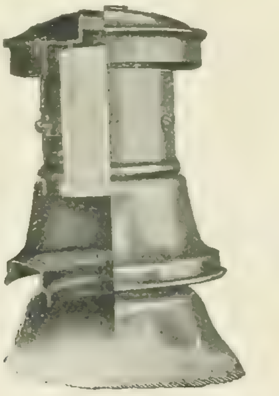


Fig. 8.—Adjustable Weather-proof Housing (No. 08).

Whereas originally only four types of distribution were listed, there are now 10, each having definite characteristics, and the bearing of these upon the height and spacing of the lamps is explained, with useful hints on planning lighting installations, and a novel chart for the same purpose. Besides various bowl patterns, there are many "angle" types for asymmetrical distribution, and we illustrate one of each of these groups in figs. 9 and 10, while fig. 11 shows a special lock-up "local" type with a wire cage to prevent the unauthorised removal of the lamp or reflector.

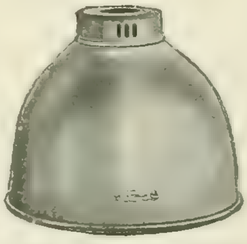


Fig 9.—Mazdalux Bowl Reflector for Ordinary Lamp.

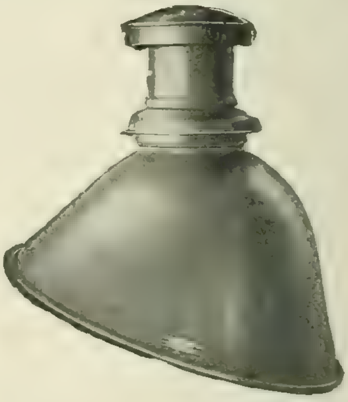


Fig. 10.—Reflector for Half-watt Lamp, 15° Angle Type.

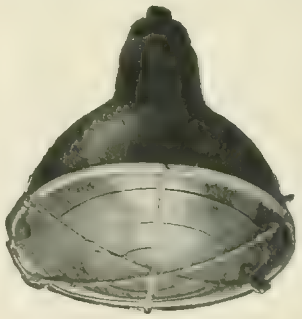


Fig. 11.—Special Local Type.

The reflectors are of enamelled steel or aluminium, with matt aluminium reflecting surface, or steel with white vitreous enamel inside and outside.

The list contains much information, and will be found useful in many respects.

Roller Bearings.—Messrs. Broom & Wade, Ltd., have just completed delivery of some 200 3-in. Hyatt roller bearings to the Associated Equipment Co. for the line shafting in their new works, which is being entirely equipped with them.

THE SELLING SIDE OF ELECTRICITY SUPPLY.—I.

Showroom Windows.

In the selling scheme of the supply of electricity the showrooms play a very important part; this is so for the reason that much educational work has always to be done in familiarising the public with electrical appliances. One would never be very sanguine about selling an electric cooker, or even a toaster for that matter, purely by advertising and distributing literature in the district served. This part of publicity work has its value, but in itself can do little beyond the preliminary ground work. Mr. "Consumer" wants to see the apparatus, what it looks like, how it works, and it is necessary therefore to have a showroom containing an exhibit of electrical goods for his inspection. There are many of these showrooms springing up now, and judging by the general arrangement, selection, and show of goods, it is evident that a few hints will not be out of place from one who has had extensive experience in showroom management. I have recently seen several of these showrooms which, to my mind, have completely failed in several of the details essential to their success.

One of these showrooms (a London one), as far as I could see, had not had the slightest alteration in the window display since my last visit to the locality, several months before. So much has been written on the subject of window display, and the importance of frequent changes, that anything further would have seemed superfluous without the evidence of one's eyes to the contrary.

Any man in charge of a showroom should pay frequent visits to the best shopping centres. If he is observant he will notice that the most successful shops in almost any line of business have the most attractive windows; he will further find that these windows are always being changed. There is no finality in window display; they must be dressed and re-dressed. The idea to be kept in mind is to let nobody get into the habit of passing your shop without glancing in. A hint might well be taken from the best-dressed windows in the West End of London; they are for ever changing, and if this is considered worth while in such a thoroughfare, say, as Oxford Street, which is always thronged with shoppers and sight-seers, how much more important it must be to alter the display in a less frequented part so that a glance or a visit may be secured from every likely consumer? Energy is an essential quality for a showroom manager, and he must never be tired of making alterations. It must be kept in view that to display appliances and apparatus tending to extend the revenue from existing services without entailing fresh capital outlay is one of the first objects of a supply undertaking showroom. Therefore irons, kettles, toasters, radiators, cookers, and all the long list of "other uses" should be kept well to the fore. Nothing should be easier than to make an attractive display with these things. We have the public interested in electricity to start with. Think of the difficulty of breaking the monotony of a shop window displaying sewing machines or, in fact, any one-line business. Yet it is done, and it is an art in itself.

It will make our task of constant change easier if we make a point of "featuring," as our American friends put it, some special article each time. It also carries a stronger impression to show a group of appliances of the same kind than a dozen oddments. Then these should not be left to speak for themselves. Attractive showcards take a high place in any selling scheme. What the appliance is for; what it costs to buy; what electricity it uses; how to use it; where to use it, etc., etc. The showroom windows should not be crowded with articles, and the goods themselves should be kept clean, as well as the windows and fitments. This may appear obvious enough, but it is a remark that is called for. Nickel-plated goods should really be kept in special cases similar to those used by jewellers; it is the only way to keep them in a saleable condition. If shown in an open window they must be frequently cleaned; in the dull state which they assume after a few hours in an exposed atmosphere they are more likely to repel people than to attract them. Something in motion is a draw—even the old dodge of a silk ribbon blown out by a fan can be made effective; one way is to fasten one end to the fan-guard and the other end to an iron or some other appliance upon which you wish attention focused.

In displaying toasters, for example, a fresh piece of toast should be made once or twice a day and placed in the rack; show everything as far as is possible performing the function for which it is designed. There are many ways of doing this, and we are going to help by making suggestions in these columns from time to time.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Coke Fuel for Steam Raising.

In the interests of my Committee may I be allowed to correct an impression which might be conveyed by the remarks made in reference to the above subject by Mr. Horace Boot, as reported in your last issue, at the annual meeting of the South Metropolitan Electric Light and Power Co., Ltd.

In discussing the policy of the company in adopting coke fuel for steam raising, and the favourable report of Mr. H. W. Bowden, the engineer-in-chief, on his experiments in this direction, Mr. Boot is reported to have said that the price of coke breeze had risen from 6s. to 8s. per ton, and that in his experience the use of this fuel would have reduced by half the life of certain steam boilers with which he had experimented. It would be interesting to many users of this class of fuel to know the precise conditions of Mr. Boot's experiments, as it is within the knowledge of a large number of engineers that steam boilers of most types common to this country are operating satisfactorily on coke breeze, and also that there are many instances where no other class of fuel has been used; and this without the baneful results indicated, and without adverse comment being received from inspectors employed by the leading Boiler Insurance Companies.

One concrete instance may be given which will be appreciated by engineers responsible for the maintenance of boiler plant operating on coal slack containing the usual proportion of volatile sulphur. In evidence recently given before the Departmental Committee on Coal Smoke Abatement, Mr. Edward Allen, chief engineer of the Liverpool Gas Co., stated that in his experience Babcock water-tube boilers had been fired with coke fuel over a period of 15 years without the necessity arising of renewing a single tube.

Similar experience with most types of boilers at colliery, coke-oven and other works where the use of raw coal is not permitted (and where boiler capacity is not an unimportant consideration) could be quoted *ad infinitum*. These boilers are almost invariably operated under impelled-draught conditions at their full normal capacity.

The increase in price reported by Mr. Boot is entirely due to conditions brought about by the war, and, unfortunately, is common to all classes of solid fuel and to a greater extent in the case of coal; but even at the higher figure indicated, coke breeze is still the best fuel value at present obtainable in London. Makers of furnace apparatus will guarantee an evaporation of 6 lb. of water per pound of breeze and rates of combustion exceeding 30 lb. per sq. foot of grate per hour have been maintained with automatic mechanical stokers of the underfeed travelling-grate type, illustrated and described in the *Journal of Gas Lighting*, July 25th, 1911.

Mr. Bowden is probably correct in stating that his is the first power-house stoking-equipment specially installed in this country to use coke breeze exclusively, and his achievement in continuous operation is certainly unique; but many of the more up-to-date power stations, whose stoking appliances do not restrict them to the use of one uniform class of coal, are now using coke breeze extensively, while others are using coke to the total exclusion of all other solid fuel for steam-raising, thus realising considerable commercial advantage in addition to the practical advantage of smokeless combustion.

As a matter of local interest it may be worthy of note that coke is now produced in the London district to the extent of over 2 million tons annually. In normal circumstances, a considerable proportion of this output is exported at a price considerably below that at which coal of equal evaporative value can be bought in London.

Engineer and Fuel Expert.
London Coke Commission.

Westminster, *March 9th*, 1915.

"Totally Enclosed" Motors.

I have for a number of years been a subscriber to the ELECTRICAL REVIEW, and have from time to time read with special interest some of the correspondence on various subjects which has appeared in your columns.

As this correspondence is undoubtedly perused by both manufacturers of electrical machinery and manufacturers' representatives who are more or less responsible for the negotiations for the sale of such plant, it occurred to me that some of those interested might be able to enlighten me, and also several others with whom I have spoken on the matter, as to what really constitutes the total enclosing of an ordinary industrial electromotor.

From experience in dealing with prospective buyers and users of electric motors for certain applications, it seems that the term "totally enclosed" is construed by the layman in its literal sense, and is generally understood by him to mean "absolutely enclosed" to the exclusion of dust and any foreign matter that may be floating about in the surrounding atmosphere.

Manufacturers, on the other hand, do not appear to recognise this interpretation of the term as being the correct one. Their definition of totally enclosing appears to imply nothing more than a solid cover enveloping the whole of the working electrical parts of the machine, rendering them quite inaccessible to either attention or inspection, except by removing portions of the casing which are designed for the purpose.

Probably there may be other commercial engineers who have experienced the difficulty of persuading a prospective customer that a totally enclosed motor is not the absolutely enclosed machine which it might reasonably be assumed to be, and no doubt a more detailed definition of such motors than the writer has yet found, will be very acceptable.

I should be obliged if any of your readers could refer me to any authoritative definition which clearly states the features of totally enclosed, or totally enclosed pipe-ventilated, motors, without ambiguity.

Walbrook.

London, E.C., *March 9th*, 1915.

Trouble with Oil.

In response to "Inquirer" *re* the above trouble, one could have desired a little more information than is given. As the "shaft is quite dry," this can be eliminated at once. Now, as the engine must run with all casing and bed-plate doors in position, the only other place to exude oil is the bare expanse of piston-rods. If, as I suspect, the engine is using highly superheated steam, the H.P. rod will be found to give off a thick blue vapour. This is (usually) only visible on a day on which the sun shines through the windows, and then in its beams the blue vapour is clearly discernible, and it will be found to proceed from the source indicated. As to its ourney to the inside of the dynamo, is there any window or ventilator which would assist it towards the machine end? If so, this should be stopped immediately, and a good fan installed in a high position to clear the atmosphere. Finally, if found absolutely necessary, the aperture in the guide giving access to the H.P. packing gland and scrapers may be covered in back and front by sheet metal doors. This, however, is not without its drawbacks for the drivers, who prefer an open space in order that an eye may be kept open for "hot rods" and any "swabbing" done if required. In any case, only the H.P. rod need be treated thus.

Triple-Expansion.

Salaries of Engineers.

Herewith I am forwarding you cutting (see below) from the ELECTRICAL REVIEW Supplement, page 16, November 13th, 1914, appearing under the heading "Situations Vacant":—

> VACANCY for young engineer to act as Works Superintendent. Must have following qualifications:—First-class technical education in mechanical and electrical engineering, and some knowledge of elementary chemistry. Two years' practical experience in power station running and repairs. Some knowledge of draughtsmanship and drawing office work. Experience in gas works and gas analysis desirable. Salary, £120 per annum.—1063, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

On reading the advertisement referred to above, I notice the salary is £120 per annum: should this not read £1,200? Surely the former amount must be a misprint.

Provided £120 is the correct amount which is offered for a man with such colossal qualifications, and is a fair criterion of what is offering in the way of salary at home at the present time, then all I am able to say is that I am not returning to England until the market price has advanced somewhat.

Doubtful.

Sydney, *January 16th*, 1915.

P.S.—This country is not looked upon as the best in the world for labour, but a bricklayer can obtain his £200 a year to say the very least of it.

Trade Routes to Russia.

In the "War Items" of the current issue of the ELECTRICAL REVIEW you reprint an extract from an American report which has just been issued. It is quite evident that this report does not contain such up-to-date information as reports emanating from America usually do. Moreover, there are several quite misleading pieces of information, and I would strongly advise your English readers to take no notice of it.

With the exception of very urgent war material, and little even of that, practically no ordinary commercial goods have been going *via* the railway to Vologda for months past. One method has been to send goods *via* the Dvina, thence joining the railway from Perm, or, what was lately done, to send the goods on sleighs at a cost of about £18 per ton. Although this amount seems an enormous one for carriage, yet on high-priced goods, such as expensive machinery or valuable metals, it is of little account. I should not advise any of your readers to depend on the Archangel route, even when the port is open, say, by the end of May.

I do not understand what the reporter intends to convey by the expression: "New interest is being taken in the all-rail route from eastern Scotland or England," &c. He seems to have discovered a new route, because I can hardly imagine anyone having the slightest knowledge of the subject being so stupid as to send goods *viâ* Bergen, Christiania and Stockholm to Tornea. There is a direct route from Trondjhem, and still a better one from Narvik across the upper part of Norway and Sweden, and the Narvik to Tornea route is probably less than one-fifth the distance, and consequently almost proportionately less in cost than the imaginary route outlined by the gaseous reporter. If one examines the map of Norway and Sweden one will see how cleverly worked out the reporter's scheme is to mislead the English manufacturer and merchant. No doubt the reporter had in his mind the more expeditious and cheaper route, such as Trondjhem or Narvik, but this, of course, is for his own country's good, and there may possibly be found a supplementary report for American consumption only.

I had the pleasure of travelling over the route suggested by your imaginative reporter, which, I may add, is the route usually taken by human freight, and I found the railway connecting the gap had already been completed some two or three weeks, consequently one can affirm that the route has been completed, say, eight weeks. The journey from Petrograd to Stockholm, even when the connecting railway was not completed, only occupied three days, but probably the reporter, or the man he met, would require more time for thinking out these wonderful new schemes than the supply of correct and reliable information to his British friends. I sincerely trust that this route will offer attractions for the shipment of American freight of any kind to Russia.

I am glad to see that the report as a whole bears the same imprint of excellence as do usually all such American reports.

Traveller.

March 5th, 1915.

Japan-China Cable.

Our attention has been drawn to the notice appearing on page 252 of your issue of the 19th ult. relative to the cable connection between China and Japan, which does not give a correct statement of affairs.

As a matter of fact, this company has not parted with any of its cables between the countries in question. It may also be added that the company has a perpetual right to work its cables from Nagasaki, in Japan, connecting the latter place with Vladivostock, in Siberia, and with Shanghai, in China.

Apart from this, the Japanese Government, under an arrangement with the authorities concerned, has laid a cable between Shanghai and Nagasaki. This cable, which is worked by Japanese Government offices at both ends, is, however, only available for Government telegrams and Shanghai terminal telegrams written in Japanese characters, and so-called kana.

I should feel obliged if you would cause a correction to the above effect to be inserted in the next issue of the ELECTRICAL REVIEW.

F. C. C. Nielsen,
The Great Northern Telegraph Company's Representative in England.

London, E.C., *March 5th*, 1915.

Consulting "Engineers."

May I ask for some further information on this subject?

1. Does "Delta" object to a man's obtaining his engineering training while manufacturing artificial teeth? (p. 212, February 12th.)

2. Or, did he mean that a particular man has less training than himself and more push? He asserts the training was obtained.

3. Is "Station Engineer" correct in asserting that "imprisonment or heavy fine immediately follows an individual who attempts to practise as a lawyer or medical man without first qualifying"? My belief is that he is quite wrong, so long as there is no misrepresentation. I do not promise unqualified men much work!

4. If "A.M.I.E.E. and M.I.M.E. sound ridiculous and foolish," does "Station Engineer" aspire to a B.Sc. or M.E. or something better? (p. 270).

5. Does "Alpha" do any serious work and pay fees to the type of consulting engineer he "prefers" ("one who knows nothing, shuts his mouth, and leaves himself in the hands of a few good firms")? (p. 307, February 26th).

6. What do the firms do?

7. How many consulting engineers has he paid fees to (both capable and incapable)?

8. Has "Alpha" followed "Delta's" advice to "look more closely into the qualifications of those to whom they entrust their work"?

9. Did "Alpha's" consultant get the blow *in the back* "after the term of maintenance" and from whom?

10. Do not incapable men find their own level in whatever activity they attempt to follow?

Theodore Stevens.

London, E.C., *March 2nd*, 1915.

Writer's Cramp.

In reply to "W. H. B." in "Medical Electricity," by Dr. Lewis Jones, sixth edition, there is the following:—

"The results of electrical treatment are unsatisfactory. Max Weiss recommends the use of constant currents of from two to five or eight milliamperes, with absolute rest from writing. Further particulars are given."

L. M.

Great relief will be obtained by using the thick cork "anti-cramp" pen-holder, which avoids that undue approximation of the thumb and fingers which produces writer's cramp.

Another W. H. B.

In reply to your correspondent "W. H. B.," as one who during many years has come across, from time to time, various medical applications of electricity, I feel it a duty to give a word of warning to this effect: that the results of promiscuous use of apparatus without advice from a really well qualified medical specialist in the particular ailment it is applied for, may be either good, bad or indifferent, and it is difficult to say which is most likely. The obvious moral is, get such advice, if possible; such specialists generally prescribe for a definite system of hospital treatment in milliamperes and minutes.

Vibro-massage, however, can scarcely do any harm, and might be tried, if available.

Whatever system of relief is tried, it is, of course, greatly helped by strict *regimen* as to diet, outdoor exercise, and avoidance of irritants and debilitants, such as alcoholic liquors and tobacco. Please pardon the mention of the latter. I would not do it, but am sure in some cases of nervous disease (and, of course, hand trembling is a nervous disease), it gives steadiness for the time, the effect having to be paid back at a high rate of interest.

A. W. B.

March 8th, 1915.

THE RÖNTGEN SOCIETY.

At the March meeting of the Röntgen Society, held at the Institution of Electrical Engineers on the 2nd inst., a paper was read by Mr. Alexander Fleck, B.Sc., of Glasgow University, on "The Chemistry of the Radio-elements." Mr. Fleck supported in the main Professor Rutherford's conception of the atom, which, he said, was the only one commending itself to the mind of the chemist, namely, that the atom consisted of a central nucleus surrounded by rings of electrons, and that it was a positive charge of electricity within the atom, together with the structure of the nucleus, which determined the properties of a given element and gave it its place in the periodic table. In the central ring of electrons the gamma rays had their origin, being produced by the passage of beta particles through the ring. Incidentally Mr. Fleck said that recent generalisations in connection with the periodic law had made it evident for the first time that positive and negative electricity each had a real existence. Previous to these researches upon the structure of the atom, he was not aware that there was any evidence which made it quite plain that positive and negative electricity were two separate and distinct things. So far as they knew until these investigations, positive electricity might only have meant the absence of negative, but this recent work upon the disintegration of the radio-elements showed that within the atom there was positive and also negative electricity, and that the atomic charge in the nucleus was in reality not a positive charge, but was the difference between the positive and the negative.

Mr. J. H. Gardiner pointed out that the actual atoms of which an element was composed were probably not all identical, but differed among themselves, and that what they knew of the properties of an element was simply what they knew of the properties of the mass of these atoms. Lead, for instance, had an atomic weight of 207.1, but this did not mean that every atom of lead had that atomic weight.

Professor Nicholson entered into the question whether a difference in atomic weight should be denoted by a difference in the spectrum of a given element, and on the kinematical theory of the origin of spectra he considered that it should. He believed the inner ring of electrons within the atom to be a mathematical impossibility; the only kind of structure they could have in the atom, over and above several outer rings, was nuclear structure, and must be regarded as beta particles which had not yet been born.

Professor A. W. Porter, who occupied the chair, considered that the new arrangement of the radio-elements, resulting in the changing of the periodic law from something entirely empirical to an orderly sequence, was the most important generalisation made since Mendeléeff, and, indeed, completed the work which Mendeléeff began.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

CANADA.—From February 12th the following provisional increases have been made in the tariff rates:—The general and intermediate tariff rates are increased by 7½ per cent. *ad valorem*, and the British preferential rates by 5 per cent. The general tariff is applicable to goods the produce of countries which have no special treaty with Canada, and the intermediate tariff is applicable to certain specified goods the produce of countries having such treaties. Articles formerly in the free list are made dutiable at 7½ per cent. *ad valorem* under the general and intermediate tariff rates, and at 5 per cent. under the British preferential tariff rates. There is a considerable list of exceptions. Other revenue measures include a 1 per cent. tax on bank-note circulation and the gross income of loan and trust companies and insurance companies' premiums other than life, marine, and benefit insurance; taxes on cable and telegraph messages, steamboat and railway tickets, stamp taxes on cheques, bills of exchange, bills of lading, letters, patent medicines and wines.

GERMANY.—The following statement by the American Consul-General in Berlin regarding the administration of the German tariff since the war, which has just been published by the American Government, will be of interest to manufacturers and traders in this country:—

The war has completely altered the status of trade agreements and customs treaties existing between the German Empire and the nations at war with Germany. It was naturally to be expected that the declaration of war should terminate the peace treaties negotiated at Frankfort and the German trade agreements with Russia, Belgium, Serbia, Montenegro, and Japan. It also naturally follows that the customs treaties by which certain advantages were given on the products of these nations by the German Government should be no longer valid. Furthermore, it was to be expected that the advantages as to duty, which were granted by the provisions of the German-English trade agreement to all the States of the British Empire, would be withdrawn.

The changes in the treaty agreements above mentioned have brought about many intricate and difficult questions, some of which have not yet been settled. It was necessary to give German buyers who had purchased goods before the war commenced an opportunity to enter their goods at the custom-houses on an equitable basis, otherwise great injustice would be done these buyers, because it was not possible for them to calculate upon such a sudden and important change in Germany's commercial relations. These exceptions have been made necessary largely because the condition of war would cause a higher rate of duty to be placed upon goods which were shipped from a country enjoying unusual duty and trade advantages.

A study of the conventional and general tariff system of Germany shows that certain industrial and manufactured products, to which the rates of the general tariff are not entirely applicable, would be particularly affected because the special concessions granted by tariff treaties to other countries would be superseded and disarranged. Certain old and established industries have thus been caused considerable difficulty because they were used to the tariff rates formerly in force and were not in a position to adapt themselves to the unforeseen changes caused by the war.

It was obvious that the immediate application of the higher rates of duty after the outbreak of war was exceedingly satisfactory to certain German industries interested in the domestic production of manufactured goods. Certain industries will undoubtedly benefit by the exclusion of the goods of countries at war with Germany, and these industries will establish themselves during the course of the war in such a way that they will not be easily stamped out when the war is terminated and the usual customs arrangements prevail. In support of this view the war of 1870 is cited, during the course of which the aniline-colour industry made great progress.

Although, strictly speaking, the relations of Germany with respect to the most-favoured-nation clause have been disarranged by the war, an effort has been made to keep the advantages granted to friendly and neutral nations in force until satisfactory arrangements can be made and mutually beneficial decisions reached.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

2,798. "Gearing for electric motors for traction or other purposes." C. Nesbitt, Jun., & W. T. Dalton. February 22nd.

2,821. "Means for increasing the oscillations in and frequency of electrical currents." R. Cartwright & H. J. Ball. February 22nd.

2,841. "System of electric ship propulsion." British Thomson-Houston Co., Ltd. February 22nd. (General Electric Co., United States.)

2,865. "Devices for extracting foreign substances from paper pulp, particularly referring to electrically-operated devices for extracting small particles of magnetic substances, as iron or any of the alloys or ores containing iron." A. J. Newell & R. J. Marx. February 22nd. (Complete.)

2,883. "Conduits for electric cables and the like." W. Oates. February 23rd.

2,888. "Automatic [illegible] electric block signalling section." W. Wakeford. February 23rd.

2,894. "Heating tools or dies by electricity, as stamping-press tools and the like." W. J. Readett. February 23rd.

2,897. "Electric railway systems." F. G. Brettell. February 23rd. (C. W. [illegible], United States.) (Complete.)

2,902. "Coin automatic electric control." C. W. H. Leathwood. February 23rd.

2,921. "Device for subaqueous signalling stations." Signal G.m.b.H. February 23rd. (Addition to 3,934/13. Convention date, February 23rd, 1914, Germany.) (Complete.)

2,928. "Electric light fittings or brackets." F. R. Hough & L. Harrison. February 23rd.

2,934. "Portable electric lights." W. J. Mellersh-Jackson. February 23rd. (S. J. [illegible], United States.) (Addition to 18,809/14.) (Complete.)

2,950. "Perforated tape duplicator." D. Murray. February 24th.

2,957. "Machines or apparatus for sheathing or braiding wire ropes, cables, hose, and the like with cotton, silk, wire, or like protective coverings or casings." P. Huntington. February 24th.

2,968. "Covers or protectors of electric switches or other electrical parts or members, and to manufacture of the same." J. H. Tucker & J. A. Crabtree. February 24th. (Complete.)

2,969. "Sockets for plug-and-socket electrical connections." L. Maxwell. February 24th.

2,972. "Vehicle brakes and the like." W. P. Thompson. February 24th. (Magnetbremsen G.m.b.H., Germany.) (Complete.)

2,982. "Process for coating metal plates and the like." S. O. Cowper-Coles. February 24th.

2,983. "Manufacture of cartridge cases." S. O. Cowper-Coles. February 24th.

2,984. "Mandrels for use in the electrolytic production of metal tubes and the like." S. O. Cowper-Coles. February 24th.

3,001. "Oil circuit-breakers." F. B. Holt. February 24th.

3,002. "Lamp signalling arrangements." A. H. Midgley & C. A. Vandervell. February 24th.

3,003. "Electric switches for motor-car and like horns." A. H. Midgley & C. A. Vandervell. February 24th. (Complete.)

3,007. "Protrudable receiver for subaqueous signalling." Signal G.m.b.H. February 24th. (Addition to 16,298/13. Convention date, February 25th, 1914, Germany.) (Complete.)

3,014. "Electric lighting devices for vehicles, particularly cycles." H. C. Contet & A. Pieg. February 24th. (Convention date, February 25th, 1914, France.) (Complete.)

3,051. "Electrically-heated iron." G. Cooper. February 25th.

3,082. "Means for operating and controlling electric switches." S. D. Cox & P. S. O'Donnell. February 25th.

3,106. "Electric lamp-holders and similar couplings." A. A. Schaschke. February 26th.

3,120. "Electric iron direct supply stand." E. N. Klein. February 26th.

3,122. "Magnetic compasses." A. S. Newman and Newman & Sinclair, Ltd. February 26th.

3,132. "Electrodes for use in electrical accumulators wherein two different electrolytes are employed." P. Marino. February 26th.

3,142. "Insulating blocks, slabs, and the like." G. A. Herdman. February 26th.

3,181. "Process for the removal of scale, oxide, and grease from metallic surfaces." S. O. Cowper-Coles. February 27th.

3,213. "Device for anchoring electric cables and wires." A. F. Foster. February 27th. (Complete.)

PUBLISHED SPECIFICATIONS.

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

1913.

25,855. Magneto-electric Machines for Ignition Purposes. F. H. Teagle. November 11th.

28,347. Means for Simultaneously Locking and Unlocking the Doors of Railway Carriages and the like. R. W. Willetts. June 9th. (June 9th, 1914.)

1914.

298. Advertising or Signalling Apparatus. J. P. Naylor and Naylorgraph, Ltd. January 5th.

515. Starting and Speed Regulation of Electric Motors capable of Regenerative Action. F. Cumont. January 8th. (Patent of addition not granted.)

2,270. Telephone Systems. Automatic Telephone Manufacturing Co. & A. J. Ray. January 28th.

2,871. Earthenware Troughs for Electric Cables and other purposes. C. J. Doulton & H. L. Morris. February 4th.

2,959. Control Systems for Series Motors supplied with Pulsating Current. British Thomson-Houston Co. (General Electric Co.). February 4th.

3,195. Telephone Systems. Automatic Telephone Manufacturing Co. & J. Savin. February 6th.

3,385. Electric Motor-starters. British Thomson-Houston Co., A. P. Young and F. Garton. February 9th.

3,596. Current-collecting Devices for Dynamo-electric Machines. British Thomson-Houston Co. & F. P. Whitaker. February 11th.

3,696. Fuse Devices for Electrical Circuits. E. O. Schweitzer & N. J. Conrad & Schweitzer & Conrad (Corp.). February 12th.

3,654. Electrolytic Apparatus. I. H. Levin. February 12th. (May 9th, 1913.)

3,706. Electrical Switches for Automobiles and other purposes. W. W. Dean. February 12th. (February 18th, 1913.)

3,808. Automatic Recording Instruments. A. A. Holloway (C. H. Wilson). February 15th.

3,925. Electric Power Transmission, Self-starter and Lighting System for Motor Vehicles and the like. E. F. Roydhouse & A. H. Cheesman. February 16th.

4,432. Electric Heating Apparatus. H. Hirst & C. H. Archer. February 20th.

4,525. Jointing Devices for Tubes Carrying Electrical Conductors. H. H. Longbottom & T. Farrar. February 21st.

4,813. Lighting and other Auxiliary Circuits on Electrically-propelled Vehicles. British Thomson-Houston Co. (General Electric Co.). February 24th.

4,931. Protective Devices for Electric Distribution Systems. British Thomson-Houston Co. (General Electric Co.). February 25th.

5,131. Appliance for Preventing Unintentional Interruptions on Telephones. R. S. O. Dudfield. February 27th.

5,966. Device for the Electrical Control from a Distance of Guns or other mechanisms by means of a source of Continuous Current. E. Schneider. March 9th.

6,351. Control of Electric Winding-gear. British Thomson-Houston Co., & E. I. David. March 12th.

6,800. Sparking Plugs and their Terminal Covers. H. G. Longford, W. W. Longford & W. A. Clark. March 18th.

6,977. Overhead Trolley Wires and the like systems of Electric Traction. G. G. Glyn. March 19th.

7,440. Apparatus for Controlling Electric Lighting Systems by means of the Action of a Selenium or other Light Sensitive Cell. C. J. Turner. March 24th.

7,451. Automatic Regulation of Electric Arcs. E. Girardeau. March 24th. (April 1st, 1913.)

7,926. X-ray Generators. U. Magini. March 28th.

8,788. Exhibition or Advertising Device. W. D. Vick, A. E. Vick, & T. J. Farmer. April 7th.

9,504. Audible Electric Signal Repeaters for Indicating the Position of the Semaphore Signals on Railways. J. W. Clarke. April 17th. (Cognate application, 16,352/14.)

9,638. Telephone Receivers. E. C. R. Marks (Electrical Experiment Co.). April 18th.

9,794. Electric Heating Stove and Radiator. S. E. Foster, W. H. Arundale & C. H. Davies. April 21st.

10,100. Storage Batteries. B. Ford. April 23rd. (May 21st, 1913.)

11,829. Moving-picture Apparatus. S. G. S. Dicker (Ad-Display Machine Corporation). May 13th.

11,942. Electric Battery Lamps. W. J. Mellersh-Jackson (Interstate Electric Novelty Co.). May 14th.

12,907. Fire-extinguishing, Alarm and Indicating Apparatus for use on board ships and large buildings. F. W. Smith. May 26th.

15,052. Electric Headlights and the like. L. Renault. June 23rd. (July 1st, 1913.)

17,528. Tubular Insulators for High-tension Electricity. E. Haefely. July 24th.

17,567. Mechanism for Controlling Movement at a Distance Electrically. Harle et Cie. July 24th. (July 28th, 1913.)

17,885. Electrically-controlled Variable-speed Mechanism. C. T. Henderson. July 28th. (July 29th, 1913.)

18,304. Means of Selectively Controlling or Actuating Monogrammic or other Groups of Luminous or Non-luminous Elements applicable to Signalling or Advertising Devices. J. P. Naylor & Naylorgraph, Ltd. January 5th. (Divided application on 298/14, January 5th.)

18,418. Thermal Electric Switches. L. J. Schrubb. August 7th.

20,695. Electric Fuse or Cut-out Boxes having Multiple Ways. C. F. Parkinson, A. H. Railing, and C. C. Garrard. October 8th.

20,999. Interchangeable Electrode Holders for Arc Lamps. L. Hughes. October 15th.

21,590. Magneto-electric Machines for Ignition Purposes. F. H. Teagle. October 27th. (Divided application on 25,855/13, November 11th.)

22,176. Mounting of Electric Indicating Instruments in Switchboards, more particularly used on Motor-cars and other vehicles. C. A. Vandervell. November 7th.

South Africa.—Municipal Power Schemes.—On the recommendation of the Electrical Trade Section of the Johannesburg Chamber of Commerce, a communication has been addressed to the Administrator, Cape Province, calling attention to the fact that in recent cases of inquiries for tenders for power schemes connected with municipalities in the Cape Province, it has been found that the conditions imposed on contractors were so onerous that firms were unable to submit tenders. The principal reason was that the consulting engineer reserved to himself such excessive powers, that if firms had tendered they would have been compelled to provide a considerable sum for possible contingencies. The Committee submitted that it was most desirable that the conditions attaching to these schemes should be such as firms could comply with—for, in the cases in question, even had the firms concerned tendered, their prices would of necessity have been higher than would be the case if reasonable conditions were laid down. It was evident that in the circumstances (and particularly by reason of the absence of due competition) public interests suffered. The Administrator was, therefore, asked to authorise the Government electrical engineer to confer with a deputation from the Chamber of Commerce in order to discuss the difficulties which had arisen. —*S.A. Mining Journal.*

Municipal Employés' Sick Pay.—At Accrington Town Council, last week, Ald. Higham explained, in answer to a question, that a young man employed on the switchboard at the electricity works was taken ill in July last. It had been the custom in some departments to pay men full wages for a short period and partial wages for another short period. Month by month this salary had been paid, and the young man in question had been receiving, in addition to his wages, his insurance money also. As near as he could tell, he had received £11 in excess of what he had been entitled to. From January to the end of last week the young man had worked off the surplus money, and had now secured another position.

THE

ELECTRICAL REVIEW.

VOL. LXXVI. MARCH 19, 1915. No. 1,947.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: March 19th, 1915. [No. 1,947.

Page

Industrial Organisation ... 385
Municipal Finance ... 386
Electric Cooking from "A" Consumer's Point of View ... 387
The Copper Position ... 387
American Trade Development ... 388
A South Wales Mining Installation ... 388
The Selling Side of Electricity Supply.—II. ... 388
Legal ... 389
New Electrical Devices, Fittings and Plant (*illus.*) ... 391
Business Notes ... 392
Notes on Coal Storage ... 398
Reviews ... 400
Notes ... 402
City Notes ... 406
Stocks and Shares ... 411
Market Quotations ... 412
Searchlight Projectors, by C. W. Denny (*illus.*) (*concluded*) ... 413
The Effect of the Present Coal Position on the Business of Electrical Supply ... 414
Russian Trade and Electrical Prospects ... 415
Electric Cooking, by W. R. Cooper (*illus.*) ... 417
Electricity Applied to Mining, by C. P. Sparks (*illus.*) (*cont.*) 419
Correspondence—
  Consulting "Engineers" ... 422
  The Government Electric Power Station at Bangkok ... 422
  Government Control of Factories ... 422
  Coke Fuel for Steam Raising ... 423
  Showroom Windows ... 423
Glasgow Electricity Works (*illus.*) ... 423
Foreign and Colonial Tariffs on Electrical Goods ... 424
New Patents Applied for, 1915 ... 424
Abstracts of Published Specifications ... 424
Contractors' Column ... Advertisement page xviii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos: Holborn 938; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.
BRISBANE: Gordon & Gotch, Queen St.
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LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto I 307.
SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

1915 EDITION
NOW READY.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

INDUSTRIAL ORGANISATION.

WAR is a solvent of social order which peace will recrystallise into new forms, better or worse. In the unsettling of old habits and prejudices, in the fluidity of general ideas under the intense action of prolonged national crisis, is seen an occasion for recasting much that is imperfect. The liquor traffic, the housing of the poor, the relations of workers to their employers, the morals of great cities, physical training of young men, national education, the political subjection of women; all such questions come into clearer light. We can regard them from a higher and more detached standpoint, in more sober and serious temper, under the stress of a great conflict.

Of all these questions, the problems of industrial organisation, the organisation by which men and women earn their livelihood, and the means to lead their lives, nobly or basely as it may be, are paramount in importance, and industrial organisation in its widest sense includes all home politics, and much of foreign. Some of its most difficult questions now call for immediate solution. Solutions of great problems adopted in urgent need, and under instant pressure are apt to be more successful than those adopted deliberately, for the reason that the urgency rules out narrow and sordid considerations that compromise principle and emasculate legislation. Heroic occasion is the opportunity for heroic action. We have seen national drunkenness abolished from Russia at a stroke. In France every man turned almost at an instant to meet the peril of German domination. Our immediate danger is not so pressing as theirs, but it is more serious than we realise. Our leaders warn, advise, exhort us; but they do not take us into their confidence, and it is not good to treat us as children. Now we have industrial experiment before us on the great scale in several directions. The nationalisation of the railways, whether permanent or not, is a working fact. *British Dyes, Limited*, is under discussion, and letters upon the proposal from Sir William Ramsay and Sir Henry Roscoe, in the *Times* of March 10th, call for most serious consideration. Indeed, in our view the whole scheme, as we understand it, should be recast in the light of those letters, on the ground that bodies of men elected to directorates under the Companies' Acts do, as a matter of experience, depress the scientific interests of their concerns.

To many it appears that the production of dyes should be initiated as a national concern, and protected by prohibition of competing imports. It might well be transferred to an independent body subsequently. The immediate occasion of this article is the proposal of the Government to administer the engineering works of the country in the military interests of the Allies. Elementary considerations of efficiency would indicate such a course, but the fact that the relations of the employers and the men are such that the national safety is compromised by a conflict of sordid interests makes the step necessary. Indeed, the condition of things recalls the faction fights in Jerusalem when the army of Titus was hammering at the gates. Though occasioned by military necessity, this assumption of the engineering works by the Government may have great consequences as an object lesson in Socialism, and it is fortunate that in the nature of things the arrangement cannot be permanent, so that its action can be watched disinterestedly as if it were only an experiment in State Socialism.

It is impossible to be satisfied with regarding the relation between an employer and a workman as a mere case of supply and demand: for from such a view it follows logically that the employer's interest lies in the workman being as dependent on him as is consistent with working efficiency, and that it is to the workman's interest to keep the employer continually anxious lest his men in a body and without notice should refuse to execute his contracts. A constant state of strain is inevitable. We do not suggest that this view of the industrial relation holds in all or many concerns, but it holds in some of great importance, and, in some degree, in many others. On the other hand, there are well-known large firms in which the human factor is conspicuous in the industrial relationship, and some such concerns are the nearest approach to, are the best models of, the ideal state, that we can call to mind. If this semi-Socialistic step of the Government in taking over the engineering works throws light on this perplexing problem, the war will have that at least to its credit.

The imperative demands that the nation and our Allies are compelled to make upon all connected with manufacturing operations in England were expressed by Lord Kitchener in the House of Lords on Monday. It seems almost incredible that while our sons and brothers are fighting for our existence and sacrificing their lives, there should be amongst us any who are slackers. Successful operations cannot be carried through without abundant and continuous supplies of arms, ammunition and equipment, and we cannot feel that the appeal from the blood-soaked battlefield will fall on deaf ears. The need is so urgent that there ought to be no hampering of manufacturing operations by drink, ca' canny policy, or output restriction by Trade Unions.

The patriotism of the great majority of the workers will undoubtedly be on the side of Lord Kitchener and the Government if short shrift be given to those who prevent our factories from running at their biggest possible capacity. Everybody must be ashamed of men—they are not worthy of the name of Englishmen—who, when the need is so great, will take advantage of higher wages for idling for two days out of the six, and so letting their own kith and kin, fighters for Freedom and Righteousness, who are driving back our Common Enemy, run the risk of being denied, at critical moments, the necessary support from the forces training at home because ammunition and equipment are not forthcoming freely enough.

While this interesting experiment in internal organisation is being undertaken, we are informed of a no less interesting one in business organisation. We have received from the Secretary of a Committee of the Engineers' Club at Manchester a copy of a report, drawn up for discussion, which recommends the establishment of an association of manufacturing engineers for promoting their foreign trade. The work is designed on a large scale, £300,000 a year is the expenditure suggested, and, so far as one can judge from a mere outline, the scheme is well conceived, though we think it is open to criticism on some points. For instance, it is proposed to reform the Consular service "by making the service a special medium for the furtherance of British commercial interests." The relations of our Foreign Office with other Governments, especially with those of dependent States, are often delicate, and depend largely, we believe, on our being disinterested in money matters. These relations might be seriously compromised if the Consuls themselves took an active part in seeking remunerative business for their own merchants. Yet something will undoubtedly have to be done towards removing the inefficiences of the present Consular report service. Whether by the appointment of more Commercial Attachés, Trade Commissioners, or other specialised representatives, matters little, so long as the Government, following consistently its Trade War policy, remedies present shortcomings. We should be sorry to see our Government doing some of the things to which the German Emperor has condescended. It is enough to say that the less the proposed association depends on the Government, and the more firmly it stands on its own feet, the better for it. The weak point of the proposal may be a difficulty in finding the necessary subscriptions. Unless all firms make a *pro rata* contribution we should doubt the permanency of the arrangement, and firms whose trade is wholly a home trade might well refuse. The alternative to voluntary association, if the foreign trade is to be properly pushed, is said to be the formation of combines or trusts, and this the Committee very properly deprecates.

But if we rule out Government action and the formation of large controlling interests, we have ruled out two of the particular methods by which the Germans built up their foreign trade so rapidly. Other methods on which Germany relied, preferential railway rates at home, and arrangements by which the shipping companies were content to run ships at a loss, looking for their profit by the development of new German business in the future, do not seem to be possible in our case. The thing ought to be done in some shape. We are tempted to think that a trading association, on financial lines, looking for a trading profit, instead of relying on voluntary contributions, would be a more promising method.

Municipal Finance.

For very many years we have endeavoured to induce municipalities that conduct electricity supply and tramway undertakings to proceed on sound and conservative lines, accumulating substantial reserve funds and making ample provision for obsolescence and renewal of their plant; for this reason we have deprecated the allocation of surplus revenue to the relief of the local rates, a process which is usually based upon political motives and is intimately associated with the propensity for vote-catching, which is so deleterious to any form of government. Those who have followed our advice, and now find themselves in possession of up-to-date plant backed up by a large reserve, are to be congratulated on their foresight and good judgment; those, on the other hand, that have squandered their receipts in sops to ratepayers and relied upon raising new loans to meet future needs may now realise the error into which they have fallen, for it is clear that the Government will not allow large sums of money to be borrowed for the purposes of municipal undertakings during the war.

As we are now approaching the period when most electrical undertakings close their financial year, a warning regarding the disposal of surplus moneys will be timely; we strongly urge all such authorities to retain full control of their funds, and absolutely to decline to permit them to be diverted from the service of their undertakings on any consideration whatever.

No one knows how long the war may last, or what the state of public finances may be for years after its close, and it is most important that undertakings which now have to depend upon their own resources should husband them most carefully.

Electric Cooking: From "A" Consumer's Point of View.

It is a good many years since the electric cooker in its embryo state made its appearance with little more than a laboratory reputation and a stiff price to recommend it. In the interval great strides have been made not only in the design of suitable apparatus but also in its use, so that in many cases electric cooking has proved a commercially successful proposition.

This progress in recent times has been largely due to the efforts of the Point Five Association, whose practical methods of dealing with an admittedly difficult problem have more than anything else resulted in placing the electric cooker where it is to-day—in the hands of many consumers. That it is in this position, and is being increasingly sought after, is, after all, the best indication of what consumers think of it, and this fact discounts to a very large extent the impression which is bound to be conveyed to the uninformed reader of Mr. Cooper's paper on this subject before the Institution of Electrical Engineers last week.

It is unfortunate that the author should have chosen to play the part of an investigator of electrical cooking methods, and still more unfortunate that he should have thought it necessary to place his experience on record, as he might have known that his results had been bettered in everyday practice by users all over the country. The average consumer is fortunately *not* an engineer; his installation is selected and fixed under expert guidance, with due regard to first and subsequent costs; and if his anticipations are not realised or his results such as do not compare favourably with those obtained elsewhere, which he is fully entitled to expect, then in nine cases out of ten there is trouble for someone until the matter has been put right.

The fact that Mr. Cooper apparently did not follow this course differentiates him from the ordinary type of consumer, and, of course, detracts from the value of the paper, which was supposedly written from the consumer's point of view. Under the circumstances it is not surprising that the author was practically "snowed under" in the discussion, or rather, we should say, the reply, which followed the reading of his paper, and is published elsewhere in this issue.

It is worth noting that one speaker pointed out that had the author lived in his area (in London) he could have had the requisite installation for a rental of 5s. or 7s. 6d. per quarter, and would have had the utensils supplied free, or, as a purchaser, he could have obtained the equipment installed and wired for use for £14, instead of paying as he did £35. Again, the consumption of energy in such a case as the author's was placed by experience at 3,500 units per annum, but the author's "careful" cook succeeded in disposing of over 5,000 units in the year. Moreover, his allocation of cost as between years with and without electric cooking seems to call for some explanation, in view of the result, which differs so widely from that mentioned by another member, who, during the past five years, has abandoned gas at 1s. 9d. per 1,000 cb. ft. in favour of electricity at the comparatively high price of 1½d. per unit for electric cooking purposes, and yet cannot from a comparison of the combined annual costs of coal, gas and electricity over those five years, find sufficient difference in cost to indicate when he changed over.

Mr. Cooper's references to load factor and diversity factor are not easily understandable; if the cooking consumers are regarded as a class, too much stress should not be laid on individual characteristics, as their combined effect alone will determine their value to the station. It is quite conceivable that a consumer with a large installation and a partiality for week-ends might have a very poor average load factor, while certainly the collective load of the small consumers who will enormously outnumber the large ones is a much more acceptable and profitable one to the central station. In fact, viewed from the standpoint of the future the so-called large cooking consumer could very well be dispensed with.

Mr. Cooper's paper forms one of the very strongest arguments we can have as to the necessity for electricity works to be in a position to advise and to hire out standard cooking equipments to consumers, and to keep in close touch with them afterwards, exactly as our gas friends have done for years.

With all due respect to Mr. Wordingham, who, in the course of the discussion, referred to our leader of February 12th on the question of standardising electric cooking apparatus, we feel that this is a matter which goes somewhat beyond the scope of the sub-committee of which he is a member, and which is apparently inclined to let the matter rest because the manufacturers cannot make up their minds to co-operate in the movement. If electric cooking is to progress on the scale which experience has demonstrated to be possible, it is vitally necessary that the only organised body in this country possessing the collective influence essential to that purpose should take the matter up. We refer, of course, to the I.M.E.A., and we would again urge that this association should recognise the necessity of coming to some agreement with a view to fixing standard lines of development, standard dimensions and ratings, and aiming at some degree of interchangeability, as the best means at the moment for placing electric cooking on a commercially competitive basis, and hastening the introduction of hiring facilities. The manufacturer hesitates because he thinks he can afford to wait; the station engineer, if he is out for business, cannot afford to wait, and if he has any doubt on the matter, a study of the Marylebone load curves ought to convince him.

The Copper Position.

The tone of the copper market remains very steady, not to say firm, and this although it is known that in North America efforts are being made to get increased capacity to work, with the intention of taking advantage of the very remunerative prices which are being realised for metal by the leading producers. The demand is very good on account of the makers of war munitions in all parts of the world, but there is very little business doing in connection with the ordinary sources of peaceful absorption. The whole of the cartridge plants in the United Kingdom are running as fully as the Trade Unions will permit, but it is possible for a good deal more to be turned out than is being done. On the other hand, the French works are making material at a great rate, and it is very fortunate for us that the British Government is able to get large quantities of munitions from the United States. It would be a poor look-out for us were it not that we can call upon the working men of North America to "do their bit" to help the nation to provide the means of offence and defence in Flanders, which are not to be got, except grudgingly, from some of the men at home. It is due to the large orders for cartridges placed in the United States that the American brass trade is so busily employed, and the activity in this direction is taken as a very gratifying feature, for it has helped to rehabilitate a trade which was feeling the fullest effects of the outbreak of war, and the constriction of credit which followed it, in its early stages. Demands have undeniably outstripped the very low point of consumption which was established last autumn, and an increase in output is thoroughly justified by the growing consumption on both sides of the Atlantic.

Producers are very well sold indeed, and the tendency of prices at the moment is firm both here and in America. There is some demand still met with for early deliveries, but those in the fortunate position of being able to supply needs in this direction are very chary of parting with their material, foreseeing that by holding on they may be able to do still better for themselves later on. There is felt in some American quarters to be a chance of the stocks in the hands of producers being added to in the near future owing to the smaller export movement recently met with, and certainly the February exports were quite small. It is probable, indeed, that the holdings of first hands across the Atlantic have undergone some expansion, possibly as much as 8,000 tons during last month, but this is not likely to cause any discontent generally, for it is recognised that the shipping position is one of the greatest difficulty, and that a restriction in the export movement is due not so much to lack of absorbing power as to the absence for a time of the means of forwarding copper from the producers' to the consumers' works. It is the current belief that American production is now proceeding at the rate of about 40,000 tons a month, and that a steady increase upon this figure is likely to be seen over the next six months or so.

American Trade Development. Ample evidence is forthcoming that American firms and the American Government are determined to take full advantage of the existing crisis in Europe for the development of American trade at the expense of her former competitors. Realisation of this fact should do much to encourage our manufacturers to do the best that can possibly be done under existing circumstances. In few trades is the activity of American firms likely to be greater than in the electrical trade, for which the United States is particularly well placed. We are constrained to call attention to these circumstances again, because we notice that the American Government has recently caused its Consular Officers abroad to prepare extensive reports on hydro-electric enterprises in various countries, and the outlook for augmented sales of electrical materials and supplies of all kinds. These reports in the main are not being published, but we are able to print certain extracts from one or two of them, under the heading, "Consular Notes," on another page. The complete reports, in manuscript form, are being placed in the industrial centres of the United States, where they may be inspected by manufacturers and exporters. For a variety of reasons many of our manufacturers are at the present moment unable to do very much in the way of trade extension, but we would urge on them the desirability of maintaining a firm hold on their markets, so that when the war is over they may retain the business they previously had, and also assure to themselves a fair prospect of further extension. To this end we would again impress upon the Government the need for developing its present activities on the lines of obtaining from abroad specialised reports on individual trades.

A South Wales Mining Installation. The paper read by Mr. Sparks on "Electricity Applied to Mining," before the Institution of Electrical Engineers, of which we are publishing an abstract, forms an instructive addition to the previous paper by the same author, which was abstracted in our issue of April 20th, 1906. Progress in the meantime has been such that the station capacity has increased to eight times as much as in 1905, viz., 24,000 H.P.; the B.H.P. of motors connected to 44,800, and the annual output of energy to between 50 and 60 million units, or about 12 times as much. In fact, the scheme is possibly the largest of its kind in the country, and the paper certainly one of the most informing on the subject that we have had.

For generating purposes both live and exhaust steam turbines and gas engines are employed on a fairly large scale, and no doubt there are many who wish it had been possible to include some data relative to the cost of generating as between these different plants.

The author informs us that the gas engines with a 72 per cent. annual load factor require 18 B.TH.U. per watt-hour or half the amount required by the live steam turbine plant, and their operating cost is sensibly lessened by the sale of by-products, but one is somewhat disappointed to find from another paragraph that these 1,200 and 2,400-B.H.P. engines, as the result of experience, are only supplying average loads of 600 and 1,200 KW. respectively, the combined maximum load being 2,200 KW. We may note, in passing, that an illustrated description of the earlier gas engine sets has appeared in our pages.

Very extensive use appears to have been made of exhaust steam turbine plant, and it would seem that a number of steam winding engines have thereby secured a new lease of life; on the other hand, a very fine electrical winding plant on the Ilgner system has been installed at the Britannia Pit, of which some views were included in our pages last week, and there is also a three-phase induction motor-driven winder of smaller size at another pit. The latter has been in satisfactory operation for the last six years, and we gather that the sudden loads of 750 K.V.A., every 45 or 50 seconds, are satisfactorily dealt with at the power station by a Tirrill regulator. Thus the winding problem is being dealt with in various ways, more or less electrical, and it would have given additional interest to the paper had some further reference been made to the conditions determining the choice of means. Mr. Sparks, for instance, makes the general statement that where a colliery is equipped with main steam winders, the cost of conversion to complete electrification is seldom justified; this has been the position for some years, but the conditions have materially altered in that time, and, without further information, it is difficult to gauge the exact position of electric winding at the present moment.

THE SELLING SIDE OF ELECTRICITY SUPPLY.—II.

An Iron Campaign.

With the heating season drawing to a close, one's plans for a spring campaign must be laid, for "business as usual" is still the order. This year economy will, no doubt, be the rule in most British homes, and the housewife will be looking round for possible savings to counteract the advances in food costs. There is one way in which she can do this; in most houses a great deal too much laundry is sent out. There is room for a saving here without reducing the standard of living, and whether the work is done by herself or by the servants, an electric iron will be welcomed. There is an extra amount of washing to be done in conjunction with spring cleaning, and this should be our opportunity. The electric iron is one of the many electrical home conveniences without a close rival. I have often wondered if electrical people themselves realise that it is the delight of those who have adopted it, and one of the last things they will let go. From a supply point of view, the iron is a profit-earner; even if we accept such a low estimate as two hours' use a week for 50 weeks in the year, each iron should consume 25 units, and none of these are likely to be used on the peak load. If we sell 1,000 irons then in the next three months, we shall add 25,000 units to our output, and as most of these will be used on lighting circuits, we are getting lighting rates for power. Good business; now, how to set about it.

First, there is the shop front display. It may be possible to arrange with one of the laundries in the district to send a girl down with material each day to do actual ironing in the window. This could be kept up so long as results were good—there is nothing so telling as a practical demonstration. They might possibly be induced to do this without charge if the value of it to themselves from an advertising point of view were well put to them. They could be offered a notice, to be fixed by the demonstrator, pointing out that the work done in their laundry was carried out by the same hygienic methods as shown. At the same time the opportunity should not be lost of endeavouring to secure their business.

The large manufacturers of electric irons would be only too pleased to co-operate in finding advertising matter, and are always willing to over-print with your own name.

One of the great barriers to the electric iron is the old sadiron, spirit, gas or charcoal iron already in use. These represent an investment and a habit not always easy to break. One way to get over this difficulty is to offer an allowance for each old iron, as part payment for a new electric one. "New irons for old" can be the slogan. Taking the selling price at about 12s. 6d., and the discount at 33⅓ per cent., the gross profit would be about 4s. One could offer a credit of, say, 6d., for an ordinary sadiron and 1s. 6d. for a gas or spirit iron.

This introduces a bargain feature to the sale which is very dear to the hearts of the ladies, and also gets the old irons out of the way, so that they can't be used. In order to bring in the orders a time limit should be attached to the offer, or perhaps, better still, it could be offered to the first 250 purchasers. If advisable, an extension to 500 or more would follow. This would be, of course, widely announced as being due to the great success of the preliminary offer.

If those of our readers who adopt this idea keep the irons bought in until the end of the campaign and, before selling them to the scrap-iron merchant, pile them up into a heap and take a photograph, we shall be pleased to receive a copy.

Other publicity efforts must be made, advertisements put in the local papers, or if funds will not run to this, notices of such a novel event as new irons for old might well be sent and find a corner in the news columns. The next quarter's accounts could have particulars printed on the back. On the front room might be found for a brief announcement: "New irons for old, see over." A paragraph could be typed into each letter leaving the office to local persons—sufficient use is not always made of this very valuable means of business getting. Of course advertising literature would be enclosed in all outgoing postal communications.

Then there is the question of a house-to-house canvass; if no canvasser is employed, a suitable man might be borrowed from the meter reading department, or perhaps a lady taken on temporarily. It will be found most helpful to offer a week's free trial; only a very small percentage are ever returned. There is no harm in circularising non-users of electric light; it will make them wish they had it, and set them thinking, which is all to the good.

Records should be kept of the number and wattage sold, left on trial, collected, &c., day by day. These records will be found inspiring and useful for the next iron campaign.

With regard to repairs to irons on circuit, charges for these should be kept to a minimum. The most frequent trouble is the flexible getting dragged out of the connecting terminals; anyone can fix this up with a penknife, for cutting back, and a bradawl. A good impression is created if no charge is made on such occasions. Another trouble is the deterioration of the flex; this is largely caused through winding it round the iron when the latter is hot, and so destroying the insulation. A few points such as these might be impressed upon the customer after the purchase has been made; it will obviate much future bother.

The B.A. Meeting at Manchester.—The *Times* states that it has been decided that the annual meeting of the British Association shall take place at Manchester, as arranged, in September next. The meeting will be restricted to its more scientific functions, and there will not be the usual elaborate local hospitality, in the form of social and other arrangements.

LEGAL.

BRITISH INSULATED AND HELSBY CABLES, LTD., v. CRITTALL MANUFACTURING CO., LTD.

(Continued from page 351.)

FURTHER evidence for the defence was given when the hearing was resumed on March 9th.

MR. A. W. READ, an electrical engineer and one of the defendants' representatives, gave evidence as to the testing of the machine at the plaintiffs' works after which, he said, it was sent back to Braintree, where it was installed with the generator under his supervision, and it was arranged that the clamps should be re-designed for a section for small frames.

By the REFEREE: The clamp arrangement was new to him at that time, as he had then had no experience. Electrical engineers were not as a rule thoroughly conversant with electric welding.

Examination continued: Subsequently Mr. Bucher, the plaintiffs' representative, made tests extending over two days, and on that occasion he (witness) suggested that the machine might have been inaccurately erected, but he (Mr. Bucher) said he was satisfied that it was properly and well erected. Mr. Bucher tried to make several welds on that occasion, using the clamp which had been made by the defendants, but he met with very indifferent success. He made a number of changes and adjustments in both the clamps and the machine, and, after two days' experimenting, he said that the machine, in its then state, would not enable him to make the tests, and that he was returning to make the gauges and stops necessary. It was arranged that he should do this, and he subsequently paid a second visit. But when he tried to make the welds there was the same indifference which was found in the first test. The only marked improvement was that the clamps were put nearer to the ends of the section. Taking the welds as a whole, they were absolutely unreliable, and blowholes were much in evidence.

On March 10th further evidence was given for the defence.

MR. F. H. CRITTALL, a member of the defendant company, described in detail the materials used for the experiments with the plaintiffs' machines, and the manner in which the claims for work done in connection with those experiments were made up. He said that the firm strained every nerve to get the machine to work, as they particularly wanted it.

MR. VALENTINE GEO. CRITTALL, general manager of the defendant company, said that they had been welding by the oxy-acetylene process, which was the best process they had been able to get up to now, and they worked upon the same material as that for which they wanted the electrical machine. Their reason for desiring to make a change was that their oxygen bill was looking big. They desired to try electricity owing to the cost of oxygen, and the fact that the gas process called for certain skill on the part of the operator. It was also understood that by using electricity they would be able to get an increased output. When Mr. Harrison visited the works in 1911, witness took him over the building and showed him what the business was. The material which Mr. Harrison saw at that time was rolled metal, practically identical with that which they asked the plaintiffs to provide a machine to weld.

MR. WM. CRAWTER, electrical engineer and director of the defendant company, who was formerly manager of the defendants' works, gave evidence as to the discussions with Mr. Harrison, which led to the plaintiffs undertaking to make the welding machine. The question of the desirability of using electricity in the place of gas for welding frames was first raised by him. In 1911, he said, he had more than one conversation with Mr. Harrison, who was employed by the plaintiffs, as to the possibility of his company being able to supply machines for the purpose of welding casement frames electrically, and Mr. Harrison said that it would be possible as they had already made a welder for printers' chases, for which a great degree of accuracy was required. It was arranged that samples of the company's material should be sent for welding at the corners. Subsequently the machine was ordered. At first English material was sent for trial, and subsequently German material was supplied, which was better as regards accuracy, and upon that they worked; but the results were not satisfactory. He looked upon the plaintiffs as experts in that particular kind of work, and relied upon their skill and knowledge. The defendants were really anxious to get the machine, and there was no foundation for the assertion that they desired to get rid of it.

A discussion then took place on the application of plaintiffs' counsel that the Referee should visit the works and order experiments to be carried out in his presence.

MR. GREER, K.C., contended that the Referee had the power to make such an order under Order 50, Rule 4, which said that it should be lawful for any Judge to inspect any property or thing concerning which any question might arise. The Official Referee was brought within that rule. He agreed that the order did not say that experiments might be ordered, but he contended that it was implied. He did not wish the Referee to inspect the machine merely to see what it was like, but he desired that a trial should be ordered to take place in his presence in order that he might see how the machine did its work.

The REFEREE: Does the defendant object?

MR. COLAM, K.C.: I do.

The REFEREE said that under the circumstances he would not make an order, but as the matter was of some importance he thought he ought to state his reasons for declining. In the first place, it was a matter of judicial discretion to be exercised according to settled principles. Undoubtedly the power existed under which he could order experiments to be made, but it was a matter of judicial discretion to say whether it should be done or not. The opinion, or what he might call the verdict of the Judge, must not be given as a consequence of his views as to the results of inspection or experimenting, which were only for the purpose of enabling him to understand and apply the evidence. In this case he did not think, after having heard the evidence, that an inspection was necessary. It appeared to him that he could not be guided rightly, in arriving at a decision, by the results of any experiments which he might see. He therefore proposed, subject to the convenience of the parties, that further evidence should be called if necessary.

Mr. Colam said that if experiments were desired they ought to have been made months ago, and if further expert evidence was to be called he ought to be allowed a little time to call expert witnesses in reply. Of course if the plaintiffs were going to call experts he wanted to know what they were going to say.

The Referee: If you talk much more about it I shall have to alter my decision and go down.

Mr. Walter Francis Crittall, one of the directors of the defendant company, then gave evidence as to a test which was made in his presence after certain alterations had been made in the machine. Those experiments, he said, consisted of making six welds with short pieces of metal, but he did not regard any of them as satisfactory.

The hearing was then adjourned until Monday, March 15th.

Tungsten Drawn Wire.—Licence Refused.

Mr. Justice Warrington, in the Chancery Division, delivered his reserved judgment in this case, reported in preceding issues. His Lordship said he believed this was the first petition under the Section to come before the Court. Sec. 24 provided that any person interested might present a petition to the Board of Trade praying for the grant of a compulsory licence, or, in the alternative, for the revocation of a patent. The Board would consider the petition, and if the parties did not come to an arrangement between themselves the Board, if satisfied that a *primâ facie* case had been made out, would refer the petition to the Court, and if the Board were not so satisfied they might dismiss the petition. If it was proved to the satisfaction of the Court that the reasonable requirements of the public with reference to the patented invention had not been satisfied, the patentee might be ordered by the Court to grant a licence on such terms as the Court might think just. It seemed to him that in order to establish a case within the Section, the petitioner must prove not only default towards himself but towards the public generally. The expression, "trade or industry," seemed to him to be used in a wide sense, as in the case of the expression "woollen trade," or "cotton trade," and the use of the expression "trade or industry" in the petition was not enough to establish that a particular trade was unfairly prejudiced. It must be proved that the trade or industry as a whole was affected. The establishment of a new trade or industry was a different thing altogether from the entry of a particular person into an existing trade or industry. If the default towards the public was established, the Section conferred two alternative rights:—First, the right of the individual to present a petition to have a licence granted to himself; and, secondly, the right of the public to be relieved from the effects of the patentee's monopoly by the revocation of the patent. His Lordship had to determine whether on the facts of the present case the petitioners had established that the reasonable requirements of the public were "to be deemed not to have been satisfied." The two respondent companies, together with the General Electric Co., Ltd., had pooled their patents, and thus controlled, to a large extent, the industry connected with electric incandescent lamps. To prevent the cutting of prices, they required from dealers and licensees that they should not sell below certain list prices. The firms and companies controlling the sale of the lamps were known as the Tungsten Lamp Association, and the result of their action was that the price of the lamps was considerably higher in this country than abroad. There was, however, no evidence that the price was so high as to be a serious burden on the consumer, or to be unreasonable, and the fact was that in the last two or three years the price had been considerably reduced, while the supply of lamps was quite adequate to meet the demands of the public. The petition was founded on the allegation that drawn tungsten wire was a patented article, and that the patentees had failed to supply this to the petitioners, or to grant a licence on reasonable terms, and that the establishment of what the petitioners called a new trade or industry in the making of their lamps had been unfairly prejudiced. It had been shown on the petitioners' own evidence that there was no trade or industry with which drawn tungsten wire was connected except the making of electric lamps, and there was no demand for the wire except in that connection. The petitioners had not proved that the respondents had been guilty of the default indicated by the Act, namely, in the matter of supply for the only purpose—that was filaments in lamps—for which the wire was required, or that the needs of the public were not amply satisfied in this respect. Nor had they proved as regarded the licence any default except in reference to themselves. It was common ground that licences had been granted, and no attempt had been made to show that the terms were unreasonable. In his opinion, the trade or industry to be considered was that of the making of tungsten electric lamps, and this would be nothing more than the entry of a fresh trader into an existing trade or industry. There was no ground for suggesting that this trade or industry had been unfairly prejudiced by the respondents. On the petitioners' own evidence, therefore, he had come to the conclusion that they had failed to establish the case required by the Act, and he must dismiss the petition with costs.

Council appearing in the case were: For the petitioners, Mr. Bousfield, K.C., Mr. Cave, K.C., M.P., and Mr. R. Frost; for the British Thomson-Houston Co., Mr. A. J. Walter, K.C., Mr. J. H. Gray, and Mr. Lunge; for Siemens Bros. & Co., Mr. Colefax and Mr. Hume.

Solicitors for the petitioners, Messrs. Ashurst, Morris, Crisp and Co.; for the respondents, Bristows, Cooke and Carpmæl.

Newcastle-on-Tyne Electric Supply Co. Summoned.

At Newcastle-on-Tyne Police Court on 12th inst., the Newcastle-on-Tyne Electric Supply Co., Ltd., were summoned on the information of Andrew Gemmell, of Castle Nook, Ovingham-on-Tyne, "that they on August 23rd, 1914, being the undertakers within the meaning of the Electric Lighting Act, 1882, did unlawfully make default in complying with the provisions of the Act and of the Electric Lighting (Clauses) Act, 1899, by not selling to the complainant a copy of the annual statement of accounts of their undertaking, made up to December 31st, 1912, the complainant having paid the sum legally demanded for the same; and in such default continued until the date of the laying of the information."

Mr. Charlesworth, for the prosecution, said that Mr. Gemmell was a gentleman interested in electrical business, and he made an application on July 8th, 1914, for a copy of the accounts of the Company, and he also wanted a copy of the auditor's report. Mr. Charlesworth said the accounts in question referred to the year 1912, and were audited in July, 1913, and he maintained that whether the application were made to the Board of Trade or not, the defendants were bound under the section to supply a full copy of the report unless the Board of Trade directed otherwise.

Andrew Gemmell said he made application for a copy of the accounts, with the Board of Trade auditor's report, and sent the statutory fee of 1s. He claimed that if the Board of Trade did not direct to the contrary, he should have had a full copy of the auditor's report.

Witness, in reply to Mr. Burton (who appeared for the company), said that he received a copy of the auditor's report on March 3rd last, but he was not satisfied, because it was two years after the period referred to.

The Clerk (to Mr. Burton): Is it your contention that you are not bound to supply the report of the auditor in the absence of any direction from the Board of Trade?

Mr. Burton: That is my argument. The point was raised by the same gentleman in a prosecution about four years ago, and decided against Mr. Gemmell.

Matthew Short, secretary of the defendant company, produced the Board of Trade report, which he said he received last week. The report was sent in July last year, with a request for observations thereon. The letter of March was the first authorising him to publish the report.

In cross-examination, Mr. Short said they looked upon the auditor's report as a confidential document.

Mr. Burton said the company's view coincided with what they had heard from the Board of Trade. This was a Board of Trade document, and was in the nature of a confidential document and could not be published without the authority of the Board. It was, therefore, necessary that the permission of the Board of Trade be obtained before the company could publish the whole or any part of the report. The company did not get that direction until a week ago—or after the summons was issued. The delay was due probably to the war. At August 23rd the matter was *sub judice*, and it would have been highly improper for them to have supplied Mr. Gemmell with a copy of the report.

The Chairman (Sir Joseph Baxter Ellis) said that the Bench were of opinion that the company had not discharged the whole of their statutory obligations. They thought, however, that there had been many difficulties to deal with, and under the circumstances the magistrates considered the case would be met by dismissing the summons on the payment of costs.

City of London Electric Lighting Co., Ltd., *v.* Bennett.

In the City of London Court on Tuesday, before his Honour Judge Rentoul, K.C., this case was heard, in which the plaintiff company sought to have the defendant, Mr. E. G. Bennett, Ludgate Arcade, committed for the non-payment of £7 7s. 1d. for electric current supplied.

Defendant said he did not think the plaintiffs were going to press for his committal as they were doing, or he would never have used their electric supply. He had lost his all, and after trading for 47 years he thought it rather hard that he should be sent to prison because he could not pay his electric lighting account.

Judge Rentoul ordered payment of 2s. 6d. per month.

R. L. Jones & Co., *v.* Orpheum, Ltd.

Judgment in this case, which was partly reported in our last issue, was given on Tuesday. We shall report the proceedings in our next issue, but may state that judgment was given for the plaintiffs for £136 11s. 10d., the £96 11s. 10d. paid into Court under Order 14 to be paid out in part satisfaction of the judgment.

Herbert Morris, Ltd., v. Saxelby.

This case came before the Master of the Rolls, Lord Justice Phillimore, and Mr. Justice Joyce, upon the appeal of the plaintiff company, who are manufacturers of pulley blocks, overhead runways, electric overhead runways, &c., at Loughborough, from a judgment of Mr. Justice Sargant, in the Chancery Division. The facts were reported in our issue of November 6th, 1914, page 618.

Sir R. Finlay, K.C., Mr. A. J. Walter, K.C., and Mr. Kerly, K.C., appeared in support of the appeal; and Mr. Mark Romer, K.C., and Mr. Sheldon for the respondent.

Sir R. Finlay contended that, in the circumstances, having regard to the nature of the plaintiffs' business, the covenant in question was not too wide for the plaintiffs' protection, and could not, and ought not, to be construed as in restraint of trade.

Mr. Romer contended that the decision of Mr. Justice Sargant was right, and that the covenant was too wide, and therefore invalid. He agreed that, speaking generally, every employer was entitled to have a covenant which would prevent his employé disclosing trade secrets, with proper limitations of time and space; but he submitted an employer was not entitled to a covenant which would prevent the employé from using the skill and business training which he had gathered in the course of his employment.

At the conclusion of the arguments of counsel, their Lordships reserved judgment.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Country House Lighting Sets.

The generating plant illustrated in fig. 1 comprises a Vickers 6-KW. 800-R.P.M. 100-148-volt, 59-41-ampere dynamo, coupled up to a 10-H.P. Belliss engine, installed at Ampton Hall, and used for lighting and power purposes. Current is supplied for 250 lights in the residence, ranging from 10 C.P. to 50 C.P., the storage battery being of 300 ampere-hours capacity.

On the power side current is taken by a Vickers 2-H.P. motor to drive a pump in connection with the house water supply, and in the garage repair works a Vickers 2-H.P. motor is installed for driving, by means of shafting, a number of machines, including a lathe, grinder, &c.

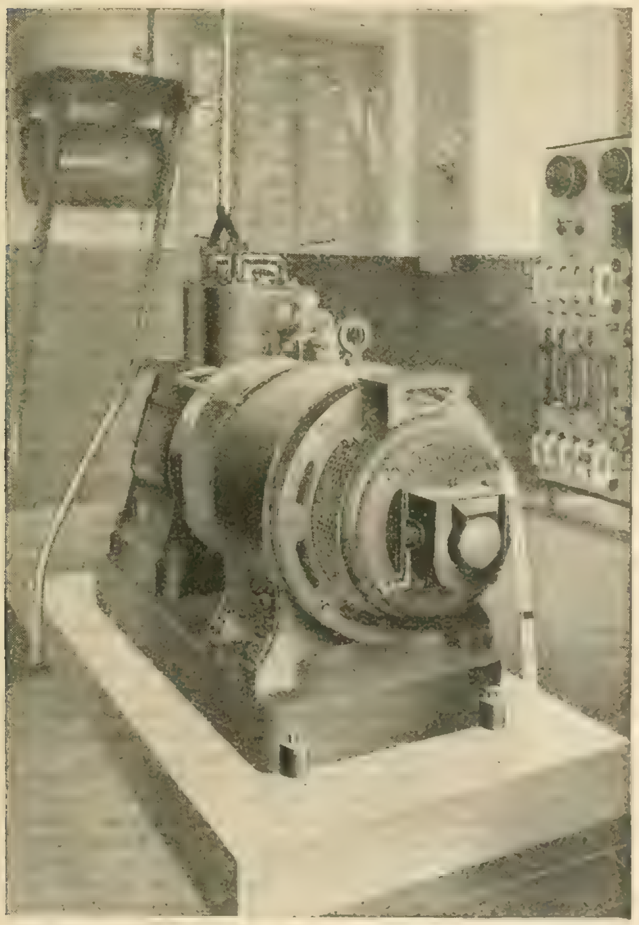


Fig. 1.—Vickers-Belliss Country House Lighting Set.

The entire installation work was carried out by Messrs. Mann, Egerton & Co., Ltd., under the supervision of Mr. W. C. Hawtayne.

Anti-Aircraft Searchlight.

Amongst other types of searchlights, the London Electric Firm, of George Street, Croydon, are at present turning out a new pattern for anti-aircraft and similar purposes, arranged to work at an elevation of as much as 90° (fig. 2). The machine is 24 in. in diameter with silvered parabolic mirrors, and revolves on ball bearings, a geared quadrant with a brake being provided for elevation; and the design eliminates the twisting of the connecting cables. The machines are arranged to work through resistances on 80 volts or higher pressures. The new lamp has the feature of combined auto and hand feed, allowing of adjustment of the carbons whilst still working automatic without any changeover whatever.

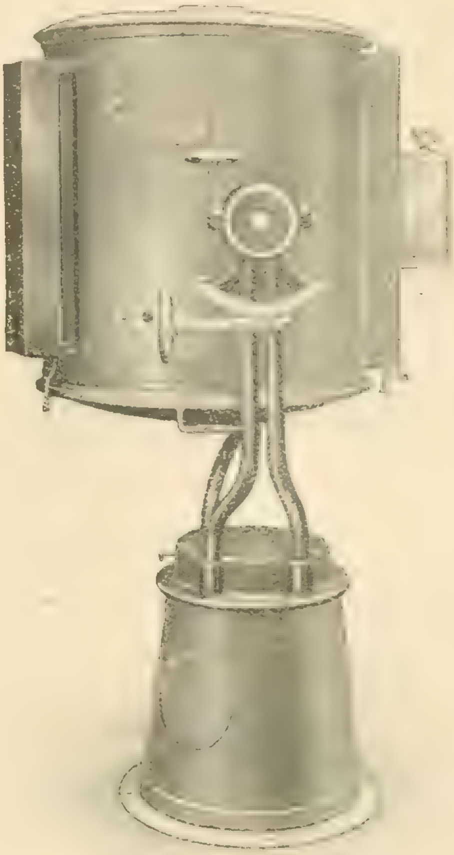


Fig. 2.—Anti-Aircraft Projector.

New Pattern "Tucker" Ironclad Switches.

Messrs. J. H. Tucker & Co., of Birmingham, have recently placed on the market a new pattern of ironclad switch intended primarily for conditions where a first-class job is necessary, and price is a vital question.

A usual feature in low-priced ironclad switches hitherto has been the "slot" in the centre of cover. The disadvantages of such "slot" are obvious, not the least being the difficulty of "earthing" the handle. A strong feature in favour of the "slotted" cover switch has been its price, that of the solid cover "side handle" type being generally prohibitive in comparison.

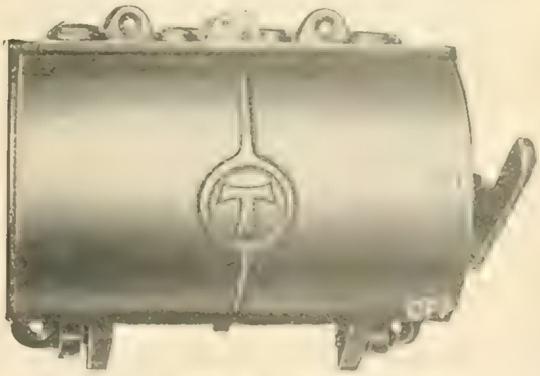


Fig. 3.—Tucker Ironclad Switch.

In the new line Messrs. Tucker are combining advantages of both these patterns by (*a*) doing away with the "slot" in the cover, which is solid; the D.P. have "side," the T.P. "Stirrup" handles; (*b*) the handle is in permanent and certain contact with the case for "earthing" purposes; and (*c*) they are making arrangements for the production of these switches in large quantities, so that they will cost no more than the "slotted" cover type, which they will displace.

Each pole is mounted on a separate vitreous china base; the cover is "interlocked" with the handle, and the position of the switch is indicated on the cover.

In accordance with their standard practice every switch case is fitted with substantial earthing terminal, and enamelled and "stoved" to a hard high-class finish. The 30 and 50-ampere sizes in both D.P. and T.P. types are now available.

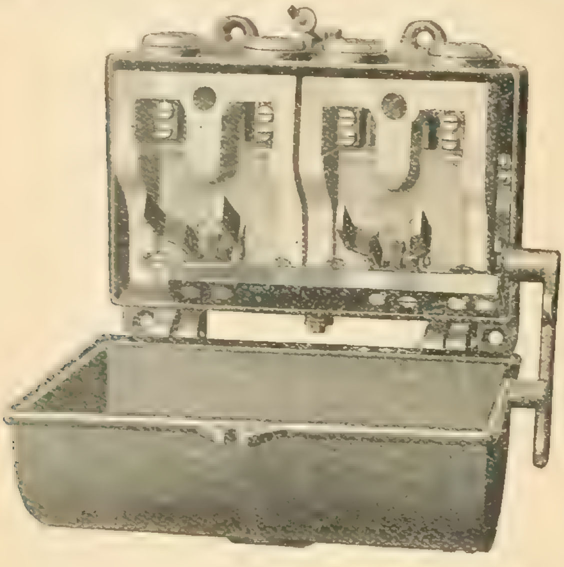


Fig. 1.—Interior of Tucker Ironclad Switch.

Railway Construction Lighting Plant.

Electric light played an important part in the construction of the Prieska-Upington Railway, in South Africa, 142 miles of track being laid in record time, and at the average rate of 2¼ miles per day. The maximum mileage completed in any one day was 3¼ miles. After the work was properly set going, it was carried on day and night, an up-to-date electric light generating plant (see illustration) enabling operations to proceed after sundown. The speedy construction of the line was considered necessary in order to facilitate the movement of troops towards the German South-West border, and to admit of assistance being rendered in the field with the greater promptitude which rail communication would afford. The line was built departmentally by the South African Railway Administration, under the supervision of Mr. N. K. Prettejohn, resident engineer.

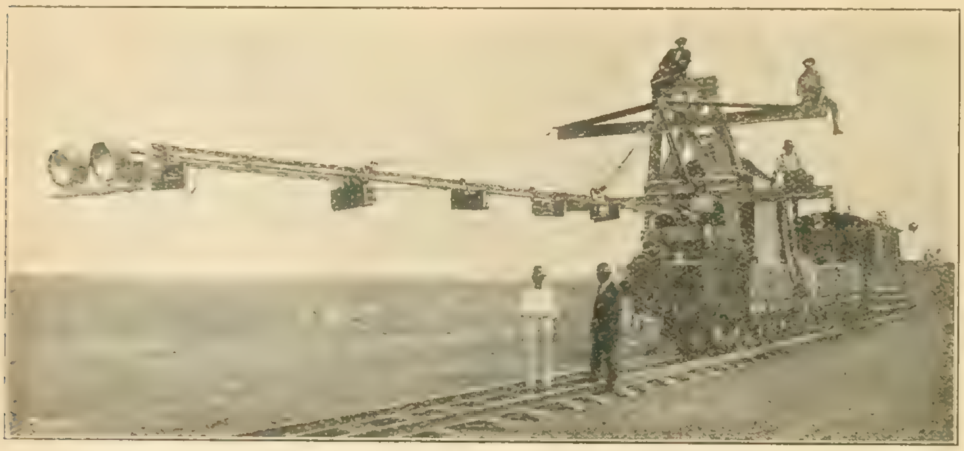


Fig. 5.—Electric Lighting Plant for Urgent Railway Construction.

BUSINESS NOTES.

Consular Notes.—CANADA.—The American Consul at Cornwall (Canada), in a recent report, states that the 45-mile transmission cable to carry 85,000 H.P. of electrical energy from Cedar Rapids in the St. Lawrence River past Cornwall to Massena (U.S.A.) is now in operation. During the first week of January of this year the current was flashed for the first time along the entire length of the cables. There are six of these cables (two circuits) each cable being aluminium one inch in diameter on a steel core. It is stated that the additional electric power is being used by the aluminium plant at Massena to operate a large increase recently made in this plant in building and equipment. Some of the power is serving for the reduction of the ore in the pot-room of the aluminium works. Cornwall's industries can have the privilege of tapping this transmission line of electric power at a reasonable rate. It is said, however, that it would be necessary to erect a sub-station at Cornwall, costing at least £10,000, before such tapping could be effected.

CHINA.—According to the American Consul at Chungking, there are great potential possibilities for electrical development in Szechuan Province; many of its cities have excellent water powers close at hand, the cost of kerosine and other illuminants is very high, and in numbers its population exceeds that of any other Province. Szechuan is also very wealthy, and sooner or later there is sure to be an era of vast commercial development. Large industrial projects are under consideration, and electrical equipment of all kinds will some day enjoy a very large sale. Owing to the unsettled conditions in China and the war in Europe the trade of the province is at present becoming very slack; adverse exchange and increased prices of foreign articles have caused imports to dwindle. Chinese capitalists, too, have grown timid and hesitate to invest in industrial undertakings. A few years ago the installation of an electric light plant in the city of Tzechow seemed assured; part of the capital had been subscribed, and negotiations had been opened for the appointment of an American electrical engineer. The Revolution in 1911, and the local insurrection of 1913, however, caused those interested to abandon the idea. Recently an influential resident of Tzechow, when requested to give his opinion as to the present and future demand for machinery, stated that at present there was no demand, but there was talk of electric light plants for the city and pumps for the coal mines. The promoters of these schemes do not seem to have got beyond the "talk" stage, but the situation at Tzechow is more encouraging than in other parts of the Province. What the Chinese need most at the present time is money. There are many industrial enterprises which would prove highly profitable, but there is no way to finance them. The Chinese are anxious to develop the country, and many towns would install telephones and electric lighting plants if sufficient money could be obtained. The sale of electrical machinery should, in many cases, be accompanied by a loan, and the companies which adopt this method will very likely secure the bulk of the trade. There is a possible market in the Province for the sale of small lighting plants for theatres and other large buildings. Many private users of current find it advantageous to maintain their own lighting sets; the American Methodist Mission in Chungking has done this successfully for several years, and the Canadian Methodist Mission at Chengtu is negotiating for a private plant.

In a report just issued, the American Consul at Shanghai states that at the present time there is practically no hydro-electric power development in China. Such electrical plants as have been installed in the country are driven almost entirely by steam. The immense delta plains of the Yangtze and Yellow Rivers are not, in a general sense, suitable for hydro-electric plants, but in Fukien, Yunnan, and parts of Shantung Provinces, as well as the Yangtze gorges, power stations of this type may ultimately be installed. While it may be stated broadly that no hydro-electric plants are in operation in China, stations for supplying current to the cities of Yunnanfor and Changtu have been partially arranged for through negotiations taken up by Germans with the Chinese Government. Inquiries made through German sources, however, fail to disclose any pertinent details regarding this undertaking. In other instances, native Chinese companies in connection with Chinese Chambers of Commerce have agitated for the development of waterpowers, and have endeavoured to arrange with the Chinese provincial authorities for permission to build such plants. As a general rule, however, the Chinese have not been successful in organising companies with such a degree of financial backing and standing as would warrant provincial or central governmental support, which support in time would enable foreign engineering firms to enter into contracts for supplying materials and installing plants.

INDIA.—In a recent report the American Consul at Rangoon states that electrical development in Burma is in its infancy. Outside of Rangoon and Mandalay there are no electric plants, except a small lighting set in the oil fields at Yenangyoung operated by the Burma Oil Co. There are practically no privately owned isolated plants in Burma, due probably to the high cost of erection and the very small population able to afford electric light and power. At present kerosene is the almost universal medium of lighting, the poorer natives using Burma oil and the European and wealthy natives American kerosene. While there is no doubt that eventually electrical plants will be erected in the more important towns of Burma little development can be expected in the present distressed condition of trade.

The only electrical plant in Rangoon is operated by the Rangoon Electric Tramways and Supply Co., which has 3,000 residence connections. Its rates are 7d. per British Board of Trade unit for lighting, 6d. per unit for combined lighting and power for fans, and 3½d. per unit for power. To Government railways and other large consumers special rates are given, which average 3d. per unit. This company also deals in electrical supplies of all kinds, The Burma Electric Tramways and Lighting Co., Mandalay, has 150 residence connections; rates for lighting are 8d. for the first 30 units per month, and 7d. for the next 170 units. Electric fans, both ceiling and wall, are coming into more general use, and are replacing the hand-operated Indian punkahs. Nearly all offices in Rangoon are now equipped with electric fans; also clubs, places of amusement, churches, and the residences of the European community. Practically the only competitor of the United States in this market, in the sale of electrical supplies, is Great Britain, which furnishes four times as much as does America. It is suggested that American manufacturers should be able to supply large quantities of lamps, cooking and heating apparatus, torches, motors, generators, &c.

SIAM.—The American Vice-Consul at Bangkok reports that the Siam Electricity Co., Ltd., had until recently the only light and power plant in Siam, and for 1913 showed gross earnings of about £100,000. The Bangkok municipal power station began operation in the early part of 1914. Both of these stations use three-phase 50-cycle current. The telegraph and telephone systems are operated by the Government.

"Electrical materials and apparatus are not manufactured in Siam, hence materials for renewals and extensions of all electrical enterprises, electric street railway equipment, lighting fixtures, telephone apparatus, cables, insulators, electric motors, fans, batteries, bells, cooking utensils, sadirons, and a variety of similar goods, should be in demand. The possibilities of extending American trade in electrical materials and apparatus might be enhanced by arranging for an exhibit of such goods in Bangkok; also by American firms entering into correspondence with local consumers as to their requirements, by submitting price lists, and by appointing local agents. Agents should be supplied with samples of materials and prices for supplies needed by the Government telegraphs, telephones, and power station, as all such goods are bought through public tenders, and the time allowed is frequently not sufficient to permit bids to be submitted from American firms direct."

Bankruptcy Proceedings.—STUART ALFRED CURZON' described as an electrical and motor engineer, of 175-6, Piccadilly, W., and late of Victoria Street, Westminster, S.W.—The first meeting of creditors was held on March 9th, at the London Bankruptcy Court, under a receiving order. Mr. E. Leadam Hough, senior Official Receiver, reported that it appeared from the debtor's statements that he commenced business in August, 1912, and had the sole right to sell the obsolete motor vehicles of the London General Omnibus Co., Ltd. He sold that business in August, 1914, to the General Omnibus Supply, Ltd., which he had assisted to promote in April, 1912, and which was a syndicate to promote motor-omnibus companies. It had a nominal capital of £10 000, subsequently increased to £55,000. The syndicate promoted Greater Omnibus Services, Ltd., with a nominal capital of £100,000, and the debtor became joint managing director at a salary of £750 per annum. In May, 1914, that Company was amalgamated with the London Premier Omnibus Co., Ltd., and the debtor held a similar position in that company. In March, 1913, the debtor became interested in the General Motor Services of Russia, Ltd., which was formed to take up what was represented to be the sole concession for the running of omnibuses in the Crimea. He put between £3,000 and £4,000 of his own money into the company, and became managing director. He went to Russia to look into the matter, and found that the concession possessed no value, and that a considerable amount of debts had been incurred there by the company. In consequence of that information he dropped the whole business, and the company had now ceased to exist. In May, 1914, the debtor promoted Stuart A. Curzon (Russia), Ltd., with a nominal capital of £50,000 to take up the running of motor-omnibuses in the Crimea in continuation of the work done by the General Motor Services of Russia, Ltd., but, owing to the war, things were at a standstill. It was his intention, however, as soon as the war was over, to carry the business through. A statement of affairs had been lodged showing liabilities £8,600 against assets valued at £10.065. The debtor, therefore did not admit insolvency, and he attributed his present position to the war, in consequence of which his Russian operations came to an end, and his English business had practically ceased. The failure was further explained by the debtor's inability to recover moneys due to him. In the absence of any offer, Mr. R. F. W. Fincham, chartered accountant (Fincham, Partridge & Co.), was elected trustee to wind up the estate in bankruptcy, assisted by a committee of inspection.

J. G. M. HILTON, electrical engineer, Birmingham.—A second and final dividend of 2s. 2¼d. in the £ was payable of March 3rd at the Official Receiver's office, 191, Corporation Street, Birmingham.

JAMES WILLIAM & TOM WHITAKER TATTERSALL, trading as "Tattersall & Tattersall," electrical engineers, 9, Regent Street, W., and Kimberley Road, Willesden Lane, N.W.—A sitting of the London Bankruptcy Court was held on Tuesday, before Mr. Registrar Linklater, for this public examination. The statement of affairs showed liabilities £3,760, and assets valued at £481. In the course of their evidence the debtors stated that in August, 1912, with about £150 capital, equally subscribed, they commenced trading in partnership as motor engineers at 9, Regent Street, their business consisting of the purchase and sale of carburetters. They invented a patent electric lighting and starting equipment for motors cars, and took out patents in Great Britain, France, and Italy. The premises at Kimberley Road were taken in November, 1913, for the purpose of manufacturing the electric starters, and, according to their calculations, they were going to make a profit of £10,000 per annum. Their output before the war was about 40 a month, but since August the trading had practically ceased. At the commencement of the war they placed their position before their principal creditors, who stated that they would not require payment of their accounts for six months, and in some cases advanced moneys for the payment of wages. In January last they again consulted their principal creditors with a view to appointing a trustee, but, the negotiations falling through, they filed their petition in February. The debtors attributed their failure and insolvency entirely to the war. The examination was concluded.

GEORGE JOHN TOM JELLEY PARFITT, 11, Priory Road, Keynsham, consulting electrical engineer.—A meeting of creditors was held at Bristol on 10th inst. The statement, according to the *Western Daily Press*, showed liabilities £4.482, of which £2,026 will prove for dividend. The assets included 50 £1 ordinary shares in the Revenge Syndicate, 250 £1 ordinary shares, Bristol International Exhibition, Ltd., £710 in debentures of that undertaking, and 1,000 preference and ordinary shares in the Keynsham Electric Light and Power Co., Ltd. The causes of failure were stated to be "losses for goods supplied to and through guarantees given for the Bristol International Exhibition, Ltd., which went into liquidation, and loss of business caused by the war." The Official Receiver said he did not see any likelihood of getting a dividend for the creditors. The Official Receiver remains trustee.

Private Arrangements.—A. J. GAGE & P. V. FRIGHT (trading as Pattersons), electrical engineers, 26. Hawley Street, Margate.—The creditors interested herein were called together on 11th inst. at Margate, when a statement of affairs was presented which had been prepared by Mr. J. W. Scarlett, accountant, showing the position as at March 4th last. The statement showed liabilities of £411, of which £218 was due to trade creditors, and £193 to a cash creditor. The assets were estimated to realise £210, from which had to be deducted £16 for preferential claims, leaving net assets of £195, or a deficiency of £216. In answer to questions it was stated that there was no surplus arising from the private estates of the partners. The cash creditor shown on the statement was Mrs. Fright. After a short discussion it was decided to confirm the deed of assignment already executed to Mr. Scarlett, under which it was stated that the estate would be realised. The following are creditors:—

Veritys, Ltd.	£85
Turner, G. H., & Co.	22
Sanitas Electric Co.	15
Metallic Seamless Tube Co.	[illegible]
Fright, Mrs.	193

Catalogues and Lists.—MESSRS. L. ANDREW & CO., 2, Whitworth Street West, Deangate, Manchester.—Wholesale price leaflet of india-rubber gloves and gauntlets.

MR. CHAS. H. BLUME, White Buildings, Fitzalan Square, Sheffield.—Descriptive leaflet concerning "Radiolac" heat-radiating insulating enamel, a heavier-bodied medium than the usual insulating varnishes, for the impregnation of electrical windings and similar purposes. "Radiolac" is being manufactured at the firm's works at Mitcham, Surrey.

MESSRS. BELCO, LTD., Windsor House, Kingsway, London, W.C.—Illustrated priced leaflets relating to "one part" holders, "Dim-a-lite" turn-down switches, weatherproof "Half-watt" lanterns, and semi-indirect lighting fittings for one-watt and half-watt lamps.

MESSRS. MARPLES & LEACH, 26-30, Artillery Lane, London, E.C.—March stock list of new K. & M. type C.C. and A.C. motors, a considerable number of which, ranging from ¼ H.P. to 30 H.P., are held in stock, or on order for stock. Copies of the firm's monthly stock lists will be sent to any address regularly on application.

MESSRS. DAVID BROWN & SONS (HUDDERSFIELD), LTD., Huddersfield.—136-page illustrated catalogue, giving very exhaustive information respecting their double helical gear and its application as a speed reducer. The D.B.S. process and the manufacture of the gearing are described in detail, and many pages are occupied with useful engineering tables and formulæ.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, E.C., have issued their Osram lamp semaphore code advertisement, which appeared in our last issue and attracted a good deal of attention, in the form of a postcard. Numbers of these can be obtained over-printed with the names and addresses of electrical contractors, dealers, and others interested in the sale of the lamps, by making immediate application. The reverse side of the postcard is an order form. The advertisement forms a novel and ingenious piece of electrical publicity work, and should be very telling.

MR. O. N. BECK, 11, Queen Victoria Street, London, E.C.—Folder illustrating the "Simpl." boring tools made by the Allen and Curtiss Co., of America.

INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., Silvertown, E.—32-page illustrated catalogue (No. 37), giving general specification and conveniently-arranged tables of weights, dimensions, prices and code-words relating to Silvertown dynamos from 75 watts to 66 KW., and motors from ·22 B.H.P. up to 90 H.P.

Advances in Prices.—THE ELECTRIC AND [illegible] ACCESSORIES CO., LTD., announce that, owing to the present situation, and the consequent increase in cost of raw materials and labour, it has been found necessary to advance their prices for motors and dynamos by 5 per cent. Outstanding quotations are subject to immediate acceptance, and the company cannot, in any case, accept orders at the old prices except where such are based on quotations made within a period not exceeding 30 days prior to the placing of the order

THE INDIA RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., of Silvertown, E., announce that in consequence of the increased cost of manufacture, due to the prevailing conditions, they are compelled to advance their prices of rubber-insulated cables, wires, and flexible cords by 5 per cent., as from March 13th

Book Notices.—*Business Prospects in Russia.* By A. T. Stewart. London: Francis Hodgson. 4d. net.—The author of this pamphlet, according to the preface, was in Russia last year, and while he somewhat discounts the value of his views and figures, he advances them in the hope that they may pave the way for fuller and independent investigation by the reader. The trading power of Russia, the effects of the war upon Russian imports and exports, the controlling influence of German enterprise and German capital, are considered, and statistics are given. The author holds that numerous opportunities for British trade have been lost by reason of our unscientific organisation and apathy, but considers it inopportune to harp upon that subject, and proceeds to discuss the difficult question "What is to be done?" He urges British manufacturers not to wait, but to strike at once. After seven or eight months' war, he says that numerous preliminaries and investigations should be made now. That is what we said many months ago. Surely it is rather late in the day to give such advice. The writer, apparently against his will, is led into considering defects in our own trade policy in comparison with German, and he goes on to write of the need of direct trading by means of proper and effective direct representation, and the necessity for co-operative action amongst our manufacturers. A great variety of other points are touched upon, but all with great brevity, such as the need for revising our credit system, the question of trading licences, joint stock companies, the importance of Russian fairs, the defects in our Consular service (in Petrograd, he says, we had a Consular staff of four at the outbreak of war, costing £1,820 per annum, and Germany had a staff of 17, costing £10,000). There is a brief chapter on engineering trade, and the well-organised German competition in the electrical branch is passingly referred to. The writer says that we must send out energetic men to advertise and create a demand for our products, and samples and models must be exhibited, and catalogues prepared in the language, currency, and measurements of Russia.

"The Theory of Alternating Currents." Vol. I. By A. Russell. London: Cambridge University Press. Price 15s. net.

"Norgé Vinterbilleder" is the name of a book of large collotype views of Norway in winter, which we have received from Messrs. James McMillan & Co., London. An article by Robert Millar, in four languages, describes the attractions of Norway as a winter holiday ground, and the beautiful illustrations bear out his claims. At another time, and under different circumstances, the delights of Norway might well entice one northwards, but during the war the face of every British sportsman will be turned to the east, and the pursuit of pleasure will be unthinkable.

"*Journal* of the Institution of Electrical Engineers." Vol. LIII. No. 244. March 15th, 1915. Price 3s. 6d. This issue contains papers on "Electricity Applied to Mining," by C. P. Sparks; and "Polyphase Commutator Machines and their Application," by N. Shuttleworth.

Russian Electrical Trade.—M. A. A. Kuznetzoff, Professor of the Electrotechnical Institute, has made a report on the relation of the tariffs on raw and finished products of the industry. He shows, with the aid of statistics, that at present the imports of finished electrotechnical goods are less than those made in the country, particularly in connection with apparatus and accessories required for telegraphs and telephones. This is explained by the tariffs being higher for finished goods than for the raw materials. He says that the famous Russian Siemens & Halske Co., founded with German capital, and managed by Germans, being hitherto without competitors in Russia, made Morse telegraphic apparatus at £69 each, whereas now this apparatus can be had from Russian factories at £13. This is how the Germans made money out of the Russian Government. The position with regard to the production of dynamos, motors, measuring apparatus and electric lamps, has become very unsatisfactory, but it is expected that it will soon improve, and that Russia not long hence will not require to import these goods from the "cultured" Germans. He says, further, that it is not enough to raise the tariffs in order to ensure the development of the electrotechnical industry in Russia; it must be carried on with Russian money, and by Russians. Further facilities for credit must be given, and geological research must be stimulated for the discovery of such necessary metals as tungsten and thorium. He observes that in Russia, in Transbaikal, there are deposits of thorium, and in Eastern Siberia of wolfram, but neither is exploited. Both metals were imported from Germany.

Aluminium Production in France.—The municipal authorities of Marseilles have placed under sequestration the Bauxites Co., whose headquarters are in that city, and whose capital amounts to several millions of francs. At the end of June last this company was French, but about that period it became German, following on the acquisition of the whole of its shares by the Aluminium Co., of Neuhausen, Westphalia.

Trade Announcements.—Messrs. Clough, Smith and Co., Ltd., have taken over new premises at Regent House, Kingsway, W.C., to which address all communications should be sent on and after the 24th inst. Telegraphic address: "Clufmit Westcent London;" telephone number, "Gerrard 3288."

It is announced that as Mr. Fisher is serving in H.M. Forces, the business of Messrs. Fisher & Hann, electricians, of Egerton Road and 23, St. Leonards Road, Bexhill-on-Sea, is being closed.

Army Contracts Department.—The address of the Director of Army Contracts has been changed to Imperial House, Tothill Street, Westminster. Further particulars are given in our advertisement pages.

Dissolutions and Liquidations.—Schleyder's Economic Steam Furnace (Continental), Ltd.—A meeting will be held at 33, Craven House, Kingsway, W.C., on April 20th, to hear an account of the winding up from the liquidator, Mr. R. W. Ednie.

Powers & Draycott, ironmongers, cycle dealers and electrical engineers, Bedwell Lane, Four Oaks, Sutton Coldfield.—Messrs. F. H. Powers and C. R. L. Draycott have dissolved partnership. Mr. Powers will attend to debts.

Electric Meters in Russia.—The principal types of electrical meters approved by the Russian Office of Weights and Measures are of German production. There is, however, no particular shortage of these, as, according to a correspondent, there has been a large decline in the number of users of current. An effort is to be made to induce the Office of Weights and Measures to approve meters made in the countries of friendly and neutral Powers, such as Switzerland, France, England, &c.

LIGHTING and POWER NOTES.

Australia.—The Cooma (N.S.W.) Municipal Council has decided to engage an expert to report upon electric lighting schemes for the municipality.

Aylesbury.—Motor Supply.—The U.D.C. has informed the British Thomson-Houston Co. that it is willing to recommend the company's motors to intending hirers and purchasers on terms contained in the tender, and to find accommodation at the works for a supply of motors for exhibition purposes on the company's responsibility. An estimate is to be prepared for installing the E.L. at the Town Hall.

Ballymena.—Workhouse Lighting, &c.—The L.G.B. has sanctioned a loan of £3,300 for the purposes of heating and lighting the workhouse by electricity.

Barnsley.—Restricted Lighting.—The Electricity Committee has made arrangement for restricting the public lighting, in order to comply with the regulations of the military authorities.

Bath.—The Electric Lighting Committee has decided to make application to the T.C. for £2,000 in respect of an expected deficit in the financial year 1914-15.

Bingley.—Proposed Loan.—The U.D.C. proposes to apply to the L.G.B. for sanction to borrow £1,000 for electricity purposes.

Blackburn.—New Power Station.—The new Government order discouraging local loans until the close of the war will, for the time being, put an end to the proposal to begin the erection of new electricity works at Whitebirk.

Bristol.—Restricted Lighting.—The T.C. has been informed that a further reduction of street lighting is necessary; lights on the water front are to be masked, and all lights not extinguished must be darkened at the top and upper portion of the globe; sky signs, facias and outside lighting must be discontinued.

Broadstairs.—Public Lighting.—The Isle of Thanet Tramway and Lighting Co. has offered to light the streets in which its cables are laid, at £2 17s. 6d. per lamp per annum on a five years' contract. The capital cost of providing 170 standards, based on present prices, would be £637 10s. The U.D.C. has referred the matter to the Lighting Committee for consideration.

Buckhurst Hill (Essex).—Prov. Order.—The U.D.C. has decided to consent to the application of the County of London Electric Supply Co. for a prov. order for electric supply for the district.

Burnley.—Reduced Discounts.—In consequence of the condition of the town's finances the rate of discount to electricity consumers is to be reduced from 10 to 5 per cent.

Canada.—The East End power station now being built by the Dominion Power and Transmission Co., of Hamilton, is situated on the Lake Ontario water-front at the extreme north-east end of the city of Hamilton. The company's present principal source of power is the hydro-electric generating plant at Power Glen, near St. Catharines, and about 35 miles distant from Hamilton. At this development there is a head of 265 ft., the water used coming from Lake Erie, *viâ* the Welland Canal. Power is supplied to subsidiary companies in Welland, St. Catharines, Thorold, Port Colborne, Grimsby, Dundas, Brantford, Oakville and Hamilton districts, but by far the largest portion goes to the city of Hamilton. Three separate transmission lines, at 45,000 volts, connect the Power Glen plant with the main switching station at Bartonville. The new steam plant will be free from the ice troubles to which all hydro-electric plants are subject in cold weather. The plant has been designed for a capacity of 75,000 K.V.A. The turbine-generator units are each of 12,500 K.V.A. capacity, operating at 6,600 volts, three-phase, $66\frac{2}{3}$ cycles, 2,000 R.P.M., and are of the Westinghouse-Parsons-Curtis type, equipped with surface condensers and Le Blanc air pumps.—*Canadian Engineer.*

Belfast.—The Harbour Trust reports that during the year a 120-ton electric derrick crane has been installed at the Alexandra wharf, also four 5-ton electric gantry cranes for the coal trade.

British East Africa.—The increased and urgent demand for electricity has caused the Nairobi Electric Power and Lighting Co. to temporarily suspend the street lighting ; a new generator is on order, and expected to be available in two months' time.

Chatham.—Increased Tariff.—In consequence of the great increase in the cost of coal and other materials, the Kent Electric Power Co. announces that from April 1st the price of current will be increased by 20 per cent.

Colwyn Bay.—L.G.B. Inquiry.—An inquiry was held last week on the application of the U.D.C. to borrow £35,000 for the erection of a refuse destructor and generating station adjoining the L. & N.W. Railway at Bronyant. There was no opposition.

Dublin.—Increased Tariffs.—The City Electricity Committee having been reassured on the matter of coal supply, proposes to abandon the suggested increase in charges of 1d. and ½d. per unit, and to revert to the original proposal of an increase of ½d. and ¼d. for lighting and power respectively.

Ealing.—Electric Vehicle Tariff.—The Electricity Committee has fixed the following tariff for the charging of electrical vehicles at the electricity works :—1½d. per unit plus 2s. 6d. for each connected for an off-peak supply.

Edinburgh.—Owing to the increasing demand for electric light, the Electricity Committee recommends the T.C. to proceed with the necessary extensions of supply mains to Juniper Green, Corstorphine and Liberton.

Epsom.—The electrical engineer's statement for the past quarter shows decreases, as compared with the corresponding period last year, of 41,489 units in the quantity generated, 12,700 units in the quantity sold for public lighting, and 34,934 in the quantity sold for private lighting, while the units used on works show an increase of 2,620.

Glasgow.—The B. of T. has consented to the construction of condensing water inlets, &c., in the River Clyde, near Dalmarnock Bridge, at the new generating station. In connection with the new works it is recommended that during the next two years Mr. Lackie should be authorised to obtain advice from a consulting electrical engineer regarding the installation of machinery and plant to be put down in the new station.

Holme (Yorks.).—E.L. Scheme.—A canvass of the village is to be made on the proposed supply of electricity, the scheme being to utilise an old water mill.

Huntingdon.—Refuse Destructor.—The T.C. has instructed the borough surveyor to inspect a refuse destructor in another town of similar size, with a view to one being installed.

Itchin.—Prov. Order.—The Southampton T.C. has informed the U.D.C. that it has applied to the B. of T. to dispense with the Council's consent to an application for a prov. order for E.L.

Kingstown.—E.L. Scheme.—The U.D.C. has now decided to formulate an electric lighting scheme, and application is to be made to the L.G.B. for a loan for this purpose.

Kingston.—Price Increase.—The T.C. has decided, on the recommendation of the Lighting Committee, to make an all-round increase in the charges for lighting of 10 per cent., as expressed in fractions of a penny, except as regards special agreements, which will be dealt with as they expire. The chairman of the Lighting Committee stated that it would be better to wait until the Diesel oil engines had been working for a year, before forming any opinion as to their suitability. It would then be for the Council to come to some decision as to continuing the works or instituting a different system. If at the end of the year the balance-sheet was unsatisfactory, it would, no doubt, be possible to get someone to take the undertaking off the Council's hands.

Leicester.—Year's Working.—The accounts of the electricity department for the past year showed that the excess of receipts over working expenses was £22,712, and after paying interest and sinking fund charges there was a net surplus of £7,643, which is to be carried to the district fund for the relief of the rates.

Leigh.—Plant Extensions.—The proposal of the Electricity Committee to duplicate certain plant at an estimated cost of £10,000 has been referred back by the T.C. for further consideration.

The T.C. has decided that from April 1st electricity for lighting places of amusement be charged for at the flat rate of 3½d. per unit ; and for power purposes and outside lighting 2½d. per unit ; to shopkeepers, outside lighting, 2½d. per unit, these charges to be subject to discount.

London.—Hackney.—The T.C. has decided to adopt the recommendations of the Sub-Committee that the annual stock taking at the electricity works be carried out by independent stock takers, so that in future the accounts of the undertaking may be presented before the summer recess ; also that professional accountants shall be engaged to conduct each year a commercial audit of the accounts of the electricity department.

Bermondsey.—The Electricity and Street Lighting Committee reports that it has been necessary to shut down the No. 2 condenser (the first evaporative condenser) for a short time as there was a leak in the exhaust pipe running between the coils of the condenser. The exhaust pipe, the Committee states, is made of ¼-in. plate mild steel, and is being continually corroded away. Another leak developed on the 1st inst. In the latest evaporative condenser the exhaust pipe is cast-iron and shows no signs of corrosion. It will cost about £180 to replace the mild steel exhaust pipe with a cast-iron one, and it will probably have to be replaced during the next financial year. The condenser cost £3,295, and £1,112 has been paid off the loan.

Hammersmith. — The Cartage and Works Joint Committee recommends that all regular employés other than members of the staff be granted a temporary weekly increase of 7½ per cent. upon their wages, provided that in no case shall the wages amount to more than 35s. per week. The Electricity Committee recommends, in addition, that regular employés receiving 35s. to 42s. 6d. a week shall be paid a temporary increase in wages of 2s. per week.

Luton.—The T.C. is recommended to give a supply of current to the factory of G. Kent, Ltd., by means of an overhead line, provided the firm pays a proportion of the cost. The electrical engineer is to report on the question of lighting the streets by electricity.

Manchester.—The Electricity Committee has decided to make a strong effort to get the Treasury and the L.G.B. to remove the ban which makes it impossible to proceed with the big power station at Barton. The scheme involves an initial outlay just short of £550,000, and sanction has been given for the purchase of the land and the erection of the works. It was hoped to have a portion of the new station at work by the autumn of 1917.

The Special Committee of the T.C. has recommended that in order to meet the increased cost of living, a war bonus of 2s. per week be paid to Corporation workmen receiving 40s. per week or under.

Normanton.—E.L. Scheme.—The U.D.C. has decided in connection with the proposed electric lighting order to inform the B. of T. that it favours an oil-engine plant, but does not wish this to be binding, should another system be found more advantageous.

Rhyl.—Camp Supply.—The U.D.C. has decided to give a supply of energy to the Kinmel Military Camp at the same rate as it supplies other large consumers, plus ½d. per unit.

South Africa.—The Worcester (Cape Province) Municipality is about to install its own electric lighting scheme. The system is three-wire, direct-current, at 440 volts, and the plant will consist of water turbines (Pelton wheels) and a Diesel engine. The scheme is estimated to cost £15 000 ; the consulting engineer is Prof. Bohle, of the South African College.

A temporary breakdown recently occurred in the Johannesbuag supply, a fault occurring in a main cable tunnel, where the bitumen cable insulation began to burn.

The scheme for extending the supply of electrical energy in Port Elizabeth is now being carried out.

A complete new plant has been ordered which will consist of two 1,000-kw. turbo-alternator sets, with high-pressure steam turbines by Messrs. Fraser & Chalmers, alternators by Messrs. Dick, Kerr and Co., and surface condensing plants. A 500-kw. motor-converter set has been ordered from Messrs. Bruce Peebles & Co., and the B.T.H. Co. will supply the switchgear. The boiler plant is being extended by the addition of two units, and a plant to mechanically handle the coal and ashes is being installed. Messrs. Fraser & Chalmers are the principal contractors for the generating plant, and will be responsible for the installation, which will be of British manufacture throughout.—*South African Mining Journal.*

Swinton and Pendlebury.—Public Lighting.—The U.D.C. has instituted a charge for electricity for public lighting of 1¾d. per unit.

Taunton.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £1,175 for electricity purposes, mains, services and transformers, and for sanction to transfer to the mains account £550, being the surplus of a previous loan.

Tenby.—E.L. Scheme.—The B. of T. has informed the T.C. that it would not consent to give the Council authority to transfer its powers to a company ; also, that a clause would be introduced into every order passed during the present session that no capital should be expended until the war was over. The Council decided to proceed with the application for the order.

Truro.—E.L. Scheme.—The T.C. has been informed by the L.G.B. that the time does not appear opportune for the raising of a loan or for the installation of a new E.L. scheme. The question was referred to the E.L. Committee.

Walkden.—In connection with the projected sinking of a new Arley mine, which will be half a mile in depth, the Earl of Ellesmere is having an extensive generating station built at his Mosley Common Collieries, near Walkden. A generating station has also been provided at his Ashton Field Colliery.

Wanstead.—Prov. Order.—The U.D.C. has deferred, until the new Council is elected, the question of consenting to the prov. order for E.L. which is being applied for by the County of London Electric Supply Co.

Wednesfield.—The Midland Electric Corporation for Power Distribution, Ltd., has applied to the B. of T. for consent to use overhead lines at Wednesfield for the transmission of energy at a pressure of 7,000 volts

Wells (Somerset).—Prov. Order.—The T.C. has been asked by the B. of T. for its observations on the application of the Mid-Somerset E.L. Supply Co. for a prov. order to supply electricity to the district, and has informed the Board, that it considers the headquarters of the company should be in the eastern or coalfield end of the area; that the prices are far above the ordinary and the lighting area is too restricted. For these reasons the Corporation should have the power of purchase at as early a date as possible, because by reason of proximity to the Mendip coalfield it might be able to produce at a cheaper rate.

Winchester.—The Electricity Committee reported that the output for the past year was 129,900 units, as against 116,982 in the previous year, an increase of 11 per cent.

Woodford.—Prov. Order.—The U.D.C. has decided, by 5 votes to 3, not to consent to the granting of a prov. order for E.L. for the district to the County of London Electric Supply Co., Ltd. The reason for the opposition was that eight present members of the Council are not seeking re-election this year, and that, under the circumstances, it was not fair to bind the new Council.

Yorkshire Power Bill.—The Barnsley, Bradford, Halifax, Huddersfield, Rotherham, Sheffield, and Wakefield Councils have formed a Joint Committee to oppose the Yorkshire Electric Power Bill, 1915.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. System Discontinued. — The Corporation Tramways Committee has now recommended the T.C. to discontinue the P.A.Y.E. system of collecting fares. The Committee considers that having regard to the nature and extent of the opposition to the system on the routes where it has been in operation, it is not expedient to continue it any longer.

Ashton-under-Lyne. — Proposed Tramway Purchase.—The T.C. has decided on the recommendation of the Tramways Committee to take steps to purchase so much of the undertaking of the Oldham, Ashton and Hyde Electric Tramways Co. as is within the borough, and for acquiring, by lease or otherwise, the tramway between the areas of Waterloo and Bardsley if satisfactory terms can be arranged with the respective Parish Councils. The proposed purchase will be possible within six months after August 7th, 1917.

Australia.—The returns of the N.S.W. railways and tramways for the quarter ended December 31st last show a falling off in receipts in the former case, while in the latter there was an increase in earnings of £15,528, a decrease in expenditure of £26,064, in passengers carried, in 7,700,000, and in mileage, of 535,000, as compared with the corresponding quarter of the previous year.

The Victorian Railway Commissioners have been informed that the first of the six 10,000-kw. Parsons units for the Newport power house has been successfully tested. Work is in progress on the boiler house and a quantity of material has arrived.

The Hawthorne (Vic.) Tramway Trust is obtaining a car body built entirely of Australian timber as an experiment.

An association of local bodies is being convened to consider a general tramway scheme for Northcote, which might link up with lines in Brunswick, Coburg and Essendon.

Belfast.—A company is seeking to secure the interest of the directors of the old tramway company in order to run a new service from the Square, Warrenpoint, to the Quay, Rostrevor, by means of electricity.

Bolton.—In connection with the relaying of certain track, it has been reported that it will be advisable to relay a length of 25 yards of the South Lancashire Co.'s tramways. The latter company has agreed to supply the material if Bolton will do the work, and the Bolton Tramways Committee has decided to do this.

Chile.—Electric Railway.—A 2,400-volt direct-current line is being built between the Tofo mines and the port of Cruz Grande. The average gradient on the 15 miles of track is 1 in 33, and the total descent 2,000 ft. From a main power station containing three 3,500-k.v.a. and one 300 k.v.a. Curtis turbo-sets, energy will be transmitted at 22,000 volts to a sub-station containing two three-unit 1,000-kw., 2,400-volt synchronous motor-generators. The line is to be used for taking iron ore to the coast, and the three 110-ton locomotives first installed will be equipped for regenerative control, feeding power back into the supply system on down grades.

China.—Railless Traction.—After being in use for only a few weeks, the system of railless cars, which was started in Shanghai by the Shanghai Tramway Co., has, it is announced, had to be suspended for the time being. The only road traversed by the vehicles was the Fokien Road, and when everything was promising well, it was found that the road foundations were in such a weak condition as to be unable to stand the weight of the car. The only way for the service to be re-started is for the road to be concreted, and it is hoped that in due course the thoroughfare will be rendered suitable for the new traffic.

Continental Notes.—Italy.—In consequence of the inconvenience caused by the electric service in the Giovi tunnel, it has, says the *Revista Tecnica d'Elettricità*, been decided to resume the old steam service. This appears to be due to the unsuitable rheostats of the new 330 type of locomotive. Several of these locomotives have been made without being properly tested. Further trouble has arisen from the supply of energy from different sources, which apparently have somewhat different frequencies.

The Italian Public Works Department has granted an application for a subsidised concession for an electric tramway between Asola, Montanara and Cremona.

Ealing.—The T.C. has decided to request the London United Tramways Co. to remove all the unlighted centre tramway poles, 51 in number, and four centre poles carrying arc lights; refuges to an approved plan are to be constructed at the bases of the poles retained, the Corporation agreeing to contribute £1,000 towards the cost of the removal of the poles and the construction of the refuges, the liability in connection with the posts carrying arc lamps, and the proposed refuges, to rest with the company.

Glasgow.—The Tramways Committee recommends that the agreement with the Paisley District Tramways Co. for the running of the T.C.'s tramway cars from Hawkhead Road to Paisley Cross be renewed, and that as a basis of renewal an allowance of 15 per cent. on the present rate per mile be asked to meet working charges.

Huddersfield.—Several extensions and improvements to the tramway system are contemplated. The Kirkgate section is to be re-laid, and on the Egerton section the line is to be doubled from the top of Cemetery Road to Thornhill Road. The Longwood extension is also under consideration.

Hull.—The Tramways Committee has decided to give the drivers and conductors earning less than 30s. per week an advance of 3s., and those earning more than 30s. an advance of 2s. This will also apply to inspectors. The engineers and electricians will also be given an increase, as the Corporation is pledged to recognise the standard rate. These concessions will cost the department about £9,000 a year.

Ilford.—Tramway Fares.—The Council has decided to levy a 1d. rate to meet the deficiency on the working of the tramways. Mr. L. E. Harvey, the tramway manager, has reported on the question of fares, against the ½d. fare and in agreement with the universal 1d. fare which has proved so successful in South Shields. If the 1d. fare covers standing charges, plus a margin for working costs, it does not matter how far, within reason, the passenger is carried. Mr. Harvey made certain recommendations in regard to workmen's 1d. return tickets. The Council has decided to allow the fares to remain as at present.

London.—The L.C.C. has decided to grant an increase of 3s. a week, or 6d. a day, as from March 1st, to all officers and employés of the Council whose wages are less than 30s. per week.

Luton.—Income-Tax Assessment.—The T.C. has been recommended to appeal against income-tax assessments on "rent of tramways," amounting to £951, for the years 1912-15.

Lowestoft.—The engineer has been instructed to proceed with repairs to the tramway track between Church Road and Pakefield, at a cost of £300.

Manchester.—The Corporation has decided to offer a war bonus of 2s. per week to employés earning less than 40s. per week. The local secretary to the Tramway and Vehicle Workers' Union has been instructed to press for the 15 per cent. advance previously applied for.

South Lancs.—Owing to recruiting, the number of men carried on the South Lancashire Co.'s system in the early morning and afternoon is showing a material shrinkage. The company's system runs through a colliery area which has supplied over 12,000 colliery workers to the new Armies.

TELEGRAPH and TELEPHONE NOTES.

Argentine.—For some time the United River Plate Telephone Co. had been suffering from the destruction of their subterranean lines, and eventually the police discovered two ex-employés of the company cutting one of the cables. They stated that they did it out of revenge for having been dismissed. The losses suffered by the company amount to about $30,000. It appears that there was a gang of men engaged in doing the damage.—*Review of the River Plate.*

Provision for Telephones.—The Postmaster-General has written to the principal Architectural Associations to call attention to the importance of making adequate arrangements in the plans of large buildings for the installation at a later stage of telephone equipment. Provision should be made, as a minimum, for one 3-in. pipe from the public footway to the basement or ground floor and for cables to the other floors. It is also desirable that there should be a ready means of leading wires to the various rooms on the different floors.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—April 6th. U.D.C. Motor-generators or converters, one H.T. switchboard and L.T. panels, and one H.T. feeder pillar. See "Official Notices" to-day.

Australia.—Sydney.—March 23rd. One 150-ton electric revolving floating crane for Naval Dockyard, Sydney. Particulars from the Board of Trade Commercial Intelligence Branch, London.

Ayr.—The Corporation surveyor is to invite tenders for the extension of the engine-room at the electricity station for new plant.

Bray.—April 6th. U.D.C. Stores for electric light works. See "Official Notices" to-day.

Bridgend.—April 8th. U.D.C. 400-KW. steam alternator. See "Official Notices" to-day.

Burnley.—March 22nd. Electricians' work for the B. of G. Forms, &c., from Mr. J. S. Horn, Clerk, Union Offices.

Carlisle.—March 31st. Corporation. Twelve months' supply of jointing materials, oils and general stores. Forms, &c. from City Electrical Engineer, Victoria Viaduct.

Dundalk.—March 23rd. U.D.C. Twelve months' supply of stores for the Electricity Department. See "Official Notices" March 5th.

Dundee.—March 29th. The Corporation Electricity Department invites tenders for stores.

Edinburgh.—March 29th. Corporation. Three, six or twelve months' supply of insulated cables, arc lamp carbons, fuse boxes, meters, &c., for the Electricity Supply Department. Forms of tender (10s.) from the Electrical Engineer's office, Dewar Place.

April 12th. Corporation. Water-tube boilers for Portobello Supply Station. See "Official Notices" to-day.

Glasgow.—The Town Clerk (Mr. John Lindsay) has been authorised by the Electricity Department to advertise for tenders for stores (with the exception of coal) for one year from May 31st.

Greece.—April 15th to 28th. Greek Ministry of Communications. Supply and installation of (1) a central exchange and telephone system at Salonica, (2) a central exchange at Athens, (3) telephonic apparatus and accessories. Only firms who have carried out actual working installations in towns of 100,000 inhabitants may tender. Deposit £400. Local representation. Particulars in French can be seen at Board of Trade Commercial Intelligence Department in London. Ministère des Communications, Direction des Postes, Télégraphes et Téléphones, Athens.

Halifax.—March 26th. Electrical fittings for six months, for the B. of G. Mr. A. T. Longbotham, Clerk, 4, Carleton Street.

Hove.—March 26th. Corporation. One 500-KW. mixed-pressure steam turbine, complete with D.C. 230/285-volt generator and surface condensing plant; also a battery of 115 accumulators. See "Official Notices" March 5th.

Hull.—March 20th. Corporation. Six or 12 months' supply of coal for the Tramways Committee. Forms, &c., City Engineer's office.

Kirkcaldy.—March 22nd. Corporation. Twelve months' supply of brass castings, pitch, iron castings, &c., for the Electricity and Tramways Committee. Forms of tender from Mr. O. F. Francis, Burgh Electrical Engineer.

Limerick.—March 26th. Corporation. Engine-room stores, &c. Forms of tender from Mr. E. B. Thornhill, Borough Electrical Engineer, Frederick Street.

London.—The L.C.C. is recommended to invite tenders from selected firms for the supply of an electric lighting main in connection with the lighting of the refuges on the Victoria Embankment.

March 31st. L.C.C. Installation, 218 wiring points, 265 lighting points, at Derington Road Elementary School, Lower Tooting, S.W. See "Official Notices" to-day.

Manchester.—March 23rd. Corporation. One 650-KW. rotary converter and static transformer, for the Electricity Committee. Forms from Mr. F. E. Hughes, Secretary, Electricity Department.

New Zealand.—Wellington.—April 30th. Supply of a three-unit exciter set, and 1,600-KW. generator for the Lake Coleridge Hydro-electric scheme. Specifications from the Public Works Office, Wellington.

Nottingham.—March 22nd. Corporation. Twelve months' supply of electrical sundries for the Tramways Committee. Forms, &c. (5s.), from Mr. J. Aldworth, General Manager, Beastmarket Hill.

Rosslynlee.—Midlothian and Peebles District Asylum, Rosslynlee, invite offers for supplying electric fittings, &c., for six months. The Clerk, 19, Heriot Row, Edinburgh.

Spain.—The municipal authorities of Babilafuente (province of Salamanca) have lately invited tenders for the concession for the electric lighting of the town.

Swinton and Pendlebury.—March 19th. U.D.C. Cables, joint-boxes, bitumen and joint-box compound. See "Official Notices" March 5th.

Tenders have been invited for the installation of a storage battery at the refuse-destructor works, and for mains extensions.

Walthamstow.—March 24th. U.D.C. E.H.T. and L.T. switchgear and cables. See "Official Notices" March 12th.

CLOSED.

Ayr.—The Corporation has accepted the tender, amounting to £9,624, of the Macintosh Cable Co., Ltd., for cables.

Blackburn.—Messrs. Chamberlain & Hookham, Ltd., have received the contract from Blackburn for A.C. and D.C. meters for the next 12 months. The same firm's tender has also been accepted by Whitehaven for meters for the ensuing year.

The Corporation Electricity and Tramways Department has placed a contract with Messrs. J. H. Tucker & Co. for ironclad switches for the next 12 months.

Colchester.—The T.C. has accepted the following tenders for yearly supplies to the Tramways Department:—

Lighting fittings.—Siemens Bros., Ltd.; Joslins, Ltd.
Electrical equipments for tramcars.—G. W. Allsop; P. R. Jackson and Co.; Le Carbone.
Overhead equipment.—Brecknell, Munro & Rogers; Andrew & Co.
Rubber and fibre.—Andrew & Co.; B I. & Helsby Cables, Ltd.
Car fittings and castings.—Stanford & Co.
Car fittings.—Malleable Steel Castings Co.; Tempered Spring Co., Ltd. Equipment & Engineering Co., Ltd.
Oils, grease, &c.—Joslins, Ltd.

Glasgow.—The T.C. Tramways Committee on Works and Stores has accepted the following tenders:—

Crane for Kinning Park sub-station.—Herbert Morris, Ltd.
Stoneware ducts for cables.—Albion Clay Co., Ltd.

London.—Hammersmith.—The Electricity Committee has authorised the placing of the following order for coal for the Electricity Department:—

Harrisons (London).—Four barges (80 to 100 tons) of Yorkshire nutty, at 24s. per ton.

The undermentioned tenders have been received for the annual contracts for the Electricity Department:—

Box Frames, Covers, Boxes, &c.

Johnson & Phillips, Ltd.	(recommended)	£377
W. Lucy & Co., Ltd.		415
Henley's Telegraph Works Co., Ltd.		472
B.I. & Helsby Cables, Ltd.		499
Callender's Cable & Construction Co., Ltd.		555
Sykes & Sugden, Ltd.		575
Siemens Bros. & Co., Ltd.		614
W. T. Glover & Co., Ltd.		1,161

Electrical Goods Accessories.

General Electric Co.	(recommended)	£25
Bromed's Patents Co., Ltd.		26
British Thomson-Houston Co., Ltd		27
Edison & Swan U.E.L. Co.		24
A. S. Goodwin		30

Insulated Wires.

General Electric Co., Ltd.	(recommended)	£1[illegible]
A. S. Goodwin		137
B.I. & Helsby Cables, Ltd.		1[illegible]
I.R. G.P. & Telegraph Works		16[illegible]

Cables.

Pirelli, Ltd.		£115
General Electric Co., Ltd.	(recommended)	116
[illegible] Cable Co., Ltd.		12[illegible]
A. S. Goodwin		1[illegible]
C. Macintosh & Co., Ltd.		1[illegible]
Edison & Swan United Electric Light Co.		1[illegible]
[illegible] & Sons		[illegible]
Johnson & Phillips		1[illegible]
W. T. Henley's Telegraph Works, Ltd.		[illegible]
Siemens Bros. & Co., Ltd.		1[illegible]
B.I. & Helsby Cables, Ltd.		1[illegible]
I.R. G.P. & Telegraph Works		1[illegible]
J. Peterson		157
W. T. Glover & Co., Ltd.		1[illegible]

Tenders were received for prepayment meters from the British Thomson-Houston Co., Ltd.; Messrs. Ferranti, Ltd.; Messrs. Landis and Gyr, Ltd.; and the B.I. & Helsby Cables, Ltd. The tender of Messrs. Ferranti, Ltd., is recommended.

The Electricity Committee recommends the Council to authorise the purchase of a further stock of coal for use at the electricity works up to a maximum of 3,000 tons

KENSINGTON.—The Guardians have been recommended to accept the tender of the General Electric Co., Ltd., at £38, for six months' supply of electric lamps. Other tenderers were:—

Fryke & Palmer		£45
Lennon & Rugby	(irregular)	31
[illegible] Electric Lamp Mfg. Co., Ltd.	(irregular)	42
Wm. Huntsman		49
Siemens Bros. Dynamo Works, Ltd.	(irregular)	41
Watlington & Co., Ltd.	(five items only, irregular)	31
Imperial United Lamp Co., Ltd.	(five items only)	30
Cryselco, Ltd.	(four items only, irregular)	31
Pope's Electric Lamp Co., Ltd.	(five items only)	30
Brimsdown Lamp Works, Ltd.	(five items only)	32
Veritys, Ltd.	(four items only)	31

BERMONDSEY.—The B.C. has accepted tenders for annual supplies from the following:—

Meters and time switches.—Chamberlain & Hookham, Ltd.
Meters, cut-outs, fuses, &c.—General Electric Co., Ltd.
Meter boards.—Ferranti, Ltd.
Cable.—Chas. Macintosh & Co., Ltd.; General Electric Co., Ltd.
Insulating box compound.—Dussek Bitumen Co.
Carbons and brushes.—Morgan Crucible Co., Ltd.
Conduits.—Thomas Wragg & Sons, Ltd.
Steel frames, covers and joint-boxes.—Sykes & Sugden.

ST. MARYLEBONE.—The Electricity Committee recommends the acceptance of the following tenders for annual contracts:—

Flexible cords, fuse wires, &c.—Pirelli, Ltd.; British Electrical Mfg. Co.; London Electric Wire Co.; B.I. & Helsby Cables, Ltd.
Underground cables.—Pirelli, Ltd.
House cables, box compounds and insulation.—L. Andrew & Co.; R. Blackwell & Co.; British Electrical Mfg. Co.; B.I. & Helsby Cables, Ltd.; Dussek Bitumen Co.; J. North Hardy; J. G. Ingram & Sons; North British Rubber Co.; Pirelli, Ltd.

The Committee recommends that the tender of Messrs. Chamberlain & Hookham (agents, Messrs. Venner) be accepted for the supply of 1,000 meters, as required, on the same terms as last year, plus 7½ per cent., owing to the increased cost of materials and wages; also that the offer of the Tudor Accumulator Co. for the supervision of their batteries, at £85 per annum, be accepted.

Lowestoft.—The offer of Messrs. Rowlands & Co. to supply one dozen gear wheels at £3 6s. each has been accepted by the Tramways Committee.

Middlesbrough.—The Corporation has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for the supply of Wotan and Tantalum lamps for the ensuing 12 months.

Sevenoaks.—The U.D.C. has accepted the tender of Messrs. L. H. Russell & Co. for installing the electric light over the interior of the swimming baths.

Southampton.—The T.C. has agreed to extend for a further period of 12 months the contracts of the following firms for supplies to the Electricity Department:—

Doulton & Co.—Pipes.
B.T.H. Co.—Meters.
W. Rickard, Ltd.—V.B. cable (six months).

The following offers have been accepted for supplies of coal:—

A. Usher & Co.—500 tons Cannock old coppice, 21s. 9d. per ton.
Cory Bros. & Co.—500 tons Pinxton slack, 21s. per ton.
Bradbury, Son & Co., Ltd.—250 tons Tamworth beans, 18s. 4d. per ton.

South Africa.—SOUTH AFRICAN RAILWAYS.—The tender of the S.A. General Electric Co. has been accepted for the supply of electric incandescent lamps.—*S.A. Mining Journal.*

St. Albans.—The tender of Messrs. Giffen Bros. has been accepted by the Guardians for wiring the Infirmary for £16 10s., and the Board-room block for £31 10s.

Wakefield.—Yorkshire (West Riding) Electric Tramways Co., Ltd., has placed a contract for single-phase house service meters, for a period of two years from March 1st, with the Electrical Apparatus Co., Ltd.

NOTES ON COAL STORAGE.

[COMMUNICATED.]

THE great increase in the size of central stations, and hence in their rate of fuel consumption; the importance of the service which they render as a "public utility," which must be maintained continuously; the high normal price of coal, and the readiness with which quotations soar upwards on the slightest pretext—all these factors make the problem of coal storage one of special interest to every central-station engineer. The problem is of equal interest to colliery engineers. From their opposite standpoints, both producer and user wish to maintain a stock covering emergency demands and delay in delivery, preventing as far as possible interrupted supply and broken contracts during periods of labour trouble, and taking advantage of market or seasonal fluctuations in price.

Seeing that 1,000 tons a week is now quite a commonplace consumption for a central station, and 1,000 or 1,500 tons a day is not unknown in large stations in the States, it is clear that the storage of 12, 10 or even 6 weeks' coal supply is no small matter. Storage on the largest scale has been practised in America; indeed, it is estimated that storage capacity is available for 10 to 12 per cent. or more of the annual coal production in the States. Some of the individual stores are very large, for instance, the Lehigh Coal and Railway Co. has storage for some 1¾ million tons, and a number of other companies for over half a million tons apiece.

Unfortunately, coal does not improve with keeping, but opinions differ considerably as to the extent by which it deteriorates, and as to the means most likely to preserve it economically. Having got some thousands or tens of thousands of tons of coal, preferably at a time when the market price is down, what is the best means of preserving the fuel? Three methods of storage at least are available. The coal may be piled in stacks, in the open or under cover; or it may be put in bunkers; or it may be placed in tanks which are then filled with water. Bunker storage is limited by considerations of capital cost to relatively small amounts of coal, but is specially convenient for temporary storage, *e.g.*, holding a day or two's supply for the washeries of a colliery or holding fuel on its way (through the bunkers) to a boiler installation. The cost of a tank store is less than that of an equal over-ground bunker capacity, and is justified in very much larger sizes by the advantages of wet storage. Ordinary pile storage is the simplest and cheapest system, but it exposes the fuel to "weathering" action, the effect of which is to weaken the coal mechanically, reduce its heating value, and introduce a certain risk of spontaneous combustion.

The effect of atmosphere and weather on coals was examined very thoroughly by Lecrivain, two or three years ago, and was found to consist, in greater or less degree, in all coals, of surface oxidation, causing cracks which gradually extend through the pieces, disintegrating them, and exposing fresh surfaces. A preliminary loss of weight, due to drying and escape of fire-damp (methane), is followed by a gain in weight due to oxidation, and then a further loss due to formation, by decomposition, of volatile hydrocarbons, which escape. Spontaneous ignition generally follows rapidly on the last-named stage.

Lecrivain's tests on French coals showed as much as 30 per cent. loss of gas value (and corresponding reduction in calorific value) in a month, and 50 per cent. reduction in three months in the quantity of ammonia by-products recoverable. These losses are higher than generally experienced, but it is not unusual to find 10 or 20 per cent. of the gas value of a coal lost by air storage, and if such coals be used for boiler firing, proportionate loss in steam-raising value is, of course, experienced. (The "gas value" is about 5 per cent. of the total calorific value.)

Tests conducted recently by the U.S. Navy Department showed that the slack New River coal, which deteriorates not at all under water, loses about 1 per cent. in calorific value during 12 months' exposure to weather; larger grades suffer less loss. Coal in a 120-ton pile on the Isthmus of Panama lost less than 0·4 per cent. in heating value during a year's weathering, and was not disintegrated or otherwise damaged physically. On the other hand, black lignite lost 3·5 per cent. heating value in three months, and 5·3 per cent. in three years in outdoor 3 to 6-ton bins. As might reasonably be expected, the loss in calorific value is several times greater in lignite coal than in hard steam varieties. From average steam coals there occurs soon after mining a loss of gas representing 0·1 to 0·2 per cent. of the total calorific value. The escape of this gas is at least as serious from the explosion risk it introduces as from the standpoint of calorific value. Coal which exhales much gas should be seasoned for a few weeks if possible before stacking.

Moisture and freezing are particularly injurious to coal which has a tendency to cleave, especially if it has begun to do so owing to rough handling and surface oxidation. In severe climates the freezing of exposed piles in winter is a serious consideration, and dynamite has had to be used before now to get coal in winter from open stacks in the States. Alternate dryness and dampness is particularly injurious, hence coal should either be submerged completely or stacked in piles which do not favour the accumulation and gradual evaporation of moisture. The disintegrating effect of weather is, of course, greatest near the surface of piles. The smaller the coal the less the penetration of weathering, the effects of which are generally most marked in an outer layer 1 or 2 ft. thick.

As shown later, the one or two per cent. loss of calorific value in weathered coal is saved by wet storage, but at the cost of roughly the same indirect loss due to the wetness of the coal as fired. This being so, the chief argument in favour of wet storage is the elimination of fire risk. Experiments conducted last year in Yorkshire show that oxidation of fine coal exposed to the atmosphere may easily proceed fast enough to cause cumulative temperature rise at the rate of $\frac{1}{2}$° F. per diem, assuming that no heat escapes, which is at least approximately true in the centre of a large coal heap to which there may nevertheless be sufficient air access for oxidation to occur. As the temperature rises, the rate of oxidation, and therefore of heating, increases. At about 160 or 170° F. the heat of oxidation is absorbed completely in evaporating moisture. During this period the coal steams freely and its temperature remains constant; thereafter heating is liable to proceed quickly and spontaneous combustion to occur. Under suitable circumstances, easily attainable in large heaps, the presence of moisture may actually accelerate spontaneous heating, moisture evaporated from the parts first oxidised condensing on and thus warming other surfaces.

Dust and smalls naturally heat up more quickly than lump stacks. Warm, moist climates favour rapid oxidation. The presence of pyrites in coal is particularly dangerous, and so is the oily nature of some varieties. The accumulation of heat to any dangerous degree cannot occur in very shallow stacks. In deep stacks special ventilating pipes or ducts are sometimes provided, but in the event of self-heating commencing, these passages may aggravate the danger by gently fanning the incipient flame. From 10 to 20 ft. is considered the limiting desirable depth for dry coal heaps in England and France, whether in the open or under cover. Besides the overheating danger, it is considered that explosible dust pockets are liable to form in deeper piles. In American storage fields, piles up to 80 or 90 ft. in height have been built with anthracite, but bituminous coal is found to be badly crushed and subject to decomposition and overheating risks if piled more than 35 ft. deep.

Big lumps rolling down an open-air stack are apt to form channels round its base which act like the air ducts in a charcoal-burner's heap, and increase the risk of spontaneous combustion, particularly if there is in the centre of the heap a mass of small coal liable to overheating. Fine coal should not be stacked when avoidable. If, as is generally the case in modern central stations, a slack coal is used on chain-grates, the reserve coal stock should either be kept under water (in which case it is wet and messy to stoke), or should be of fairly large grade and crushed as and when required. Since the reserve can be held (particularly under water) for very long periods without serious deterioration, the second alternative is not extravagant, for the more costly lump reserve coal is crushed only once in one or several years, emergencies excepted.

Storage under water, whether fresh or salt, undoubtedly does preserve the calorific value of coal almost indefinitely. It is sometimes said that it renders coal brittle, and no doubt fuel subject to easy cleavage is weakened by long immersion, water seeping into minute cracks and then, by its lubricating action and hydraulic rigidity, facilitating breakage. Freezing has, of course, a bad disintegrating effect on coal containing water in its fissures. On the other hand, the buffer effect of the water in which the coal is stored reduces breakage in dumping and grabbing, so that the net effect as regards breakage is probably rather favourable than otherwise. The chief value of water storage lies, however, in preventing spontaneous combustion, and it is a fortunate though natural coincidence that those coals in which the risk of spontaneous combustion is greatest, are also those which deteriorate most by weathering, and, therefore, benefit most in this direction also by sub-aqueous storage.

The first large under-water coal store was the 10,000-ton tank built by the Western Electric Co. in Chicago 13 years ago. Since then many others have been built for industrial and navy use, but more in the States than in Europe. The general construction resembles a swimming bath (but of uniform depth) spanned by a travelling grab crane and loaded by a travelling tower and shoot, or by grab crane. The reinforced concrete tank in which the Omaha electricity works stores 10,000 tons of coal measures 100 × 116 × 22 ft., and, in addition to the main reinforcement, a number of old rails are sunk flush in the concrete bottom to prevent the grab bucket from injuring the latter by impact or scraping. Since only constructional costs limit the depth to which wet storage tanks may be excavated, it is possible to store safely and indefinitely more coal per acre under water than in dry stacks.

A fact which is often overlooked is that wet storage generally means firing wet coal. Fine coal naturally retains more moisture than larger grades, and with it wet storage is at once most desirable and most messy; with it, the sticking and general messing-up of mechanical stokers is most troublesome when the coal is wet, and with it the loss of heat required to evaporate moisture in the fuel is most serious. Even the ordinary amount of moisture in coal, which is nominally dry, accounts for $\frac{1}{2}$ to 1 per cent. of the calorific value of coal, *i.e.*, for an amount of heat which is of the same order of magnitude as the loss in calorific value of medium-sized hard coal, during some months' weathering. Where water pans are used in the ash pits of a boiler, 3 or 4 per cent. of the heat value of fuel may be absorbed in evaporating moisture therefrom, but this expenditure is considered justified by the compensating advantage of smokeless combustion and increased available heat in the combustion chamber. The same result is not secured, at any rate so efficiently, by using wet coal, for the fresh fuel dries before it becomes incandescent, and the steam liberated escapes without passing through the fire, *i.e.*, without experiencing that dissociation and recombination on which the advantage of wet ash-pans or special steam jets depends. After prolonged immersion, some coals will hold as much as 5 to 15 per cent. additional water, after the longest draining that can reasonably be given. If the calorific value of the fuel be 14,000 B.TH.U. per lb. and the water content be 15 per cent., its evaporation (requiring about 1,000 B.TH.U. per lb. of water) will absorb 1·1 per cent. of the heat value of the coal, and may thus constitute as serious a loss as the loss of calorific value which would follow storage in open-air piles. It is in preventing decomposition and possible ignition by spontaneous heating that water storage is most valuable.

Coal storage by producers, to form a shipping reserve, or under compulsion by transport deficiencies or a flooded market, is generally for short periods only; a certain amount is always in store, but it is not the same coal throughout. On the other hand, storage by a large consumer is to form a real emergency reserve, and if the coal be stored under water it can be kept almost indefinitely. So long as it can be taken out as fast as it is required in emergency, there is no need to sacrifice anything to convenience of filling and emptying, and where land is valuable there is no reason why buildings should not be erected over the storage tank, using conveyors for loading and unloading. The latter do not need much headroom, and by handling the wet coal in a thin continuous stream, it is given most opportunity to drain before use. In such installations a certain working reserve of fuel should be kept in an open stack or, usually, in overhead bunkers filled straight from trucks on a railway siding. The cost of water storage equipment is not excessive, and is practically limited to that of the tank itself. The filling and emptying pumps need not be very powerful, and their cost is at least saved on the coal-handling gear, for this has to extend over a smaller area than where open storage is practised.

The cost of a complete mechanical coal-handling equipment is justified by the less breakage of fuel, by its more expeditious handling, and by the saving in labour costs. The mere fact that an extensive coal plant can be controlled by one or two men is specially important to central stations in times of labour trouble. The telpher system is cheap, convenient in operation and flexible in application. It permits of continuous and practically automatic working. The coal routes can be adapted to any shape of yard in any stage of filling. A travelling terminal bridge with adjustable trips permits coal to be placed or removed just where desired, and one or two men can operate an equipment conveying 60 tons an hour over a mile or more. In the new Bordeaux harbour works, for instance, a double aerial-transporter system carries coal 1¼ miles from the wharf to railway yards and warehouses, &c., where it delivers into shoots on a terminal tower. Thence the coal falls into trucks or on to a belt conveyor running along a travelling gantry, and spreading material evenly all over the pile. Grab-buckets, of 20 or 30-cwt. capacity, on the gantry, provide for subsequent collection of the coal. The tipping transporter buckets run on an overhead cable or rails, and are towed by an electrically-driven tractor cable at nearly three miles per hour. Up to 200 tons an hour is handled by each transporter (4,000 tons a day total) by this all-electric equipment.

In the case of a station served by river or canal and railway, there are five coaling operations to be provided for, viz., from waterside to boiler house or storage, from sidings to boiler house or storage, and from storage to boiler house. Experience in the national coal strike a year or two ago showed that six or eight weeks' supply was the minimum coal reserve with which a central station should be provided, *i.e.*, storage must be arranged for anything from 10,000 to 100,000 tons or more (the New York Edison Co. has 150,000 tons storage, besides overhead bunkers in its stations). Safety demands that the reserve be near the station, not only for convenience, but also because the "sympathetic" strikes of the twentieth century are apt to paralyse transport and coal supply simultaneously. On the other hand, it is not always possible to accommodate the vast reserve desirable, in yards immediately adjoining the station, for as shown by the following data (based on 45 cb. ft. per ton) over 2 acres would be required to store 60,000 tons in a stack 30 ft. deep (the limiting safe depth for dry stacks of most coals) :—

Depth of Pile.			*Storage per Acre.*
20 ft.	...	...	19,500 tons.
30 ,,	...	...	29.000 ,,
40 ,,	...	...	39 000 ,,
50 ,,	...	...	48.500 ,,
80 ,,	...	...	77,500 ,,

To store even 20,000 tons requires a heap 600 ft. long, 50 ft. wide and 30 ft. high (or its equivalent), so that if land be dear or scarce round the central-station site, a few days' supply may be kept on the latter, and the remaining reserve within easy reach by private light railway or telpher system.

REVIEWS.

Experiments. By Philip E. Edelman. Minneapolis, U.S.A. : P. E. Edelman. Price $1.50.

It is seldom that we have read so refreshing a book on Science as this little volume on "Experiments," by Mr. Edelman. The author sets out to give a "Complete account of experimental work in Science, invention, the industries and the amateur field, with practical illustrations and working directions," and if he has not succeeded in giving his "complete account," he has at any rate written a book at once suggestive and inspiring.

The volume is dedicated to "all those who have encouraged and contributed to the progress of experimental work," and the author has prefaced his book with an able essay on the value and need of experiments. He points out that progress only comes about through experiments, and that it would be difficult to think of even a few things that we possess that have not come to us by experiments ; but at the same time he draws attention to the fact that a large amount of experimental work is being done by "hit-or-miss" methods, which naturally give meagre results for the time and energy expended ; and he lays special stress on the advantage of possessing a sound knowledge of fundamental principles as well as experimental skill and resource. This volume comprises two distinct books, one part devoted to experiments which may be repeated, the other leading to new and original work.

Chapter I deals with models, copies and makeshifts, and describes the latent possibilities of old cans, jars, sticks, paper, string and glue in the production of working models. Chapter II consists of 12 sections devoted to simple experiments in chemistry, including the preparation and properties of common substances such as oxygen, hydrogen, water, ammonia, acids and sulphur. Then follow chapters in which most of the wonders of chemical technology find a place, *e.g.*, thermit-welding, catalysis, electro-deposition and rubber substitutes. Electricity naturally occupies a considerable space in this book of experiments ; a chapter is devoted to the construction of small electric motors, and the details of construction are so carefully given, that it would be difficult for the merest novice to fail to make a workable machine. Some very interesting experiments are also described on electric heating, welding, &c.

In Chapter XI, four of Faraday's experiments on electromagnetic induction are described, and the repetition of these classical experiments is suggested as leading up to other experiments on transformers, &c., to be described later in the book. There can be no doubt of the value of the repetition of fundamental experiments such as these, and if such a course were taken in other branches of science it would probably lead to a far better understanding of the fundamental principles. The more complicated and consequently less instructive experiments often performed in school laboratories could well be replaced by repetitions of the original experiments of Oersted, Volta, Faraday, and Maxwell.

Another chapter includes an account of the construction of a small transformer, a spark coil, an interrupter, and an ozonator, all of which are made of quite inexpensive and easily procurable materials, but which are, nevertheless, capable of doing good experimental work on a small scale. There is in Chapter XIII an account of how to make and use a small wireless station, and the author's reputation as a writer on wireless subjects naturally gives considerable weight to whatever he may say on this subject. To the description of the wireless telegraph is also added an account of a wireless telephone, which may be easily set up to operate over distances of 70 to 80 ft. In the remaining chapters of Book I experiments are described with Tesla coils and ultra-violet and X-rays ; one section is devoted to Experimental Aeronautics, and the final chapter to Microscopic Photography.

From such a number of experiments it is difficult to make a selection ; there is so much that is valuable and so little dross, that justice can only be done by reading the book from cover to cover.

Book II, which deals with the principles of research and invention, although occupying less than a quarter of the whole volume, is nevertheless a most interesting collection of suggestions and examples. The methods and principles of research work are carefully set out, and although it is obviously impossible to do more than merely point the way to successful researching, yet many pitfalls may be avoided and much time saved by following the very sound advice given in these few pages. Some chapters are added on Radio-research and Commercial Testing, which serve as examples of the general methods described earlier in the book.

It is interesting at this time to notice the author's opinion stated at the end of his book, that "Scientific endeavours are least affected by periods of military activity . . . . and progress continues in spite of economic and destructive losses."

It is impossible to read this book without feeling an increase in "keenness," a passion for experimenting, and a desire to convert the "vast potential possibilities" into the "kinetic realities" mentioned by the author.—P. K.

Wireless Telegraphy. By Rupert Stanley, B.A. London : Longmans, Green & Co. Price 7s. 6d.

Though there are already a considerable number of textbooks for students on the subject of wireless telegraphy, it will generally be conceded that Prof. Stanley's work is a welcome addition. It is arranged and written in a manner that will appeal well to the student and give him a useful insight into the theory of the subject. This affords sufficient warranty for its appearance, and for the same reason parts of it will be examined in some detail in this review. It will therefore be understood that the criticisms made will, in general, apply rather to specific points than to the character of the work as a whole.

The symbols C and K, for current and capacity respectively, are in general use throughout the book, in spite of recent conventions, but the reviewer is not disposed to quarrel with this, as it really seems a pity to try to upset such well established expressions as C^2R and $1/2KV^2$.

The second chapter is devoted to a brief consideration of matter and electrons, with the idea of imbuing the student with the electron theory of electrical phenomena, especially in regard to radio-telegraphy. Hence we learn that an electric current along a wire is nothing more or less than a flow of electrons along the wire, or from atom to atom in the wire. It is not clear to the reviewer how this conception is of real help to the deep-thinking and serious student, and it certainly appears to be one on which he is likely to ask some awkward questions. Thus, considering a linear oscillator whose linear dimensions are almost half the wave length given out, if the oscillating currents along the conductor are alternate fluxes of electrons (which are negative charges of electricity according to the theory), then it is reasonable to ask if the positive charges at one end of the oscillator remain quiescent until the electrons from the other end reach them. If this one-sided explanation be conceded, then seeing that it takes a quarter period for the positive charges to be annulled, it follows that a movement of electrons along the whole length of the oscillator has occurred in the same time, thus postulating a mean velocity, including starting and stopping, of nearly twice the speed of light, and this in spite of the fact that electrons possess inertia. There are cogent theoretical reasons why the velocity of electrons may not exceed the speed of light as a maximum, and it would be interesting to know where the fallacy lies. Again the student may well ask why, if the electrostatic field is made dissymmetrical in this way, the magnetic field is not also dissymmetrical. It will also be legitimate to ask how it comes about that the grounded loops of strain which form part of the propagated wave in an ordinary wireless system travel over the surface, seeing that one set of grounded extremities of the loops postulate positive charges on the surface of the ground. Do the negative charges push them on? These are only a few of the questions that would present themselves due to the assumption that it is only negative electricity in motion that constitutes a current. It is the reviewer's suggestion that while electrons (or, preferably, "corpuscles") have a useful and well-defined place in the theory of the constitution of matter, the time is not yet ripe to assume that electric currents are in all cases electronic fluxes; and, further, that such assumption is liable to confuse the serious student. Just as the author of the book directs the student's attention to magnetic strain apart from the magnet which produces it, so it is possible to direct his attention to the electrostatic strain apart from the nature of an electric charge.

Another point of theory on which the author appears to deceive himself lies in the statement that a current can only flow in a wire when it connects two conductors which are charged to different electric potentials. But a current can be made to flow in a circular circuit by a changing magnetic flux without any difference of potentials.

In dealing with questions turning upon the conductivity of the upper atmosphere, the author seriously misquotes Sir J. J. Thomson (unless the reviewer is badly mistaken). The error is a very common one, hence there is all the more reason for pointing it out. The atmosphere at a certain stage of rarefaction is said to have better conductivity for high-frequency currents than sea water, and for this statement Sir J. J. Thomson is quoted as authority. Surely, what Sir J. J. Thomson's experiments showed was that rarefied gas when violently ionised and in disruptive activity through electric stresses of relatively prodigious intensity, possessed this degree of conductivity. If the whole of the upper atmosphere were rendered intensely luminous by electrical activity then we might expect the degree of conductivity referred to.

In the more practical part of the book there are a few points on which comment might be made. Thus the author dwells too much on the need for winding secondaries of spark coils used for charging condensers with comparatively thick wire. There is not so much in the argument as the author appears to think, and it would possibly appeal better to the student if the limitation of condenser voltage were considered rather from the point of view of energy transference from the magnetic field of the spark coil to the charged condenser.

In regard to the question of coupling, the author appears to hold the fallacious view that if energy can be prevented from returning into the closed circuit of a coupled sender, then the radiation of a pure wave length is assured. The assumption apparently is that coupling waves are given off in succession, and this appears to be the view adopted by many. It will hardly be necessary to point out to any mathematical student that the Fourier series is the same, whether we wait till the energy begins to return to the closed circuit or consider only the initial part of the radiation. Out of this fallacy there has been an attempt made to claim special qualities for certain disk discharger transmitters. It is unfortunate also that the author follows the wrong lead given by certain wireless experts in assuming that because a spark gap is shortened the spark resistance is necessarily less. The reverse is probably more frequent, as witness quenched spark transmitters.

Telegraphy—Preece and Sivewright. New edition; revised by W. Llewellyn Preece. London: Longmans, Green & Co. Price 7s. 6d.

In its new edition this well-known text-book has been largely revised and extended, with the object of embracing more recent advances in telegraphy and telephony. The work of extension and revision has been undertaken by Mr. W. Llewellyn Preece. New chapters have been added on the Baudot system, on comparative results obtainable with high-speed telegraph systems, and on secondary batteries. Practically all other chapters have been very much revised. Those on telephony and on wireless telegraphy are stated to be of a purely introductory character.

The work is well got up and forms a very presentable volume. In the matter of bringing up to date it is in some respects disappointing. In one or two cases modern forms of apparatus or appliances have not been referred to. Thus, old-fashioned forms of Wheatstone A B C apparatus are fully described and illustrated, whilst more efficient modern forms are not alluded to.

The chapter on secondary batteries is marred by inexact methods of expression. For instance, it is stated that the internal resistance of accumulator cells does not exceed ·0015 ohm, without allusion to limitations imposed by the dimensions of the cells or other factors, and a definite figure for density of electrolyte when a cell is discharged is given without reference to the quantity of electrolyte in relation to the capacity of the cells. Nor is it made clear why "more distinct signals" are obtained as a result of using accumulators for telegraph purposes. A reference to the matter of working costs, as compared with primary batteries, would not be out of place. In regard to the chapter on telephony, it is observed that no explanation of working principles of speech transmission on central-battery methods is attempted, though a number of figures are given, and the signalling arrangements are explained in some detail. In figure 206 a distinctly objectionable method of jointing paper-insulated cable wires is illustrated. On page 229 a heat coil is most inadequately described as a small coil which fuses should a heavy current flow on the line. From these examples it will be seen that the work is capable of much improvement.

The section on wireless telegraphy cannot be commended. Admittedly a large amount of ground is not covered and the matter given is only intended as introductory, but many of the statements made are open to a considerable amount of criticism. Thus, on page 378 an inaccurate definition of coupling is given in which the term is made to refer only to the windings of the "jigger," whereas it embraces the whole primary oscillation circuit on the one hand, and the whole aerial oscillation system on the other. Of these the "trigger" is usually but a small part. Again, in explaining the early Lodge method of shock excitation on page 368, reference is made to the closed-circuit oscillations being quickly damped (why, is not apparent) and to the aerial circuit being free to oscillate, *having but little inductance.* The italics have been added. Nor is it at all clear upon what grounds the statement is made that the Marconi transmitter in its later developments is "an extremely close approximation to the ideal requirements of a transmitting wireless station." It is more than doubtful whether there are any extremely close approximations to the ideal in wireless telegraph transmitters at present.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, March 19th. At 8 p.m. At Storey's Gate, S.W. General Meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 19th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General Meeting.

Association of Mining Electrical Engineers (West of Scotland Branch).—Friday, March 19th. At Royal Technical College, Glasgow. Paper on "The Use and Abuse of Oils in Connection with Electrical Plant," by Mr. T. C. Thomsen.

(Notts. and Derbyshire Branch).—Saturday, March 20th. At 3.30 p.m. At University College, Nottingham. Papers on "Turbine Pumps for Colliery Pumping," by Mr. R. H. Willis, and "Utility of Surface Earthing on Armoured Systems," by Mr. W. Webster.

Electro-Harmonic Society.—Friday, March 19th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 19th. At 7.30 p.m. At the Lecture Theatre of the Literary and Philosophical Society, Westgate Road, Newcastle-on-Tyne. Paper on "The Future of British Engineering and Shipbuilding," by Mr. E. W. Fraser Smith.

Association of Engineers-in-Charge.—Thursday, March 25th. Visit to the House of Commons, Engineering Department.

There will be no meeting on March 27th.

Institute of Marine Engineers.—Tuesday, March 23rd. At 8 p.m. At Tower Hill, Minories, E. Paper on "Comparative Efficiency of Lubricants," by Mr. J. Veitch-Wilson.

Institution of Electrical Engineers.—Thursday March 25th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Telephone Troubles in the Tropics," by Mr. W. L. Preece.

(Manchester Local Section).—Tuesday, March 23rd. At 7.30 p.m. At Engineers' Club, 17, Albert Square. Paper on "Electric Cooking, mainly from the Consumer's Point of View," by Mr. W. R. Cooper.

Royal Institution of Great Britain.—Friday, March 26th. At 9 p.m. At Albemarle Street, W. Paper on "Experiments in Slow Cathode Rays," by Prof. Sir J. J. Thomson, F.R.S.

Saturdays, March 20th and 27th. At 3 p.m. Lectures (V and VI) on "Recent Researches on Atoms and Ions," by Prof. Sir J. J. Thomson, F.R.S.

Physical Society of London.—Friday, March 26th. At 5 p.m. At University College, Gower Street, W.C. Paper on "The Change of Thermal Conductivity with Fusion," by Prof. A. W. Porter, F.R.S., and Mr. F. Simeon.

NOTES.

Correction.—In our last issue under "Official Returns of Electrical Companies," appearing on page 364 we, by a printers' error, which we regret, reported the debentures of the E. S. Co., Ltd., as £20,000, instead of £2,000. Our readers will remember that in our notice of the registration of the company (Elec. Rev., February 12th) we correctly reported the capital of the company as £2,000. The operations of the company were further referred to in our issue of February 19th.

Electro-Harmonic Concert.—We wish to remind our readers that the last of the Electro-Harmonic Society's concerts for the season takes place to-night at the King's Hall, Holborn Restaurant. The large and enthusiastic gatherings at all the events of the season so far have proved that the Committee did not err in considering that electrical men wished the concerts to be kept running as usual as a relief from the stress and strain of these serious times, and it is hoped and believed that to-night there will be a large and representative company present to meet their friends and to enjoy the varied and appropriate programme that has been prepared. Sir John Snell will be in the chair.

Trade Announcement.—Messrs. Estler Bros. are temporarily closing their office at Dowgate Hill, E.C., from Monday, March 22nd, and their sole office in London will be at the works, South Molton Road, Victoria Docks, E. Telephone Nos.: "East 320" and "East 407"; telegraphic address, "Isolable, London."

Patents and Alien Enemies.—In connection with the Thermit process for welding rails in Australia, Mr. Hughes, the Attorney-General, has suspended the Goldschmidt patents in favour of the Engineer-in-Chief of the Commonwealth railways.

The Board of Trade has granted a licence to Messrs. Ed. Bennis and Co., Ltd., in respect of Patent No. 8966/1903, granted to Bousse.

Late Legal.—British Insulated & Helsby Cables, Ltd. v. Crittall.—The concluding stage of the hearing of this case, which is reported on page 389, was reached on Wednesday, when Mr. Greer, K.C., counsel for the plaintiffs, completed his comments upon the whole of the evidence. The Official Referee said that owing to the nature of the case, and its length, he would have to take time to consider his judgment and put his decision in a satisfactory shape.

The Arc Lamp Carbons Case.—Mr. Justice Eve, in the Chancery Division on Wednesday, March 17th, heard an action by the Beck Engineering Co., Ltd., and A. M. Billington, against the Sloan Electrical Co., Ltd., for a declaration that they were entitled to a stock of about 213,000 carbons for electric arc lamps lately stored at the Foster Engineering Co.'s premises at Wimbledon, and an injunction restraining the defendants from disposing of them. The defendants counterclaimed for damages in respect of an alleged trespass on the Foster Co.'s premises when the stock of carbons was removed by the plaintiffs. The Foster Co. were originally defendants, but were dismissed from the action last October.

The plaintiffs' case was that they had an agreement with the defendants, who acted as agents for a Mr. Conradty, of Nuremberg, a maker of carbons, to keep a stock of carbons at Wimbledon from which they could draw in connection with the making of the Beck electric flame lamp, and that upon the cancellation of the agreement they were to be at liberty to purchase the stock at the current price. The question was what was the meaning of the phrase "current price."

His Lordship held that "current price" meant the price ruling at the time the carbon was taken from stock and sold, and not the price agreed upon between the parties two years ago. He dissented from the view that the purchaser was to have the right for the duration of the agreement to insist upon having his goods at a price which might mean making them at a loss. He dismissed the action with costs, and said it really should have been brought against the German maker. He also dismissed the counterclaim on the ground that the Foster Co. were not bailees of the goods for the defendants, but for the plaintiffs or the maker.

Appointments Vacant.—Switchboard attendant (25s.), for Stretford U.D.C.; switchboard attendant (35s.), for Portsmouth Corporation; junior assistant (£88), for Sheffield Electric Supply Department; switchboard attendant (32s.), for Burnley Corporation; electrical fitters (39s.), for drawing office, H.M. Dockyard, Portsmouth; switchboard attendant (27s.), for Wakefield Corporation. See "Official Notices" to-day.

The Electric Vehicle Committee.—At the last meeting of this Committee it was reported that there had been a further demand for the *Electric Vehicle* journal; the main feature of the June issue will be "The Municipal Uses of Electric Vehicles."

The General Electric Co. has been appointed the official manufacturer to the Committee for 12 months, from April 1st, for the illuminated type of charging station signs, and the Patent Enamel Co., of Selly Oak, Birmingham, has been appointed the official manufacturer for the same period for the enamel plate type.

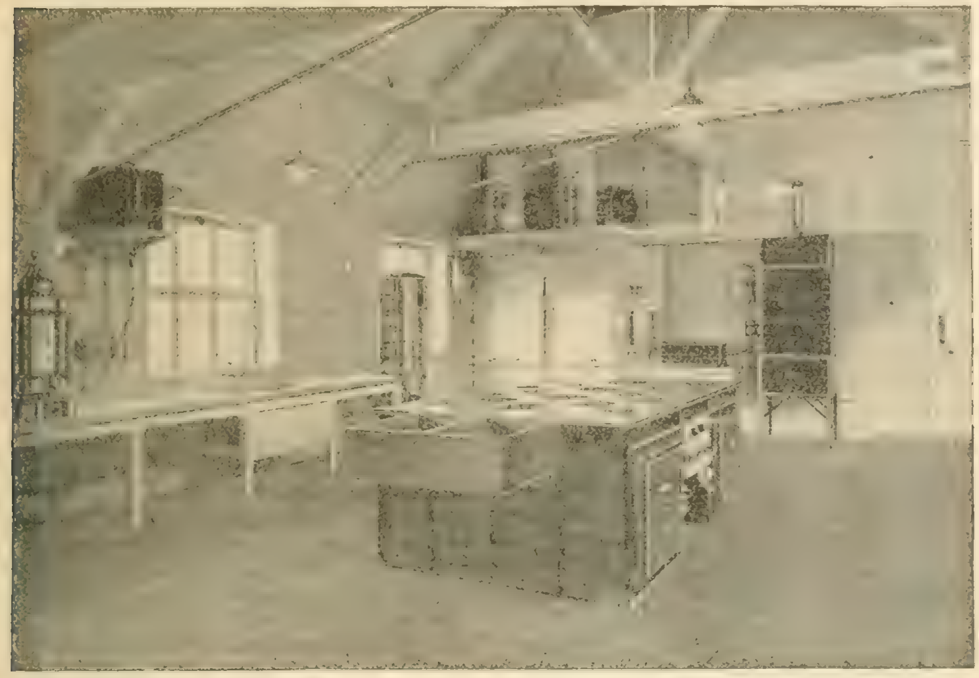
As to the standardisation of metal-filament glow lamps for use on electric vehicles, the Committee has had before it samples of fittings, and in view of the restricted amount of room has decided to recommend, as standard for electric vehicles, the lamps of the size and voltage recommended by the Engineering Standards Committee (Report No. 69). These lamps are for a pressure of 12 volts and, in view of the small energy consumption and the comparatively short hours of use, the Committee recommends that, for the present, they be coupled across such a number of cells in the vehicle as will give the required voltage, and that a special extra terminal be provided on the cells for this purpose.

The Technical Sub-Committee is still engaged in drawing up a report as to the methods of charging and standardisation of charging equipments.

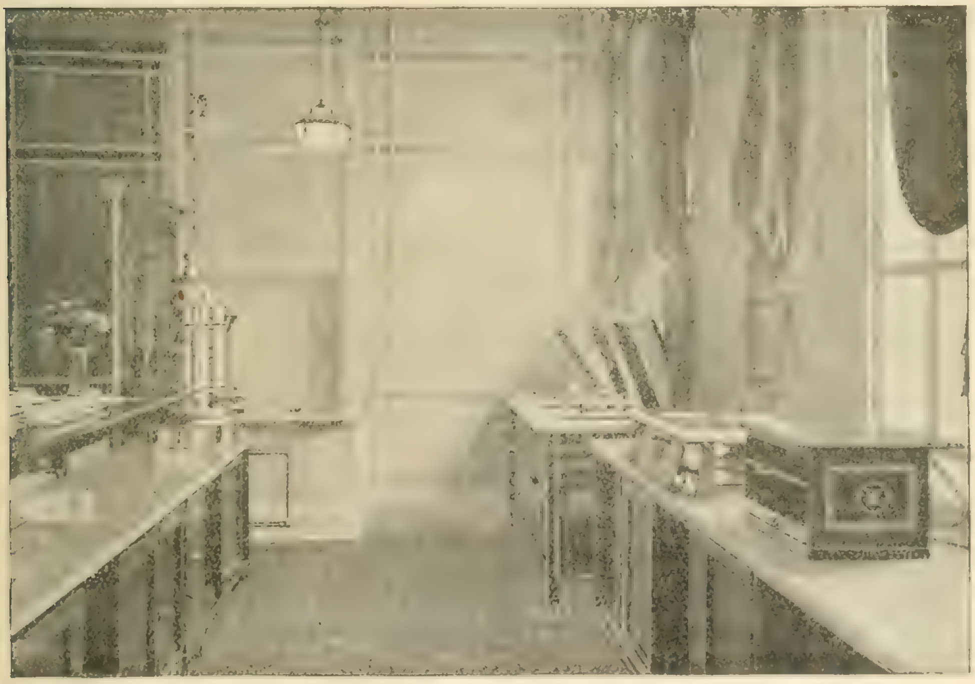
The secretary was directed to write to those London municipal and company undertakings charging more than 1d. per unit for "off-peak" supply, expressing the hope that they will reconsider this matter and come into line with the large number of supply undertakings which have already adopted the Committee's standard tariff.

Fatality.—Sheffield.—An inquest was held on 10th inst. into the death of Walter Carley, a lad of 14 years, who was on the previous Sunday fixing an electric light outside his brother's scullery in Attercliffe Road. He had been apprenticed for five or six weeks to an electrician. His brother tried to dissuade him from attempting the job. After the work had been finished, his sister-in-law heard a cry and found him hanging from the wire by his arms and with a pair of pliers in his hands. One of his legs was in a water tub and the other was drawn up. An employe of the Corporation electricity department said that the voltage was 200, and if deceased had caught the wire with the pliers the pressure would have sufficed to kill him. The boy had no right to be doing the work. The rules showed that the electricity department must be notified when any work of the sort was to be done, and the work had to be reported when completed, but in this case no notification had been sent. The wire was not the proper wire for the purpose, and the work had not been carried out properly. The Coroner said that apparently it was a fairly simple job, and had been completed, but carelessness afterwards in interfering with the wire while alive caused the death. A verdict of "Accidental death" was returned.

Electric Cooking at the Bradford Kursaal.—As briefly reported in our last issue, the Bradford City Council last week opened the Kursaal with the first electrically cooked dinner on a large scale that has taken place in the city; the plant was installed by the officials of the Electricity Committee, and was supplied by the Brompton and Kensington Accessories Co., Ltd., London, with the exception of a geyser and towel rails that were supplied by the British Electric Heater Co., of Glasgow. The equipment is capable of cooking a table d'hôte dinner for 500 persons, and consists of the following items :—



Interior of the Main Electrical Kitchen, Bradford Kursaal.



Electrical Cooking Equipment, Ground Floor Café.

One central range, fitted with bain marie, overall dimensions 9 ft. 3 in. × 5 ft. × 2 ft. 9 in. high, fitted with four ovens of 4 KW. each, and measuring 2 ft. high × 2 ft. 2 in. deep × 2 ft. wide; the frame is of cast-iron, stove enamelled black, with ground bright facings and bright boiling table.

The latter is fitted with four 2-KW. 12-in., six 1·5-KW. 10-in., and eight 1·2-KW. 8-in. boiling rings.

The ovens and boiling rings are arranged for three regulations, viz., "high," "medium," and "low." The switches and fuses are mounted in conspicuous and easily accessible positions, and each oven and boiling ring has an indicator lamp to show when the current is on.

The bain marie is 2 ft. 8 in. × 1 ft. 9 in. × 6 in. deep, and is divided into two compartments, separately controlled by switches and fuses, and taking a maximum of 3 KW.

One circular steamer tinned inside and nickel-plated outside, 19 in. in diameter, with six 6 in. deep steaming compartments fitted internally with steam channels and draining holes. The steamer is controlled by three heaters which may be used singly or collectively, taking 4·5 KW.

One fish or potato frier made of blue planished steel with bright mouldings, and having a compartment 2 ft. × 18 in. and of ample depth. This is fitted with two heaters taking 4 KW., and is controlled by four switches for easily adjusting the temperature of the fat in which the frying takes place.

Grill.—This has a grilling area of 24 in. × 12 in. and is made of cast-iron and fitted with grill guard, grilling grid and drip tin. The loading is 4·5 KW.

One 10-gallon nickel-plated copper hot water urn for drinking purposes, taking 3·5 KW.

One 10-gallon copper cylinder mounted on the wall, fitted with ball cock and water gauge for providing hot water for washing-up purposes, pipes being connected to sinks for this purpose. This takes 6 KW.

Ground Floor Café.

One carving table and hot cupboard, measuring 6 ft. 6 in. × 2 ft. 6 in. × 2 ft. 9 in., mounted on castors, and fitted with three tinned copper carving dishes, 19 in. × 14 in., with hinged covers, and four 7-in. nickel plated gravy and sauce pots. The hot cupboard underneath has internal dimensions of 5 ft. 9 in. × 2 ft. 1 in. × 2 ft. high. There are three regulations of heat provided with this apparatus, which takes 3·5 KW.

One double lined nickel-plated coffee or milk urn of five gallons capacity, taking 2·5 KW.

One 10-gallon hot-water urn for drinking purposes, 3·5 KW.

One bread toaster, having a toasting surface of 17 in. × 11 in., 2·5 KW.

One breakfast cooker, 2 ft. 6 in × 2 ft., containing two 8-in. boiling rings, one 6-in. boiling ring and one 11-in. × 8½ in grill, with a total loading of 4·6 KW.

One electric hot-water geyser, fitted in the counter for providing hot water for washing-up purposes to two wash bowls, the amount of water being regulated. This takes 4 KW.

Middle Café.

This is fitted with one toaster (2·5 KW.), one hot-water urn (3·5 KW.) for providing water for drinking purposes, one coffee or milk urn (2·5 KW.), and one electric geyser (4 KW.), fitted to the wash bowls.

Electrically-heated towel rails, taking 150 watts each, are provided in each of the cafés, in order to ensure a supply of dry towels always being on hand.

An American Carbon Co.—According to the American *Electrical Review and Western Electrician*, the National Carbon Co., which early last year took over the American Ever-Ready Co., subsequently operating its works as branches of the National Co., showed very satisfactory results in 1914. The company now has ten factories in operation in the States and one in Toronto. A new factory has been completed at Jersey City, and a large one is completing in Long Island City. The profits are reported as equal to 26 per cent. on the common stock, as compared with 15 per cent. for 1913. The preferred and common stocks aggregated $15,565,000, as against $10,000,000. The profit advanced from $1,476,621 to $2,215,880. The dividend distributed on preferred stock advanced from $315,000 to $372,750, and that on the common stock increased from $330,000 to $582,930. A bonus of $25,000 was paid to employés as against nothing in 1913, and the surplus figures at $825,618 as compared with $495,907.

Board of Trade Assistance.—The Commercial Intelligence Branch of the Board of Trade has issued lists 10, 11 and 12 (for the weeks ended February 27th, March 6th and 13th) of articles which inquirers desire to purchase.

British firms interested, as suppliers, in any of the goods mentioned should communicate with the director of the Branch at 73, Basinghall Street, London, E.C.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The opening meeting of the Calcutta Local Section took place on January 28th, when the address of the chairman, Mr. W. H. Everett, was read by the vice-chairman, Mr. A. K. Taylor. The address dealt with the electrical industry in India; it was shown that in the supply of apparatus and machinery for electric lighting and power the United Kingdom held by far the largest share, and telegraph and telephone apparatus and materials were almost entirely derived from this country. The total imports in 1913-14 exceeded one million sterling in value, the provinces of Bengal and Bombay providing 78 per cent. of the demand. The principal schemes in operation, or in progress in India, were the following:—

Water Power.—Tata Power Co., Bombay, 32,000 kw. (to be increased to 100,000 kw.); Cauvery Falls, Mysore, 12,400 kw.; Jhelum River, Kashmir, 4,000 kw.; Darjeeling, 2,500 kw.; Mussoorie, 1,900 kw.; Simla, 750 kw.; Jammu, Kashmir, 700 kw.; total, about 54 000 kw.

Steam and Oil.—Calcutta, 14 800 kw.; Calcutta Tramways, 2,900 kw.; Bombay, 9,000 kw.; Rangoon, 5,400 kw.; Madras, 3,800 kw.; Colombo, 1,550 kw.; Kolar Mines Co., 1,500 kw.; Dacca, 900 kw.; Delhi, 840 kw.; Cawnpore, 850 kw.; Gwalior, 700 kw.; Lahore, 600 kw.; Kandy, 540 kw.; Mandalay, 520 kw.; Bikanir, 500 kw.; total, about 58,000 kw., of which about 1,800 kw. is generated by Diesel oil engines.

Power was being transmitted over distances up to 92 miles, at pressures up to 100,000 volts. The author estimated that the rainfall in the uplands represented something like 1,000 million h.p., and if only 1 per cent. of the total could be utilised commercially it represented an immense annual value; the energy might be used for the production of artificial fertilisers, the electrification of railways and industrial power. In Calcutta already some 1,229 motors, aggregating 10,263 b.h.p., were in use for commercial purposes. Better provision was being made for the technical training of electrical engineers.

The following gentlemen have been nominated for the respective offices in the Scottish Local Section:—Chairman, Mr. D. A. Starr; vice-chairman, Mr. J. K. Stothert; hon. secretary, Mr. Joseph Taylor; assistant secretary, Mr. Wm. F. Mitchell; chairman of Students' Section, Mr. Arch. Page; Committee, Messrs. Wyatt (Greenock), W. W. Lackie, Prof. Maclean (Glasgow), Messrs. Arch. Wilson (Edinburgh), J. S. Nicholson, James Sayers, E. T. Goslin, George Stevenson, A. S. Hampton, and Prof. Cormack, Glasgow. The nominations will be confirmed at the annual general meeting in Glasgow next month.

Students' Section.—The following further arrangements are announced for this session:—

March 31st.—Discussion on the applications of electrical engineering to warfare.—"Searchlights and Projectors," to be opened by E. L. Emtage.

April 14th.—J. M. Heslop. "The Electric Drive of Rolling Mills."

April 28th.—Annual General Meeting. Lecture on "The Paragon System," by W. P. Dartnall.

At the meeting of the Birmingham Local Section, on Wednesday last, Mr. W. R. Cooper read his paper on "Electric Cooking."

Birmingham Electric Club.—On Saturday last a lecture was given by Mr. W. E. Warrilow on "Electric Vehicles," which was illustrated by lantern slides. In the course of the discussion, Mr. W. A. Jackson (borough electrical engineer, West Bromwich) said that the petrol 'buses in his district had been commandeered by the Government; they got some more, but, fortunately, the Government took them also, and then they got Edison battery 'buses. The last were slower and more costly to buy, but, on the figures guaranteed by the makers, they would save £400 per annum over the petrol-driven 'buses, and he was confident that as a result of experience with them the West Bromwich Corporation would ultimately replace the horse-drawn vehicles used by the street cleansing departments with electric dust carts, &c. Mr. Hargreaves (Edison Co.) said he took three commercial vehicles a distance of 3 000 miles through the Midlands last summer and had experienced no difficulty in obtaining a charge.

Municipalisation of the Berlin Electricity Works.—It is officially announced by the Berlin City authorities that the "majistracy" decided at the meeting on February 23rd to proceed with the municipalisation of the Berlin Electricity Works. As a result of the course of events, it is said that room no longer exists for a conflict of opinion within the majistracy or for a decision of a majority against a minority in the matter. The lignite coal fields of Golpa-Jessnitz, which have been held in prospect by a company associated with the Berlin Electricity Works Co. and the A.E.G. for meeting the supply of energy for Berlin, are now intended for other purposes in the interest of the country, and no other solution therefore is presented than that of taking over the works for municipal administration. As a result of this announcement the city of Berlin will acquire the works on October 1st next provided that the City Council itself agrees to the scheme which has just been placed before it for this purpose. It is, however, considered probable under the prevailing circumstances that as in the majistracy, so in the Municipal Council itself, will there be a majority of votes cast in favour of the scheme. The present agreement expires in October, and in view of this fact the city has been in negotiation with the Berlin company for a long time past with the object either of securing considerably more favourable terms for supply and a larger share in the profits, or, if this were not possible, of taking over the undertaking. The question of converting the works into a joint private-municipal enterprise has been dismissed for practical reasons as well as on account of opposition offered to the suggested community of interests, whilst the diversion of the distant lignite fields to the other objects has also placed a different complexion on the question. During the past few years the city has received from the company about £350,000 per annum as tax and share in the profits, and the decision to absorb the undertaking is based upon the assumption that the net yield to the city will be greater than this sum under municipal administration. It is calculated that the purchase price, which will be settled according to the book value on October 1st, will reach about £6 500,000; but the raising of the necessary money under existing circumstances will be difficult, whilst money is expected to be dearer after the conclusion of the war. The reference previously made to the extensive lignite coal fields of Golpa-Jessnitz is explained by the fact that the company concerned has just entered into a contract of many years' duration for the annual supply of 500,000,000 kw.-hours to an undertaking which is to produce artificial fertilisers, and a second company is being formed which will require a further quantity of 250,000,000 kw.-hours every year.

London Electrical Workers' Demands.—We have received the following communication:—

"The following is a brief account of a meeting of the London members of the Union:—

"At a largely-attended meeting of the London members of the Electrical Trades Union it was decided by an overwhelming majority of those present, to press for an advance of wages of 1½d. per hour for all grades of electrical workers employed in the metropolis. The application presented to the London Electrical Masters' Association for one shilling per hour with a 48-hour week was ratified, and it was further decided that a special code of working rules for men engaged on ship work should be circulated to all employers in the Port of London.

"The wiremen employed on the London County Council tramways, both members of the Electrical Trades Union and non-members, struck work on Saturday last to secure the recognition of 10½d. per hour as the minimum rate. Should there not be an early settlement satisfactory to the men, it is stated there may be an extension in dispute. The London Electrical Masters' Association agreed with the Union that the rate for wiremen should be 10½d. per hour as from July last.

"J. Potter,
"*Dis. Sec., Elec. Trades Union.*

"Kilburn, N.W., *March 17th*, 1915."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Before leaving to take up his new appointment with the Pirelli Co., Ltd., Mr. W. A. Brown, who was the distributing engineer to the St. Pancras Borough Council for a period of nearly 18 years, was the recipient of an electric hot plate from the clerical staff, and a set of cut-glass rose bowls from the men and staff of his department. Both presentations were made by Mr. Sydney W. Baynes, the chief electrical engineer, who expressed the regret of all at Mr. Brown's leaving the service, and wished him every success in his new sphere. At a meeting of the Electricity Committee on the 11th inst., the Mayor (Alderman Joseph May), on behalf of the Committee, presented to Mr. W. A. Brown a silver stop watch suitably engraved, as a memento from the Committee, and spoke in highly complimentary terms of his services to the Council.

The Bingley Council's Electricity and Tramways Committee recommended that the salary of the electrical engineer (Mr. F. C. Pedley) be increased by £30 a year, and that of the assistant engineer by £26 a year. The recommendation was, after discussion, adopted.

It is recommended that the salary of Mr. H. A. Kell, chief assistant engineer at the Luton electricity works, be advanced by £20 to £200.

The Stoke Newington B.C. has been recommended to grant the following increases in the salaries of members of the staff of the electricity department:—Mr. S. Hann, electrical engineer, £280 to £290 per annum; Mr. H. Large, chief assistant, £130 to £140, reserving for future consideration an honorarium for his services in acting as borough electrical engineer during Mr. Hann's absence with the Forces; Mr. E. G. MacKenzie, sub-station assistant, £2 to £2 2s. per week; Mr. A. H. Gay, sub-station assistant, £1 15s. to £2 2s.; Mr. A. E. Collings, sub-station assistant, £1 15s. to £2; Mr. G. F. Malden, temporary sub-station assistant, £1 12s. to £2; Mr. A. S. Cushing, temporary sub-station assistant, £1 12s. to £1 15s., reserving further consideration of salary to take place after the lapse of six calendar months; Messrs. Ford, Rayner and Laws, engine drivers, an addition of 2s. per week; Mr. S. Bone, clerk, an addition of 4s., and Mr. G. Hodges, night duty man, an addition of 2s. per week.

Tramway Officials.—The Plymouth T.C. has, by 46 votes to 10, rejected the recommendation of the Tramways Committee regarding the appointment of Mr. C. R. Everson, mentioned in the last issue of the Elec. Rev.

Southampton Tramways Committee has received 48 applications for the post of tramways manager. The following candidates have been selected for interview :—Mr. H. Pilling, Accrington ; Mr. F. Buckley, Wigan ; Mr. W. Billington, Salford ; Mr. W. T. Robson, South Shields Corporation tramways. A deputation has been appointed to visit the towns and to interview the selected candidates where they are at present engaged, and report.

General.—The undermentioned have been appointed members of the L.C.C. Highways Committee for 1914-15 :—Lord Monk-Bretton, Sir John Benn, Messrs. D. Davies, G. A. Dutfield, H. H. Gordon, W. Haydon, G. H. Hume, W. Hunt, H. Marks, T. Prestige, A. C. Rawson, A. H. Scott, S. J. Thomas, H. Ward, and A. W. Yeo.

In the *London Gazette* on Tuesday the following appeared :—

Territorial Force.—*Electric Lights Company.* Roger H. Emmett, Robert Burleigh.

No. 5 Electric Lights Company ; Alfred Thurston Taylor to be second Lieutenant, March 17th.

The Axbridge Board of Guardians has increased the salary of the electrical engineer at the workhouse (MR. F. C. HARRIS) from £80 to £100 a year.

MR. GEORGE SUTTON, M.I.E.E., managing director of Messrs. W. T. Henley's Telegraph Works Co., Ltd., has been elected to succeed the late Mr. J. F. Albright, as chairman of the Kent Electric Power Co., and MR. H. B. HARVEY, M.I.E.E., who has for the past six years been the company's manager and engineer, has been elected to the vacant position of director.

It is announced that MR. DAVID WILLOCK has been elected to a seat on the Board of the Electric Construction Co., Ltd., rendered vacant by the death of Mr. William Bulloch.

MR. ALEX. SPENCER, a director of Messrs. George Spencer Moulton & Co., Ltd., has been elected a director of the British Westinghouse Electric and Manufacturing Co., Ltd.

In the Italian Senate on Tuesday, MR. MARCONI was introduced to the House as a new senator with the customary formalities. Press dispatches state that he was received with long and enthusiastic applause, in which the public in the gallery joined.

Obituary.—MR. H. WARD LEONARD.—We regret to read in our American exchanges of the death which occurred suddenly on February 18th in New York, of Mr. H. Ward Leonard. Mr. Leonard was 54 years of age, and at the time of his death he was attending the mid-winter dinner of the American Institute of Electrical Engineers, of which he was at one time a vice-president, and at another manager. The American *Electrical Review* says that when he was 23 years of age the deceased gentleman became associated with Mr. Edison, as one of four engineers on his staff selected to introduce the Edison central-station system, and three years later he was appointed general superintendent of the Western Electric Light Co. in Chicago. After some years in private consulting practice, he for a year or two acted as general manager of the light and power departments of the combined Edison interests for United States and Canada, and subsequently in 1891 established his own independent manufacturing business, which is still operating as the Ward Leonard Electric Co., at Bronxville, N.Y. For some years past, Mr. Leonard had not taken an active part in the affairs of the company, but had been engaged in experimental work and in the development of his many inventions. Practically all the ships in the U.S. Navy are fitted with his system of control, this application following upon the successful use of the system in one turret of the *Brooklyn* during the Spanish-American war. His system of motor control was applied to the moving sidewalk at the 1900 Paris Exposition after other systems had been applied unsuccessfully. He was an early worker in connection with the electric lighting of railway trains—indeed his first invention of all, in 1888, related to that subject. He was connected with many technical and other associations, had delivered many papers and addresses before them, and was awarded various medals.

MR. F. E. POLLARD.—The death has occurred at Hertford, at the age of 55 years, of Mr. F. E. Pollard, a member of the Research Sub-Committee on Insulating Oils appointed by the Institution of Electrical Engineers.

MR. THOMAS SWINYARD.—The *Times* reports that the death took place in New York, on February 25th, of Mr. Thomas Swinyard, who went to Canada in 1862, at the request of the British shareholders of the Great Western Railway Co. of Canada, as their general manager. He was appointed general manager of the Dominion Telegraph Co. in 1875, and subsequently president, an office which he held until his death.

MR. HOWELL ASHBRIDGE GODBY, who had spent four years at Faraday House, and joined the H.A.C. at the beginning of the war, died on February 19th in hospital in France as the result of wounds received in action on February 14th.

In the latest casualty list there appears the name of SECOND-LIEUT. J. L. MOFFETT, Royal Scots Fusiliers, who has been killed in action. Lieut. Moffett was 27 years of age, and obtained his commission last September. He was educated at Watford Grammar School and Manchester University, where he graduated B.Sc. (Eng.). He was an Associate of the Institution of Electrical Engineers. Up to 18 months ago he was engaged at the Lancs. and Yorks. Railway Co.'s Works at Horwich, near Bolton. He left there to take a position with the Chloride Co., at Clifton, near Manchester. He had been at the Front five weeks.

Will.—The late MR. W. EDGAR ALLEN, of Sheffield (Edgar Allen & Co., Ltd., Imperial Steel Works), left £271,068 gross and £251,792 net. Various charities and employés benefit to the extent of £150,000. After various legacies are dealt with, he leaves two-fifths of the residue to the University of Sheffield, partly to the Committee of the Applied Science Department, and partly for founding Edgar Allen Scholarships for students at the University.

NEW COMPANIES REGISTERED.

Drycells, Ltd. (139,605).—This company was registered on March 11th with a capital of £100 in 10s. shares, to carry on the business of manufacturers of electric refill batteries for pocket and other lamps. The subscribers (with five shares each) are : R. W. Gale, 259, Goldhawk Road, W., clerk; J. Dunkley, 46, Devonshire Road, Colliers Wood, Merton, S.W., electrician. Private company. The number of directors is not to be less than two or more than five; the first are R. W. Gale and W. H. R. Hargrave. Qualification £5. Registered office : 24, John Street, Bedford Row, W.C.

Sunlight Manufacturing Co., Ltd. (139,636).—This company was registered on March 13th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of and dealers in electric batteries for pocket lamps and torches, general electrical goods and accumulators, magnetos, motor-cars, motor and other cycles, etc. The subscribers (with one share each) are : J. Abrahams, 54, Redcross Street, E.C., manufacturer's agent; P. Abrahams, 54, Redcross Street, E.C., manufacturer's agent. Private company. The number of directors is not to be less than two or more than five; the first are J. Abrahams and P. Abrahams (both permanent). Qualification 100 shares. Registered office : 1 & 3, Paxton Road, Tottenham, N.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Sterling Telephone and Electric Co., Ltd.—Mortgage, dated 8th February, 1915, to secure £10,000 and further advances, charged on certain land at Dagenham, Essex, and company's undertaking and property, present and future, including uncalled capital. Holder : Secretary of State for War.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Charge, as substituted security on shares in Carville Site and Power Co., Ltd., which may be acquired by the company, dated 5th March, 1915 (supplemental to trust deeds dated 30th June, 1909, and 10th November, 1914, securing £854,500, debenture stock). Trustees : Rt. Hon. Viscount Ridley, and Rt. Hon. W. B. Cunliffe.

Foster Engineering Co., Ltd.—Issue on 10th February, 1915, of £2,208 7s. 2d. debentures, part of a series of which particulars have already been filed.

Carrara-Persilia Electric Railway and Power Co., Ltd.—Deed of further charge on a certain concession, and company's other assets, present and future, including uncalled capital, dated 25th February, 1915, supplemental to charge dated 25th May, 1914, to secure £40,000. Holders : Commercial Bank of Scotland, Ltd., 62, Lombard Street, E.C.

Curtis and Co., Ltd.—Particulars of £500 debentures, created 22nd February, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £50. Property charged : The company's undertaking and property, present and future, including uncalled capital. No trustees.

Rangoon Electric Tramway and Supply Co., Ltd.—A memorandum of satisfaction to the extent of £1,410 on 3rd February, and £4,785 on March 10th, 1915, of debenture stock, dated 1st February, 1906, 22nd December, 1908, and 5th November, 1913, securing £250,000, has been filed.

Edison Accumulators, Ltd.—Debenture, dated 10th March, 1915, charged on company's property, present and future, including uncalled capital, to secure all moneys due or to become due from the company to London County & Westminster Bank, Ltd., not exceeding £5,000.

CITY NOTES.

British Electric Transformer Co., Ltd.

THE directors report that they consider the result for 1914 satisfactory. The accounts show that after paying all manufacturing costs and expenses of administration there remains a net profit of £16,235, plus £4,108 brought forward, making £20,343. They recommend that there be placed to reserve account £5,000, to depreciation reserve £1,500, preference dividend of 6 per cent. £3,719, dividend of 7½ per cent. on the ordinary shares £6,410, extra remuneration to the directors £237, leaving to be carried forward £3,478. The directors refer to the death of Mr. J. F. Albright, the chairman of the company.

Annual meeting : To-day.

Bath Electric Tramways, Ltd.

THE traffic and other receipts for 1914 show a decrease of £1,410 for the 52 weeks compared with the 53 weeks of the previous year. But for the receipts obtained in respect of special military services rendered by the motor vehicles, the decrease in the earnings brought about by the war would have been more pronounced. Certain economies effected in operating costs have to a great extent been offset by additional expense incurred in connection with these military traffics. In September, 1914, the company was called upon to dispose of several of its torpedo cars to H.M. War Department. The cars thus impressed or disposed of to army contractors have reduced the motor fleet by 14 vehicles. Arrangements have, however, been made for replacing some of these vehicles at the earliest possible dates consistent with the requirements of the Army. The foundry belonging to the company continues to give most satisfactory results. Approximately one half of the company's employés have joined H.M.'s naval or military forces. After charging the expenses of operation and administration, there remains a balance of £16,133. After paying debenture interest and sinking fund charges, and paying the preference dividend for the year there is a balance of £5,224, which the directors recommend should be carried forward, and should be used towards replacement of the motor fleet, etc. They consider that, by the adoption of this policy, provision is made for depreciation in a most effective form.

Davis & Timmins, Ltd.—Sir Henry Mance presided at the annual meeting on 9th inst., and said that they had attained the results mentioned in the report in spite of the war, and not through business resulting directly from it. The outbreak of hostilities caused a serious set-back from which they did not entirely recover until nearing the end of the year, but their trading during the earlier months had been very satisfactory, and they were, therefore, able to show results nearly as good as those for 1913. Ready money had enabled them to secure the stock of metal absolutely necessary to carry on their work. They were full of work, and were likely to be so for a considerable time. Mr. G. E. Davis, the managing director, said that the opening of the war found them well equipped with good stocks of metal and an efficient plant. To-day they were in a favourable position to deal with the enormous pressure of orders that had been put upon them. The existing state of things was such that no man could tell what the difficulties of obtaining supplies, even against cash, might be in the near future, but anything that forethought and anticipation of events could do had been done, and would continue to be done. Though it was their first and bounden duty to give preferential treatment to war supplies, they were in no way neglecting their old customers, the mainstay of the business, and their best efforts were being used to cause them as little inconvenience as possible. Generally speaking, the whole of the works were employed on war material, either as contractors or as sub-contractors.

British Insulated and Helsby Cables, Ltd.—The profit for 1914 was £277,428, plus £98,267 brought forward, making £375,695. From this have to be deducted directors' and debenture trustees' fees, and remuneration to Works' Committee, £5,315; interest on first debenture stock, £22 500; interest on second debenture stock, £10,000; depreciation on buildings, plant, machinery, &c., £25,000; transfer to reserve account, £50,000; transfer to special reserve account, £8,500; transfer to first mortgage debenture stock redemption account, £5,000: pension fund, £25,000: dividend on preference shares to December 31st, 1914, £30,000; interim dividend on ordinary shares to June 30th, 1914, £20,000, leaving available for dividend £174,380. The directors recommend a further dividend of 11s. per share on the ordinary shares, making a total of 15 per cent. for the year, £55,000, carrying forward £119,380. There has again been an increase in the volume of trade compared with last year, and this has resulted in an additional profit of £30,077. £25,000 is applied to depreciation on buildings, plant and machinery, as against £22,000 last year. An amount of £25,000 has been set aside to form the nucleus of a pension fund, and the directors will ask the shareholders to approve this proposal. Annual meeting, March 22nd, at Liverpool.

W. T. Henley's Telegraph Works Co., Ltd.—The directors report that during 1914 a profit of £119,246 was made. Deducting directors' and auditors' fees, debenture interest, income-tax, and amount written off for depreciation on buildings and machinery, £29,121, and adding £59,065 brought forward, there is a total of £149,191. Deducting transfer to reserve account, £20,000; transfer to special reserve account, £10,000; dividend on preference shares to December 31st, 1914, £9,000; interim dividend on ordinary shares, £10,000; and income-tax on interim dividend on ordinary shares, £771, there remains an available balance of £99,420. The directors recommend the payment of a final dividend on the ordinary shares of 10 per cent., less income-tax; making 15 per cent. for the year; and also a bonus of 5s. per share, less income-tax, and this will require £30,000, leaving £69,420 to be carried forward. Annual meeting: to-day.

Automatic Telephone Manufacturing Co., Ltd.—With reference to the paragraph in our last issue the directors' report now received shows that the profit for the year 1914 was £38,248 plus £3,219 brought forward. Directors' fees require £2,450, depreciation on patents, goodwill, buildings, plant and machinery absorbs £5,760, there is written off underwriting commission on shares £3,500, written off preliminary expenses £1,700, the dividend on preference shares requires £12,000, and after paying 3 per cent. on the ordinary shares, £5,256 will remain to be carried forward. During the year more progress has been made in the installation of automatic telephone equipment, and the general business of the company has been satisfactory. Annual meeting, March 22nd at Liverpool.

Dublin and Lucan Electric Railway Co.—Mr. J. W. Hill, presiding at the annual meeting, stated that the gross receipts were £7,367, being £40 less than in the previous year, and the expenditure had decreased by £12. The balance was £362, which was carried to next account, payment of cumulative preference dividend being postponed. Receipts for the sale of electric current in 1914 amounted to £208, against £142 in 1913. It was announced that the company had secured a favourable contract for the carriage of mails and parcels between Dublin, Chapelizod, Palmerstown, Lucan and Leixlip.

Mexican Northern Power Co.—The *Financial News* states that a meeting of the holders of the 5 per cent. first mortgage 30-year gold bonds is to be held on March 30th, for the purpose of consenting to the company's issuing from time to time the remaining $2,000,000 6 per cent. prior lien 30-year gold bonds.

South London Electric Supply Corporation, Ltd.—The directors have declared the dividend on the 6 per cent. cumulative preference shares for the half-year to April 1st next, payable on that day.

Madras Electric Tramways (1904), Ltd.—The accounts for 1914 show a gross profit of £21,522. After debiting interest and London office expenses, making provision for the debenture stock sinking fund, and transferring £7,000 to the depreciation and renewal fund, there remains a balance of £9,300, plus £3,321 brought forward, making a total of £12,621. A dividend of 6 per cent. per annum on the preference shares absorbs £6,000, a dividend of 5 per cent. per annum on the ordinary shares requires £2,863, there is written off from the cost of issue of new preference shares £500, leaving £3,258 to be carried forward. The traffic receipts show an increase of 3 5 per cent. upon 1913. Down to the end of July the increase was 8 7 per cent., but since that date the receipts have suffered on account of the outbreak of war. As heretofore, the undertaking has been maintained out of revenue, and special improvements and renewals have been debited to the depreciation and renewal fund. The reserve arising from the debenture stock sinking fund now amounts to £6,280. Annual meeting, March 23rd.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—Holders of this company's 6 per cent. bearer bonds are informed that, owing to the situation created by the war, it is almost impossible to get deliveries of suitable material at reasonable prices. The board therefore intend to defer the expenditure on those works for which the money was raised by the issue of 6 per cent. bonds. Consequently, it is proposed to redeem bonds to the value of £10,000, and holders are asked whether they are willing for a portion or the whole of the bonds they hold to be redeemed, plus accrued interest to date. The offer to repay at so early a date is exceptional, as also are the causes which have led to the offer —*Financier.*

Wycombe (Borough) Electric Light and Power Co., Ltd.—At the annual meeting on 10th inst., the directors reported that further progress had been made during 1914, the connections having risen to 68,306, an increase of 3,056 equivalent 8-C P lamps. Including £169 brought forward, there was a profit to the credit of net revenue account of £6,506, and after paying interest on debentures and outstanding accounts amounting to £3,322, there remained £3,184 available for distribution. A dividend at the rate of 2½ per cent. for the year will absorb £1,000, and £2 000 is to be placed to the reserve fund for renewal account, leaving £184 to be carried forward.

Shawinigan Water and Power Co.—The revenue from all sources for the year 1914 was $1,805,217; the net income, after making provision for operation and interest, was $1,081,347. After paying a dividend at the rate of 6 per cent. for the year, there is transferred to reserve and sinking fund $200,000, to depreciation reserve $100,000, to contingent fund $20,000, and the surplus undistributed is $39,472. The net revenue bears the ratio of 8·6 per cent. to the total outstanding common stock at the end of the year, but the proceeds of the issue of $1,375,000 of common stock were received only in July, 1914.

Wedmore Electric Light Co., Ltd.—At the annual meeting the managing director (Mr. W. G. Burrough), who presided, gave a full report on, and expressed the entire satisfaction of the directors with, the year's working, although they were only able to recommend payment of dividend at 4 per cent. instead of £5 per cent. The set-back was caused by increase in the price of materials for wiring houses, &c., and would not recur. A vote of thanks was passed to the managing director for his voluntary efforts on behalf of the company during the year.

Wemyss and District Tramway Co.—An income of £14,955 shows that the war has not seriously affected receipts, while the management effected economies in several ways. The directors recommend that, out of the profit of £6,819, a dividend of 7½ per cent. be paid on ordinary shares, and 1½ per cent. extra on the 6 per cent. preference shares—7½ per cent. in all—and the balance, £1,580, be carried forward. During the year the doubling of part of the line was completed.

Ontario Power Co. (of Niagara Falls).—The report for 1914 shows total receipts $1,825,320; net income, $1,398,522; interest, $898,443; surplus, $500,078. Owing to the provisions of the Railway Act of Canada, which are by charter made applicable to the company, the declaration of dividends should be made by the shareholders at the regular annual meeting. The payment of dividends during the year 1915 will not therefore be made in quarterly instalments.—*Financial News.*

Oldham, Ashton and Hyde Electric Tramway, Ltd.—For 1914 the revenue was £33,398, and the expenditure £26,024, leaving a net profit of £7,374, plus £147 brought forward. It is proposed to place to reserve fund £1,000, to pay a dividend at the rate of 6 per cent. per annum on the ordinary shares, and to carry forward £1,021.

Folkestone Electricity Supply Co., Ltd.—For 1914 the directors report a net revenue, including £538 brought forward, of £20,024. After transferring £5,661 to depreciation account and placing £8,500 to reserve, a further dividend of 4 per cent., making 7 per cent. for the year, is recommended, leaving £1,438 to be carried forward.

Liverpool District Lighting Co., Ltd.—After transferring £1,000 to reserve fund, a dividend at the rate of 4 per cent. per annum, less income-tax, is to be paid for the December, 1914, half-year.

Direct Spanish Telegraph Co., Ltd.

The accounts for 1914 show, after providing for interest on, and redemption of, debentures, and for the dividend on the preference shares, a balance of £28,898. The directors consider the opportunity a favourable one for dealing with the question of depreciation on the company's investments which has been progressive for several years, and now amounts to the large sum of £19,212. They therefore propose to apply the balance of £28,898 as follows:—Dividend on the ordinary shares at 4 per cent. per annum £2,586, bonus on ordinary shares of 2 per cent. £1,293, to writing down Stock Exchange securities £19,212, to reserve fund £5,000, and to carry forward £807. Both the dividend and the bonus on the ordinary shares will be paid free of income tax. The £30,000 4½ per cent. first mortgage debentures created in June, 1894, fell due for payment on June 30th last, and were redeemed at that date. To enable this to be done without realising securities at a considerable loss, a loan of £30,000 was obtained from the Eastern Telegraph Co. The Bilbao cable became interrupted on September 23rd last, three knots from the landing place in Cornwall, and the necessary repairs were carried out by the cable steamer *Electra*, the cable being reopened for traffic on September 27th after an interruption of five days. The cost of these repairs, viz., £328, has been charged to revenue.

The annual meeting was held yesterday.

County of London Electric Supply Co., Ltd.

The annual meeting was held on Monday, at Winchester House, E.C. Mr. J. B. Braithwaite, who presided, said that they would remember that at the last meeting he told them they proposed to issue 10,000 additional preference shares of £10 each and 6,000 additional ordinary shares of £10 each, which raised the figure of each denomination of share to £650,000. The issue was made on terms which secured them a premium of £19,000, and they proposed to utilise £5,000 of that sum in writing down preliminary expenses, carrying forward £14,000 as a reserve against any future contingencies that might arise. The issue was over-subscribed and they had every reason to congratulate themselves upon having made it when they did, as after the war broke out it might have been very difficult for them to find the funds they required for the development of the business. On the credit side of the balance sheet there was a considerable increase in the investments. That was due chiefly to the purchase of a block of shares in the South London Electric Supply Co. That was a company whose area adjoined their own, and whose system of supply was also identical with theirs, and it was a company with whom there appeared to be a good opportunity of their working together in closer relations, and it was possible that something might be done in that direction during the present year. The South London Co. had shown considerable progress even this year, when the bulk of the London companies were showing decreases in revenue and in earnings. They had expended a good deal of capital during the past year, but when they saw what the results had been he thought they would say that none of it had been expended unwisely. They had expended altogether £167,916, of which £94,917, or 56.52 per cent. of the total, was for mains. Included in that expenditure on mains was a considerable amount for a new inter-connector between their station at City Road and their Wandsworth station. Already they had derived considerable advantage from that inter-connector—the engineer-in-chief telling him that during the first two months of the current year its use had enabled them to secure an economy of 15 per cent. The rest of the expenditure on mains had been made on the lines he had previously indicated. They did not lay mains at random—they only laid them where they would bring them profitable business, and that had been the case this year. In spite of the five months war period which the accounts covered, the earnings had increased from £255,670 to £274,080, an increase of £18,410. £14,000 of that increase was due to increased receipts from sale of current, the balance being made up by increased rentals of meters and increased dividends from their investments, which included the return on the South London Electric Supply Co. shares to which he had referred. They were able to carry to net revenue £164,043 against £147,812, an increase of £16,231. In other words, of the £18,410 gross increase they retained £16,231 as net and available for distribution. In view of the special circumstances which prevailed he thought they would agree that such a result reflected very great credit upon their technical staff; and the increase in the gross revenue reflected equally great credit upon the commercial staff. Out of the net revenue they had placed £40,000 to reserve for depreciation, repairs and renewals, instead of £33,000 as last year; in other words, they were placing an additional £7,000 to that fund, and after doing that they carried forward to the balance sheet £86,841 as against £76,978 last year, or roughly £10,000 more. They had therefore disposed of the increased revenue of £16,000 by placing £7,000 extra to the depreciation fund, they had paid the dividend on the new capital, which had absorbed £4,405, and they proposed to raise the carry forward by £5,458—from £7,000 to £12,500. Even after placing the £7,000 additional to depreciation, raising that allocation to the substantial sum of £40,000, they still earned double the amount required to pay the dividend on the additional capital, which would show them that that capital had been profitably and judiciously expended. They might think that £69,558 was rather a small sum to carry into the balance sheet for depreciation, but he must remind them that that was the balance still available for depreciation, and took no account of the £108,000 which they had already written off that account. With regard to the obsolete plant, he told them last year that they had written off the whole of such plant at City Road. This year they had allocated to the demolition account the whole of the obsolete plant at Wandsworth, and after writing off the sum they had allocated for the present year, there was only £30,000 to the debit of the demolition account; and they had £69,000 left in the account. There were very few companies which were in such a really sound position as regarded their plant as they were. In regard to the business done, in spite of the check caused by the war during the last five months of the year, they had the pleasure of reporting another record in the new business. Last year and the previous year they created a record, and again this year they had a record with new applications of 5,206 kw., which was easily ahead of anything they had secured in any previous year. That reflected the greatest credit upon their commercial staff. It had been obtained by the addition of 1,897 new consumers, bringing the total number of consumers to 24,212, the largest number that any London electric supply company could show. The increase in units sold was 2,269,418, or nearly 9 per cent.; the total sales for the year being just over 28 million units. With regard to the associated companies, the Bournemouth Co. had maintained its dividend at 7 per cent. and the Coatbridge and Airdrie Co. still continued to expand its business, the increase for the past year being the very substantial one of 1,841 kw. The war had prevented the past year from being one of almost phenomenal prosperity with them. They had suffered very severely by the increasing stringency of the lighting restrictions which the Admiralty had imposed upon London and the surrounding districts; but in spite of those restrictions they had progressed to the extent he had indicated. The war had also had a serious effect on their staff; 120 members had responded to the country's call and were serving in H.M. Forces. He was sure the shareholders would approve of the arrangements they had made that those men should not suffer financially in any way. The fact that so many had responded to go to the front had necessarily thrown increased anxiety and strain upon those left behind. He would like to take that opportunity of testifying to the unswerving loyalty and cheerfulness with which those members of the staff who had stayed at home had worked the additional hours and submitted to the additional strain. They would expect him to say a few words about the Parliamentary position. When they met last year he had hopes that common-sense might prevail and that the Bill, of which they were the nominal proprietors, which was put forward by influential bankers, for the unification of the London electric supply, might have had a fair chance of becoming law. He was sorry to say that owing to jealousy nearly all the London companies opposed the Bill, and their opposition reached such a height that the promoters felt it was no use wasting any more money, and they reluctantly withdrew it. It was not their fault that the position of electric supply in London was not now on a satisfactory basis. Their efforts, however, had not been altogether in vain, because this year three Bills had been introduced, one by the L.C.C., which was an exceedingly important Bill which followed almost exactly the same lines as their Bill of last year. The Council had adopted both of the suggestions which they made in their Bill last year. It provided for the acquisition of the companies by the L.C.C. or some statutory body to be created for the purpose, and the leasing back to them of their undertakings for a period of 50 years to be worked by them. It also defined exactly what price the companies should get at the end of the 50 years. They did their best to help the L.C.C. with their Bill, but apparently the incurable jealousies and the smallness of outlook of the London companies caused them to again oppose the Bill, with the result that the Council failed to secure the necessary three-fourths majority to bring it forward, and the Bill had therefore been withdrawn. They had, however, put their hands to the three points which were of the utmost importance to shareholders in the London electric light companies—first that it was a fit and honourable thing that they should have their period of purchase extended to 50 years, second that the best results were to be obtained not by municipal ownership and management but by municipal control and company management; and, third, that it was fair to place the settlement on such a basis that, instead of being dependent upon the result of some arbitration, those who were engaged in the supply of electrical energy to London should know exactly what they were going to get at the end of 50 years' time, so that they might be able to make proper provision for the redemption of their capital. He thought it was a very great gain to have had those principles embodied in a Bill put forward by the L.C.C. Ten of the companies put forward a Bill of their own, and it might come as a surprise to the shareholders when he told them that although those companies threw out the Bill which the County of London Co. promoted last year on the ground that it was foolish to ask the L.C.C. for 50 years, the associated companies had adopted that proposal in their Bill. The companies, apparently, could not agree among themselves, and their Bill had been withdrawn too. As far as the directors of the County of London Co. were concerned, they did not intend to allow the question to rest where it was. They had a very clear view as to what was the proper policy to pursue, and they proposed to forward the unification of the electric supply of London by every means in their power. He had already alluded to a possibility of their coming into closer working relations with the South London Co. They had acquired a very large area in the Romford district and they proposed to go forward with the lighting there, and by next year he hoped to be able to tell them that they had commenced a supply there; and step by step they proposed as opportunity offered to follow up their policy of doing their utmost to unify the supply, and place the electric supply of London, as far as they had power to do it, on a satisfactory and sound commercial basis. The outlook for the current year was the most difficult matter that confronted him. We were in the middle of a great war, and none of them knew when it was going to end. At the present time conditions were somewhat unfavourable for electric supply companies owing to the dislocation in coal prices and other difficulties. They would do the best they possibly could to meet those conditions. Both the gas companies in London had increased their prices, and, although they would do it reluctantly, it might be necessary for them to ask some of their customers to share with them the burden of the excessive cost of coal while the war lasted. If they found it necessary they would do that in order to protect the interests of the shareholders, and he had no doubt that the consumers would regard any increase in the price of current as part of the sacrifice which they would have to bear in order to carry on the war. He was glad to say that up to date the applications for new business were slightly in excess of those up to the corresponding period last year, and the units sold had increased by 4 per cent.

Mr. F. W. Reynolds seconded the motion.

Mr. J. J. Bisgood congratulated the board upon the report and also in regard to their policy for unifying the supply of electricity to London. No matter what happened in the future, it would always stand to the credit of the board of that company that they suggested a solution of that great problem.

The report was adopted.

Metropolitan Electric Supply Co., Ltd.

Mr. W. Harrison Cripps presided on Tuesday, at Winchester House, E.C., over the annual meeting of this company. After reviewing the finances as given in the report, he said that in regard to the capital expenditure, the money was raised partly by a further issue of their 3½ per cent. debentures and partly against the reserve fund. It was spent partly upon generating and distributing plant and partly in providing connections for new consumers. At Willesden, in addition to minor improvements, they had installed a new 4,000-KW. Parsons turbine. They had had nine months' experience of this machine and found that it was saving them a large amount in coal, water and oil, thus materially reducing their running costs. It was working in the most satisfactory way. They had also bought some freehold land in the Holborn district and had erected a building to accommodate large storage batteries, the effect of which would be to save the generation of many kilowatts at Willesden on the peak load. During the last few years they had been making considerable additions to their reserve fund: thus during the three years 1908 to 1910 they placed £15,000 annually to reserve. In 1911 this was increased to £17,000, in 1912 to £20,000, and in 1913 to £22,000. This year they proposed making a similar addition to the fund. He would remind them that when they had Marylebone, and their generating station at Sardinia Street, considerable sums had been put aside against the depreciation of those properties for which they received under the two arbitrations payment in full using the money they obtained in buying new plant for the remaining parts of their undertaking. These reserves thus became available to increase the amounts set aside in respect of the remaining plant, much of which had been acquired within the last twelve years. If the past year had been a normal one the position of the company, judging from the results of the first six months, would have been quite satisfactory, but the year was not a normal one. When they made up their accounts in July for the first six months there was a satisfactory increase both in new business and receipts, the result showing a satisfactory margin over costs. The actual number of new customers in the year was 1,620. The increased connections had been 1,550 KW., or an equivalent of 50,000 25-C.P. lamps. This was practically as good a progress as they had made in any one year. The new connections were at present coming in at a favourable rate. In spite of the war they were in excess of the corresponding period of the previous year. In August, like a bolt from the blue, the war was upon them, unsetting every calculation. They soon had difficulty in keeping up their coal reserves and the prices began to rise. They had to part suddenly with some of their most experienced workmen; they had also to make provision for guarding their works and the exposed portions of their mains, and it at once became evident that their expenditure during the last half of the year would be increased. When October arrived a new unforeseen loss of revenue had to be faced. They must bear in mind that, owing to the situation of their undertakings, chiefly in the West of London, the main source of income was from the sale of light, and October, November and December were the most important and profitable months for selling light; indeed, as much light was consumed during these three months as was the case in the six summer months of the year. Just as this important period commenced the order came for reducing all light to a minimum. They did not complain of this. They supposed it was necessary, but the shareholders had had to sacrifice a considerable part of their income for the general safety of London. To show the effect of this, he might mention that the revenue for lighting in their London areas decreased by over £10,000 in the last quarter of the year. The reason why the net decrease was no greater than about £2,000 was due to the large amount of new business they had been able to secure in the western areas. He only gave this as an explanation for the fall in revenue, which was in no way due to any permanent diminution of their business. It was one of the incidents of the great war. How long it would last who could tell, but sooner or later it would pass, and he hoped that the trade and prosperity of the country, upon which the electric supply industry depended, would have a quick and vigorous revival. During the past year an attempt had again been made to consolidate the electric supply of London. The Bill which the London County Council was to introduce failed owing to it not obtaining the necessary two-thirds majority of the whole Council. Most of the companies, subject to the settlement of certain details, were not necessarily in opposition to the Council scheme, the essential of which was the purchase by agreement by a new authority of the present companies of London. The new authority was to delegate its powers, safeguarded in many respects, to a new company to take over the actual working of the undertaking. The companies, failing any satisfactory agreement with the London County Council, had a Bill of their own to effect a combination of the majority of the present undertakings. This Bill was to provide for the alteration of the present terms of life and to place the future purchase of the undertakings on a more satisfactory footing. These two Bills, with certain modifications, were not inconsistent with each other, but their Bill had had to be withdrawn in deference to the views expressed by the Chairman of Ways and Means that no private business of such magnitude should be undertaken during the present session. They believed that a proper combination of the present companies would reduce costs and would ultimately be an advantage to the consumers of electricity. They did not regard the matter as dropped, but merely postponed to a more favourable season. The year had been an anxious one to their staff, and had entailed much extra work. The directors wished to thank them all for what they had done, and would especially mention their two chief officers, Mr. Highfield, the engineer and manager, and Mr Cunliffe Owen, the secretary, for the zeal and devotion which they, with other members of the staff, had shown in the interests of the company during this very trying period. No less than 58 of their employés responded to the first call and were now away at the front. If these men served their country with the same faithfulness that many of them for years past had served the company the British Army would contain no finer body of men, and they knew that when they returned it would be with honour to themselves and their country. He wished to speak well of those who still remained in their service. Many of these also would have liked to have joined, but the board felt that they were equally doing their duty by their work in keeping up a regular supply of electricity, one of the most essential necessaries for London at the present time. They could not let their men leave them for the war without doing something towards the support of their families during their absence. The directors had made some provision for this.

Sir J. Pender, Bart., seconded the motion.

Mr. H. L. Cripps expressed his approval of the Chairman's statement that it was intended to proceed with the Bill for amalgamation when the time was opportune. He felt great confidence that amongst all the business men of the London County Council, no matter what their politics might be, there was a very strong feeling in favour of the policy which the Chairman had indicated, and which had been expressed in their own Bill.

The report was adopted.

Braunton Electric Light and Power Co., Ltd.

At the annual meeting recently held it was reported that the net revenue account showed a balance of £238. The directors recommended a dividend of 5 per cent (less income tax) on the cum. pref. shares, amounting to £23, a dividend of 2½ per cent. on the ordinary shares (less tax) £63, writing off a further £30 from formation expenses, and 5 per cent. for depreciation of machinery, plant and accumulators, and 2 per cent. off mains, cables and services, amounting to £100, leaving £22 to be carried forward. The net revenue account showed that £234 was yielded from private lighting supplies, £77 from contract lighting, and £50 from contract pumping.

Mr. Yeo, who presided, gave figures showing the advance made annually since the company was inaugurated a few years ago, and considered the position of the undertaking most satisfactory.

Electrical and Industrial Investment Co., Ltd.

An extraordinary general meeting was held on Monday at Electrical Federation Offices, Kingsway, under the presidency of Mr. E. Garcke, when the Chairman formally proposed the following resolution for reducing the capital of the company:—

That the capital of the company be reduced from £400,000 divided into 200,000 six per cent. cumulative preference shares of £1 each, 100,000 of which have been issued and are fully paid, 100,000 issued and fully paid seven per cent. preferred ordinary shares of £1 each, and 100,000 deferred ordinary shares of £1 each, 90,000 of which have been issued and are fully paid, to £314,500, divided into 200,000 six per cent. cumulative preference shares of £1 each, of which 100,000 have been issued and are fully paid, 110,000 seven per cent. preferred ordinary shares of £1 each, of which 100,000 have been issued and are fully paid, and 90,000 deferred ordinary shares of 1s. each, all of which have been issued and are fully paid, and that such reduction be effected by cancelling capital which is lost, or is unrepresented by available assets to the extent of 19s. per share upon each of the 90,000 fully paid deferred ordinary shares of £1 each, which have been issued and are now outstanding, by reducing the nominal amount of each of such shares to 1s., and by converting the 10,000 unissued deferred ordinary shares of £1 each into 10,000 unissued preferred ordinary shares of £1 each.

Mr. Garcke remarked that he fully explained the reasons for the resolution at the recent annual meeting, and he might say that while they had not received a single proxy against the proposal they had received a large number in favour of it.

Mr. Cunningham seconded the resolution, and it was carried.

Subsequently a similar resolution was passed by the holders of the deferred ordinary shares of the company.

South London Electric Supply Corporation, Ltd.

The gross receipts for the year 1914 were £55,030, while the expenditure was £25,431, leaving £29,599, plus £728 brought forward. After placing to depreciation account £5,416 (making the fund £50,000) and writing off special items capital account £978, also making provision for the dividend on 6 per cent. cum. pref. shares due October 1st last, and accrued to the end of the year 1914, debenture and other interest accrued, etc. £14,428, there remains £15,899. Out of this the board recommend a dividend on the ordinary shares at the rate of 5 per cent. for the year, amounting to £13,000, carrying forward £2,899. During the year new connections representing the equivalent of 38,742 (35 watt) lamps, or 1,355 kw., were added to the company's system, making a total connection at the end of the year of 340,866 (35 watt) lamps, the equivalent of 11,900 kw. The units sold during the year amount to 6,153,241, and show an increase of 412,015 or 7.2 per cent. over the previous year. The ratio of total costs to revenue is 46.2 per cent. The plant, machinery and mains have been maintained out of revenue in an efficient condition. The report refers to the position of the two London Electric Supply Bills which are not to be proceeded with at present.

Units generated	7,669,760
Sold to consumers and used by public arc lamps	6,153,241
Used on works for lighting, meter testing, and motors ...	414,960
Total	6,568,201
Expended in distribution	1,101,559
Total connections	11,900 kw.

Annual meeting, March 23rd.

Salisbury Electric Light and Supply Co., Ltd.

The report for 1914 states that the generating plant has been sufficient to meet the output and the whole of the plant is in thorough working order and capable of dealing with a considerably increased demand. The profit on the year's working, including £1,098 brought forward, amounts to £6,994, and after paying £1,044 interest on debentures and an interim dividend at the rate of 4 per cent. for the half-year, amounting to £700, there remains £5,250. The directors recommend that a further dividend at the rate of 8 per cent. for the half-year be paid, making with the interim dividend, 6 per cent for the year, and that £2,400 be carried to reserve, leaving £1,450 to be carried forward.

Mr. F. E. Gripper presided at the annual meeting, held on March 9th. He first referred to the death of the Chairman, Mr. W. M. Hammick, who was practically the founder of the company. They were hoping to induce Mr. Woodrow, a Salisbury man, to become chairman. The company had had quite a good year. In spite of war troubles and the great difficulty there had been in the matter of coal transit, it had been the most successful year they had had. The staff had responded extremely well to the call of their country in joining the colours At the commencement of the war they had 23 members of the staff, and 30 per cent. of those were now serving with the colours. The company had made arrangements to give those men a generous allowance during the time they were away, and were reserving their positions as far as it was possible to do so. There had been a considerable amount of economy in lighting since the war began, and that had reduced the amount of current which would have been used under ordinary circumstances. In spite of that, their receipts on the revenue account were £138 larger than last year, while the costs of running were only £88 more, about half of that amount being due to the increased cost of coal. Altogether they had £352 more to deal with than they had last year. They thought it advisable, under present conditions, to carry forward a substantial amount, so that they might have provision for any trouble that might turn up. But for the existing conditions he thought the directors would have been justified in paying another 1 per cent., but the more prudent course was not to increase the dividend this year and to live in hopes of being able to do so next year. The company was in a very sound financial position.

Mr. A. C. Bothams seconded, and the report was adopted.

The Chairman mentioned that the directors had elected Mr. J. C. Wigham, one of the representatives of Messrs. Edmundson, to fill the vacancy on the board caused by the death of Mr. Hammick.

Brompton and Kensington Electricity Supply Co., Ltd.

The revenue account for 1914 shows a credit balance of £30,271, plus £7,153 brought forward, and £322 balance of interest received and accrued, making a total of £37,746. After deducting £1,273 for interim dividend on the 7 per cent. cum. pref. shares, and £7,360 interim dividend (free of income tax) at the rate of 9 per cent. per annum for the half-year to June 30th on the ordinary shares, the directors recommend that £29,114 be dealt with as follows:—Written off cost of investments £1,100, written off the shares in and advances to the Brompton and Kensington Accessories Co., Ltd., £4,000, reserve fund account (raising it to £46,000) £6,500, dividend on the preference shares for December half-year £1,052, dividend on the ordinary shares for December half-year at the rate of 11 per cent. per annum, making 10 per cent. for the year, £9,315, income tax on interim dividend £521, directors' additional remuneration £1,000, leaving to be carried forward £5,626.

Year.	8-c.p. lamps connected.	Inc. in 8-c.p. lamps.	Customers connected.	Gross receipts.	Expenditure	Net receipts.	Av. price per unit.	Div. on ord. shares.
1912	272,701	18,147	5,798	£56,848	£23,170	£33,178	4·18d.	10%
1913	291,108	18,407	6,118	£56,484	£24,984	£31 500	4·08d.	10%
1914	310,258	19,130	6,350	£56,370	£26,099	£30,271	3·92d.	10%

The annual meeting was held yesterday.

Edison Accumulators, Ltd.

Mr. Bernard M. Drake, M.I.E.E., presided on Friday, at 2, Duke Street, S.W., over the first annual meeting.

The Chairman, in moving the adoption of the report, said the results shown in the balance sheet were fairly satisfactory, due allowance being made for the abnormal times through which they were passing. The item under the profit and loss account for staff, offices, and selling expenses might appear high, but they would understand that in initiating the industry of the company, which was new to this country, it was necessary to be constantly running cars for demonstration purposes, and enquiries had to be followed up closely so as to educate the public as to the results which might be expected under various working conditions, and the particular ones for which their products were best suited. It had also been necessary to prepare special designs to suit the conditions prevailing in England, which in many cases were different to those in America and elsewhere. They would notice amongst the assets an item of £4,845 under the heading of "royalties paid in advance." He might explain that in order to obtain the concession for the sole rights of the Edison battery for England a sum of about £5,000 had to be paid in advance. This amount, however, was being credited to the company on orders as placed with the Edison Co. of America. For part of the period under review they were unfortunately paying for two sets of offices; their former offices, however, had now been let, so that this extra outlay would not recur. At the end of the year there were sufficient unexecuted orders on the books to have enabled them to show a profit had it been possible to obtain the necessary equipment in time. As regarded the future, they would be pleased to hear that encouraging reports were being received concerning the results obtained with the vehicles now at work. Not only was the cost per ton-mile comparing very favourably with that of other road transport systems, but the reliability, ease of manipulation, and quiet running of the Edison accumulator vehicles were proved to be advantages with which no other system could hope to compete. An objection sometimes raised to the use of electric vehicles was the trouble of recharging and the time occupied in this operation. This, however, would largely disappear with increasing use and additional charging stations. One special feature of the Edison battery was the rapidity with which it could be recharged. Another important point with regard to the working of electrically propelled vehicles was that the cost of generating and supplying current was steadily decreasing, whereas the cost of petrol or other fuel for the internal-combustion engined commercial and private cars had been continuously rising. To give them a practical example, he might mention that one Borough Council engineer had found that four 2-ton tipping wagons had replaced no less than 11 horses and carts, besides doing the work of refuse collection more efficiently. Although the first cost was heavier, it was claimed for the Edison battery that being composed of more durable materials it could successfully withstand vibrations and hard work which would shorten the life of lead batteries, so that in the end the cost for traction work would be lower. The life of a lead battery was now pretty accurately known, and was short, but the life of the Edison battery, judging from examinations of batteries which had been in use and showed no deterioration whatever, would be indefinitely long. The Edison battery had also a very distinct advantage in that it suffered no deterioration from being completely discharged, or even left in a discharged condition, a state of affairs which was very prejudicial to lead batteries. Mr. Edison was reported to have said that in his opinion the nickel iron alkali battery would play an important part in the transportation of the future. This statement was already verified in America, but in England they were slow to move in anything new, and it was often difficult to overcome the want of enterprise shown by the older established stores, cartage contractors, and other firms, who were content to wait until their more up-to-date competitors had shown what could be done. Arrangements had been concluded with the firm of Drake and Gorham, Ltd., of which he was chairman, under which their widely-spread organisation would be available for pushing the sale of Edison vehicles, especially in Lancashire and Cheshire, for which district they had purchased a two-ton truck which was constantly employed in making demonstrations. He was glad to say that the orders received since the expiration of the period covered by the balance sheet had been most satisfactory, in fact they amounted to over three-fifths of the total during the period covered by their balance sheet. He had every hope, therefore, that when next they met the directors might be in a position to recommend the payment of a good dividend.

Col. H. C. L. Holden seconded the motion.

A shareholder remarked that the statement was most encouraging, and he hoped the board would be in no hurry to pay dividends.

The Chairman said that was advice they rarely received from shareholders.

The report was adopted.

Oxford Electric Co., Ltd.

Sir Henry Mance presided at the annual meeting, held at Oxford on March 5th. The Secretary (Mr. H. Eeles) read the Chairman's financial memorandum, which showed that the capital expenditure was less by £4,623 than for 1913. In the revenue account the expenses were adversely affected by increased price of commodities, increased taxes, and heavier wages, due to the war. The revenue had increased by £400. The item of street lighting showed a decrease, as the account had been charged with the cost of providing a system of incandescent lighting to take the place of the large arc lamps which were extinguished some weeks ago. Cost of carbons had largely increased owing to shortage of imports. The balance of gross profit was less by about £500, approximately ½ per cent. on the ordinary share capital. The Chief Engineer (Mr. F. H. Francis) read a report on the engineering work of the year, plant alterations, mains extensions, new installations, etc. There seemed to be a growing demand for 2 and 3-H.P. motors for such work as boot-repairing, firewood making, etc. In regard to new services, 1913 was an exceptionally good year, and but for the war they would probably have broken the record in 1914. The price of coal had increased nearly 4 per cent., and fuel oil for the Diesel engine by 31 per cent. They were deprived of the use of the Diesel engine for a considerable period in consequence of an accident in September. It was now in use again, but with a reduced output. The repair of the third cylinder, the one severely damaged by the accident, was now under consideration, and would be taken in hand as soon as possible. Their present stock of coal would last eleven weeks, and with the assistance of the Diesel engine three months. The prospects for lower prices of fuel were not encouraging.

Sir Henry Mance, in the course of his address, said that he had taken the view that in this period of great national stress, when investors would be disappointed in many of their sources of income, it was their duty to pay to the shareholders every shilling they could which had been fairly earned and which they could prudently do. They would continue to act on that policy. They were doing remarkably well when the war broke out and looked like having a revenue £1,000 in excess of the previous year, but they were affected by the colleges and allied institutions needing less current, and by the prohibition of private outside lighting. Personally, he believed that the citizens of Oxford were in greater danger during a thunderstorm than they would be from the visit of a hostile aeroplane. Some of the staff had volunteered to do the duty of one of the employés who was at the front, by means of overtime, for which they asked no extra remuneration. The issue of preference shares made last month had been several times oversubscribed for. The shares were offered to the shareholders a few days before the Treasury minute appeared. He saw one of the Secretaries to the Treasury and was informed that there was no objection to the issue, but it would be necessary to communicate with the Treasury when they applied for a Stock Exchange quotation. Sir Henry said that he did not suppose that the most sanguine amongst them anticipated that the war would be over before the autumn, and that being so they must not expect any increased demand for current on the part of the colleges and allied institutions. Still, if they were to put the question to him, "were they downhearted?" he would reply emphatically "No!"

The report was adopted.

Waste Heat and Gas Electrical Generating Stations, Ltd.

The annual meeting was held in Newcastle-on-Tyne on the 10th instant. Mr. E. L. Pease, who presided, said that Dr. Simpson (the Chairman) and Mr. F. S. Newall were prevented by illness from being there that day. The capital expenditure on buildings, generating plant and machinery totalled £273,994, which was nearly £3,000 less than last year. The reduction was due to one of their customers having exercised his option to purchase some electric motors and other plant which that company had supplied on hire-purchase terms. The value of the plant sold under the agreement was £3,922, but on the other hand they had paid on capital account during the year £980. The profits for the year were £39,001, an increase of £756 over the previous year, and they were transferring an extra £1,000 to the reserve fund. The profits available for distribution were £40,611, as compared with £37,710. Since the outbreak of war there had been a slight decrease in the amount of waste heat obtained at some of the stations; compared with the corresponding period of the previous year, it represented in units of electricity about 7 per cent reduction. This did not mean, of course, that the company's profits during that period had necessarily decreased to that extent; as a large part of the revenue was received in the form of fixed charges which were paid by the electric power companies for the use of the stations. He would not venture to give any forecast as to the probable results of this year. The company's supplies of waste heat and gas depended largely upon the regular working of coke ovens and blast-furnaces, and if those businesses were seriously affected by the war they would themselves be affected also. The company had not erected any new generating stations since the last report, but the directors had had recently under consideration the advisability of installing some additional plant at Weardale power station, in view of a more efficient utilisation of the gas received from the coke ovens, and they had also made arrangements to erect some further plant at the company's Grangetown power station with the object of maintaining greater output from the plant installed there. If those works were carried out it was estimated that they would involve an expenditure of £35,000 to £40,000, which would be within the company's available cash resources.

The report was adopted.

It was decided to distribute £1,000 amongst various relief funds.

Chelsea Electricity Supply Co., Ltd.

In the absence of Mr. Davies, who is on service with the Red Cross in France, Major W. F. Woods presided on March 11th, at Winchester House, E.C., over the annual meeting. He said that during the part of the year previous to the declaration of war, the number of units generated and sold showed a very satisfactory increase, and revenue was growing steadily, but in the latter part of the year the restrictions imposed on street lighting had caused a considerable shrinkage in the sale of current, attributable to the reduction of the lighting of shops and other outside illumination, the earlier closing of licensed premises, the cessation of most forms of entertainment, and the general practice of economy in businesses and households. In the first half of the year there was an increase of 40,932 in the units sold, or an increase of about 2 per cent., as compared with the first half of 1913, but by the end of the year this was converted into a decrease of 108,983 units, or about 2½ per cent., as compared with the previous year. Added to this, the increased price of coal, which was from 25 to 30 per cent higher than before the commencement of the war, coupled with the difficulty of obtaining regular supplies owing to the dislocation of traffic on the railway systems, caused the directors to prepare them for a possible falling off in the net profits in 1915. Unfortunately, the immediate outlook, so far as coal prices were concerned, were not encouraging, but the Government were now taking steps to give electricity supply undertakings assistance in deliveries, and they hoped to reduce the expenditure by using more oil fuel in connection with the Diesel plant. Notwithstanding the adverse circumstances, the receipts and expenditure were practically the same as in 1913, and the net amount available for distribution after payment of interim dividends and debenture interest was £29,058. There was considerable delay in getting their Diesel plant to work. It was still in the hands of the contractors, and certain questions with them were still outstanding. The engines had, however, been at work during the latter part of 1914, and they believed that their anticipations in regard to their effect in reducing the fuel costs would be fully justified. They proposed to utilise this portion of the plant to a considerable extent during the current year. The amount paid to the Central Co. for current purchased had been £1,077, as against £641 in 1913. The increase in 30-watt connections during the year was 7,854, and but for the untimely circumstances of the war this item would doubtless have been considerably increased. In regard to the London power Bills, now withdrawn, whatever might happen in this connection in the future, the directors might be relied upon to see that the interests of the Chelsea Co. were properly safeguarded, and the shareholders would, of course, be asked for their approval of any scheme by the companies dealing with this very difficult question. The directors had interested themselves in the question of recruiting men for the Army and personally interviewed all members of the staff who had not previously enlisted, and who were eligible for service, to ascertain (without, however, bringing any pressure to bear) whether there were good reasons for their abstention. He was glad to report that 34 men out of 122 had joined the colours, or more than 25 per cent. of the staff. The directors had made provision for their dependents with a promise of reinstatement on return. The thanks of the shareholders were due to all those members of both the indoor and outdoor staff who, during a very difficult time, had loyally carried on the work of the company. He also expressed their gratitude to the police, and especially to the special constables, who had given their ungrudging services during the dark hours of the night, and often during the most inclement and unpleasant weather, for the protection of the company's stations.

Mr. H. E. Beeton seconded the motion, and the report was adopted without discussion.

Mr. S. Beeton was re-elected a director, and a vote of thanks was passed to the special constables for their services in guarding the company's properties.

Derby Lamp Works, Ltd.

At the statutory meeting, held at Moorgate Place on March 12th, it was stated, according to a report which has been supplied to us by the secretaries, that the number of preference shares applied for fully reached expectations and practically 50 per cent. of the ordinary shares offered as 3s. 6d. paid had been applied for, and shareholders of Metalite, Ltd., were congratulated on having exercised their rights to such a substantial extent. They had purchased a few new machines, principally labour-saving devices, which the works manager thought desirable. They were selling some of the machinery which, owing to their not making filaments, was now unnecessary. They had invested £250 in the Sheraton Glass Manufacturing Co. in order that they might secure a constant supply of bulbs at minimum cost. They went to allotment on January 15th with a clear working capital of £7,000. This was a satisfactory result considering the financial difficulties consequent upon the war. Finance once satisfactorily arranged, said the Chairman, the present state of affairs undoubtedly militated in their favour; they could not have started business at a more favourable time—a time when their enemy competitors were entirely shut out of the market. After the war, Austrian and German manufacturers who in the past had found this country such a convenient dumping ground, would find that the energy and initiative of the British lamp makers had "changed all that." The speaker went on to refer to the management, which he confidently believed was going to make "our company not only successful, but one of the foremost lamp factories in this country." The works manager, Mr. J. L. Green, "has had an experience of which many in this trade may well be envious." "Although we only went to allotment two months ago we already have a satisfactory production, and what is at this stage perhaps the most important point, we are satisfied that the lamps we are producing are second to none in quality." This "rapid progress" however would hardly have been possible if the directors had not financed the company out of their own pockets for over two months before allotment. Those who were shareholders in Metalite, Ltd., were under a considerable obligation to them in that respect.

We are informed that in reply to questions which were asked, the directors stated that they were satisfied that the working capital available was sufficient to bring the company to a paying basis, and that they had been offered a contract for the whole output, also one for 20,000 lamps per week. These contracts were under consideration.

STOCKS AND SHARES.

The recovery in markets to which we alluded last week is continuing steadily. Although in Consols there is still no chance of realising stock, for most of the other gilt-edged securities a demand is distinctly noticeable. This investment enquiry has the virtue of spreading, and, for the first time in many months, we are in the position of being able to record that buyers are searching the electric lighting list for what they consider to be cheap shares. The Home Railway group is decidedly better.

What is known as the Miscellaneous market, wherein are comprised most groups of industrial securities, is the most active in the Stock Exchange; and of all its varied sections, that for oil is pre-eminently strong. One of the main features of the week turned out to be a further sharp advance in the price of Marconis, though the movement lacked sufficient staying power to hold the quotation at the best level reached.

The especial point that makes the electric lighting market noteworthy is the fact that a number of the shares which hitherto have been practically unsaleable at their quoted levels can now be realised without difficulty. The change would be remarkable were it not remembered that, under the restrictions imposed by the Government, Stock Exchange jobbers are not allowed to sell shares unless they have actually got them. One direct consequence of this is that, whereas in the ordinary way they would sell, taking a business risk of replacing the shares at an early opportunity, they cannot do so unless armed either with the shares themselves or with the positive knowledge that they (the jobbers) can get them. And as, in market circumstances so unique as those at present ruling, the timid buyer is frightened when he finds his chance of acquiring cheap stock looks like becoming practicable, so also the hitherto anxious seller no sooner gets a bid for his shares than he promptly raises his price, in the hope of getting more.

If in this exposition of circumstances there savours aught approaching the iteration regarded by good authorities as so damnable, the writer on Stock Exchange topics must fain cover his defence with the statement that the aforesaid set of conditions comes into play so frequently, and yet so unexpectedly, that he is compelled to fall back upon it in endeavouring to set the market picture clearly before those interested in its view.

Within the next two or three weeks all the electricity supply shares will be quoted ex-dividend, and it will be possible to reinstate that table of yields on money invested which previously, since war broke out, might have given a false impression instead of a correct one. The quotations below are mostly cum dividend, allowing for which, the leading ordinary shares can be bought to pay 5½ to 6½ per cent. on the money. The trouble, as hinted above, is to secure shares; and in cases where only a month ago there were blocks up to 500 on offer, to-day's investor will learn from his broker that, if he is fortunate, he may be able to secure 100 at some comparatively high price. In addition to the following prices, we may add that bargains were done to-day (Tuesday) in South Metropolitans at 9s. 9d., and in Bournemouth Ordinary at 10⅛.

We append our usual list of representative stocks and shares in the electric lighting markets:—

Home Electricity Companies.

	Mean price. July 27, 1914.	Mar. 16, 1915.	Rise or fall this week.
Brompton Ordinary	9⅛	8¾	—
do. 7 per cent. Pref.	8⅝	8⅛	—
Charing Cross Ordinary	5¼	4½ xd	—
do. do. do. 4½ Pref.	4¾	4⅛	—
do. do. City Pref.	4⅜	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅞	4¾	—
do. 4½ Deb.	96½	92	—
City of London	16	14¾	+ ¼
do. do. 6 per cent. Pref... ..	13½	12¾	—
do. do. 5 Deb.	116½	112	—
do. do. 4½ Deb.	100¼	98	—
County of London	12	11¾	+ ¼
do. do. 6 per cent. Pref. ..	12	11⅝	+ ⅛
do. do. 1st Deb...	102½	99	—
do. do. 2nd Deb.	100½	97	—
Kensington Ordinary	7½	7 xd	—
London Electric	1 1/16	1¾ xd	+ ⅛
do. do. 6 per cent. Pref... ..	5 1/16	5 xd	—
do. do. 4 Deb.	92½	87	—
Metropolitan	3½	3⅛	—
do. 4½ per cent. Pref.	4 7/16	4	—
do. 4½ Deb...	97½	96	—
do. 3½ Deb...	83	80	—
St. James' and Pall Mall	9⅝	9 xd	—
do. do. do. 7 per cent. Pref.	7	6⅞	—
do. do. do. 3½ Deb.	84½	80	—
South London	8 1/16	8	—
South Metropolitan Pref.	1¼	1⅛	—
Westminster Ordinary	8⅜	7½	— ⅛
do. 4½ Pref...	5⅛	4¾	—

Telegraphs and Telephones.

	Mean price. July 27, 1914.	Mar. 16, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108¼	103¼ xd	—
do. Def.	23	21½ xd	—
Chile Telephone	7⅝	6⅝	—
Cuba Sub. Ord.	8½	8½	—
do. Pf.	16½	15½	—
Eastern Extension	12¾	12¾	—
do. 4 Deb.	97½	92 xd	—
Eastern Tel. Ord.	130½	128½	+ 1½
do. 3½ Pf.	77½	74	+ 1
do. 4 Deb.	96½	94	—
Globe Tel. and T. Ord.	11¼	11	—
do. Pf.	12¼	11¼	+ ⅛
Gt. Northern Tel.	32½	29	− 1
Indo-European	59	51	—
Marconi	[illegible]	[illegible]	—
New York Tel. 4½	101	97	—
Oriental Telephone Ord.	2 3/32	2	—
do. Pf.	1 1/32	1 1/16	—
Tel. Egypt Deb.	98	88½	—
United R. Plate Tel.	6⅜	6	—
do. Pf.	5¼	5	—
West India and Pan.	1¼	1 3/16	—
Western Telegraph	13⅝	13¼	+ ¼
do. 4 Deb.	96½	94	− 1½

Foreign Trams, &c.

	Mean price. July 27, 1914.	Mar. 16, 1915.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅛	4½	—
do. 2nd Pf.	4¼	3⅛	—
do. 4 Deb.	91	84	—
do. 4½ Deb.	98½	93	—
do. 5 Deb.	96	88	—
Brazil Tractions	66	52¾	− ½
Bombay Electric Pf...	11⅜	10⅜	—
do. 4½ Deb.	96	91	—
Mexico Trams..	70	35	—
do. 5 per cent. Bonds ..	84	50	−10
do. 6 per cent. Bonds ..	76	30	−10
Adelaide Sup. 6 per cent. Pf.	5¼	5⅛ xd	—
do. 5 Deb.	104	103	—

Home Rails.

	Mean price. July 27, 1914.	Mar. 16, 1915.	Rise or fall this week.
Central London, Ord. Assented	83	76	—
Metropolitan	37½	80	+1
do. District	21¾	17½	+ ½
Underground Electric Ordinary	2½	1⅛	+ ⅛
do. "A"	7/6	6/-	—
Income	88	81 xd	+ ¾

Manufacturing Companies.

	Mean price. July 27, 1914.	Mar. 16, 1915.	Rise or fall this week.
British Westinghouse Pref.	1¾	1 15/16	—
do. 4 Deb.	74½	72	—
do. 6 p. lien	102½	99	—
Callenders	11⅛	11¾	—
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2½	3 3/16	—
Edison & Swan, £3 pd.	3/32	14/6	—
do. do. fully paid	1¼	2¼	—
do. do. 4 Deb.	59	65	—
do. do. 5 % Deb.	63½	60	—
Electric Construction	17/32	18/6	+ 6d.
do. do. Pf.	15/16	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	14½	+ ½
do. 4½ Pref.	5	5	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	8¾	—
Telegraph Con.	38½	37½	—

One of the features in the Home Railway market is a point rise in Metropolitan Consolidated stock. The chairman at the recent meeting was mildly bullish, and he went quite frankly into the question of the Government's obligation with regard to making up the traffic receipts. What the Government guaranteed was a certain income from certain sources, reduced through the carriage of troop trains. The Government had not guaranteed their net income out of which the dividend was paid, and it therefore followed that they had not guaranteed the dividend itself. The price of the stock has risen to 30. Surplus Lands are higher at 56. Districts are 10s. better at 17½. Underground Electric income bonds have progressed still further towards recovery of the full amount of the recent £3 deducted for the dividend. Central Londons are steady. There is even a little business in East London ordinary stock, on the basis of 3¾. It may be recalled, incidentally, that the price of East Londons at the time war broke out was 5½.

Brazilian Tractions have been fluctuating within comparatively narrow limits round about 53. The exchange from Rio rose to 13⅜d. at the end of last week, and later came back to the neighbourhood of 13d. The company continues to declare its quarterly dividends of 1½ per cent.—that is, at the rate of 6 per cent. per annum; and although there are qualms as to its retention, which make the price somewhat wobbly every three months as the declaration date draws near, the speculative investor is manfully buying shares which, so long as the existing payments continue, give him the handsome return of 11¼ per cent. on his money.

Marconis touched 39s., a fresh advance of 2s. 3d., but the effort met with large sales of pre-moratorium shares, and this took the price back again to 36s. 3d. Holders who had been running Marconis just before war broke out were allowed, under the Government's scheme, to keep them in suspense at 38s. 9d. so long as that price was not reached, but on shares becoming saleable at 1 15/16, the bulls could be called upon either to pay for the stock or else sell it. So many selling limits were fixed at the price mentioned that the recent buyers became exhausted before the sellers did. Market theory contends that while the Marconi Company is under Government control, the Treasury will recoup whatever loss the undertaking may be put to by reason of naval and military exigencies.

The Consolidated Gas & Electric Co. of Baltimore, very familiar to investors over here, is about to issue Two-year 5 per cent. Notes at 98, with conversion privileges into common stock at 115. Out of this issue arises the rather important question whether the British investor will be allowed to participate, supposing the Treasury decline to allow the stock to be offered here at all. Some weeks ago, official prohibition was applied to a bond-offer by a first-class American Railroad. but if the Baltimore Co. chooses to allot its Notes by way of rights, the patriot may well be puzzled in his search for some method whereby the British investor is to be debarred from subscription.

Mexico Tramways bonds have gone back 10 points in each class, for reasons too hopelessly well known to call for comment. Other than these, the changes are not large enough to quote. As a curiosity may be mentioned the record of transactions in Kalgoorlie Electric Lighting ordinary shares at threepence; the preference mark 4s. 6d.

The Telegraph market is generally steady, with the Eastern group in the ascendant. Eastern ordinary put on 1½, the preference a point, and Globe preference ⅛. Westerns were a better market at 13¼. Great Northerns gained £1. We have already pointed out that investment demand has penetrated this section, and that the difficulty is not to sell shares, but to buy them at anything like the quoted prices.

The Manufacturing list is firm, holding its rises of the past week or two. Electric Constructions advanced a little, and Henleys at 14½ are the fraction up. British Westinghouse preference rose to 39s. 6d., at which price sellers came in and reduced it to its former level of 38s. 9d. Armament shares are decidedly weaker. Lord Kitchener's speech on Monday night foreshadowed a Government scheme for enabling employés of large contracting firms to share in whatever of extra benefit such firms derive from the war. As it had already been assumed in the market that the armament companies were scarcely likely to raise their dividends next month, this announcement by the Minister of War did not stimulate prices. The rubber market, on the other hand, is good, with a number of the best-class shares in such demand as to lead daily to better prices.

Interesting points have arisen in connection with certain of the Government telephone contracts in respect of private lines between the Stock Exchanges of London and the provinces. The Government took over the lines altogether when war broke out, and for about six months the brokers had to rely on trunk calls. Now the Post Office offers to cancel the remainder of whatever contracts may be outstanding, or, alternatively, to continue them at a reduction of 33 per cent., in view of the shrinkage of Stock Exchange business caused by the Treasury regulations. Readers tired of acrostics might take this as a week-end problem, asking themselves how they would act in like circumstances if they were brokers.

MARKET QUOTATIONS.

Owing to the war, the prices given below are, of course, more or less nominal.

Wednesday, March 17th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a " Nitric	"	19/-	..
a " Oxalic	per lb.	10½d.	2½d. inc.
a " Sulphuric	per cwt.	5/-	..
a Ammoniac Sal	"	£49	..
a Ammonia, Muriate (large crystal)	per ton	£49	..
a Bleaching powder	"	£9	10/- inc.
a Bisulphide of Carbon	"	£21	..
a Borax	"	£20	30/- inc.
a Copper Sulphate	"	£28 10	£1 inc.
a Lead, Nitrate	"	£35	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
c Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	6d.	..
a Potash, Caustic (88/90 %)	per ton	£75 to £80	..
a " Chlorate	per lb.	1/6	2d. inc.
a " Perchlorate	"	1/6	6d. inc.
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£5 10	..
a Sulphur, Sublimed Flowers	"	£11 10	..
a " Recovered	"	£8	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %)	"	£10 2 6	..
a " Chlorate	per lb.	9½d.	¾d. inc.
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	8½d.	..
METALS, &c.			
Aluminium Ingots, in ton lots	per ton	£90	£5 inc.
" Wire, in ton lots (1 to 14 S.W.G.)	"	£120	£8 inc.
b " Sheet, in ton lots	"	£ 20	£8 inc.
p Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	..
c " Tube (brazed)	"	10½d.	½d. inc.
c " " (solid drawn)	"	10½d.	½d. inc.
c " Wire, basis	"	9½d.	..
c Copper Tubes (brazed)	"	11¾d.	½d. inc.
c " " (solid drawn)	"	11¾d.	½d. inc.
g " Bars (best selected)	per ton	£86	..
g " Sheet	"	£86	..
g " Rod	"	£86	..
d " (Electrolytic) Bars	"	£71	£1 inc.
d " " Sheets	"	£89	£1 inc.
d " " Rods	"	£77	£1 inc.
d " " H.C. Wire	per lb.	9½d.	..
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	1/8	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/5½	½d. inc.
j Iron Pig (Cleveland warrants)	per ton	61/-	4/2 inc.
l " Wire, galv. No. 8, P.O. qual.	"	£18	£1 inc.
g Lead, English Pig	"	£24	£3 5 inc.
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£12 5	5/- dec.
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e " " " medium	"	3/- to 5/	..
e " " " large	"	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/2 to 1/3½	..
p " " rolled strip & sheet	"	1/3½ to 1/6½	..
o Platinum	per oz.	185	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£70	..
g Tin, Block (English)	"	£187 to £191	..
n " Wire, Nos. 1 to 16	per lb.	2/6	1d. inc.
p White Anti-friction Metals	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

SEARCHLIGHT PROJECTORS.

By C. W. DENNY, A.M.I.E.E.

(*Concluded from page* 349.)

The use of flame or mineralised arcs necessitates a different form of mirror and different controlling mechanism. The flame arc projectors, and also the use of petrol-oxygen in projectors, the writer hopes to deal with at a future date. In consequence of the excessive heat generated by the electric arc, it has been necessary to give special attention to the ventilation of the projector body and mirror. When projector lamps are consuming current up to 200 amperes, it will be readily appreciated that some means must be provided to carry away this heat. It may be mentioned that a metallic mirror, after being a considerable time in use, reached a temperature in the neighbourhood of 700° F., with an arc taking approximately 180 amperes. The heating up of projector bodies and fittings, more especially in the case of small projectors, and even large projectors when used in a sheltered position, is a source of trouble in handling, and is always dangerous in the case of crystal glass mirrors.

A suggested method of cooling the barrel was recently brought before the writer's notice. It consisted of ribbing the barrel with light angle sheet $\frac{1}{16}$-in. thick, and also the back of the mirror frame. In the case of the latter special flat plates were allowed to press lightly against the mirror (metallic mirrors being used) as a means of rapidly conducting the heat to the ribbed cover, which materially lessened the temperature rise of mirror and barrel. Of course, the ribs on the barrel were omitted where doors, ventilators, and other mountings interfered with their use. It was claimed that the radiating surface of the projector body was increased 75 per cent. by the ribs. A rough sketch of such a method is shown in fig. 3, the usual ventilating hole being omitted in the sketch. A further advantage is the use of wooden handles, or, to be more correct, iron handles with a wooden covering or sleeve, on mirror frames and front glass doors, as the usual iron handles become too hot to be comfortable after prolonged use.

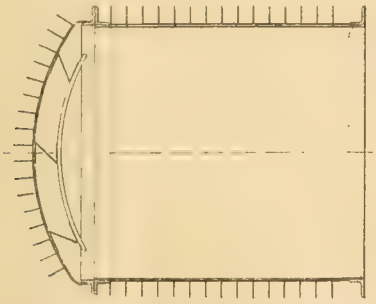


FIG. 3.—SECTION OF PROJECTOR WITH COOLING RIBS.

Mechanical Movements of Projectors.—The balancing of the projector body on its trunnions is usually accomplished by having one of the trunnion guide rods screwed and passing it through a screwed hole in the trunnion bracket at each side of the barrel.

Any movement of the barrel parallel to its axis can be made by revolving the screwed trunnion rods. It is preferable that the screwed rods should be coupled together by chain gear or other approved means whereby both rods revolve at the same time, keeping the barrel quite parallel with the guide rods. This is of the first importance on military projectors, where adjustments of the barrel have to be made rapidly and often in action. The movements of the projector barrel through 30° above and below the horizontal and the describing of a complete circle by the turntable are accomplished by means of worm gearing, which is so arranged that it can be thrown out of action should it be desirable to move the projector rapidly by hand.

Various friction plates and clamping screws are in vogue for stiffening the movements of the barrel and base when operating the projector by hand. Difficulties sometimes occur with devices of this kind, inasmuch as the operator often throws out the worm gearing for obtaining the slow motion before sufficiently tightening up the clamping plates, the result being that the projector body, if not perfectly balanced, swings rapidly through the range of its lower movement, and in the case of a large projector comes with a heavy bump against the fixed stops which limit such movement. Such rough usage is not conducive to the long life of the mirror (if of crystal glass) or other delicate parts of the optical apparatus.

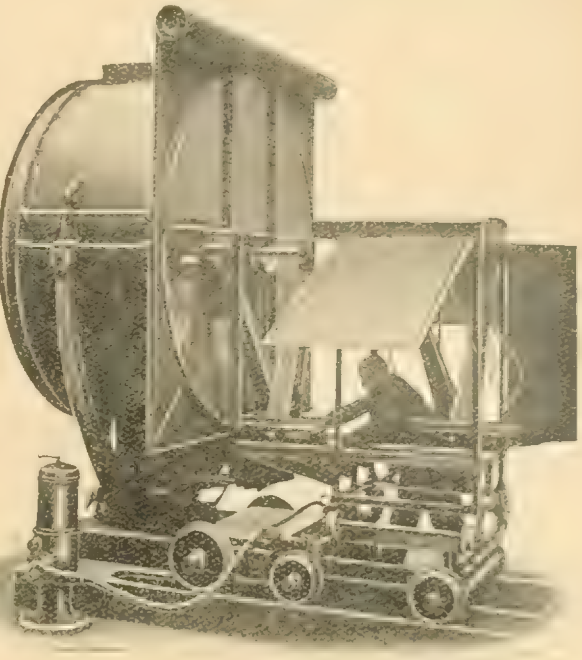


FIG. 4.—PROJECTOR FOR COAST DEFENCE SERVICE.

Various suggestions have been put forward with regard to a "one-wheel control" arrangement for projectors, that is, operating the movements of the barrel and turntable at one and the same time by one wheel. By means of suitable clutches, either turntable or barrel can be operated separately, the advantages in support of this arrangement being the ease of manipulation with one hand-wheel, as against two, and that the operator always has one hand free to attend to the lamp, &c. Although there are these points in favour of such a device, the writer does not advocate its use, owing to the somewhat complicated clutch mechanisms employed.

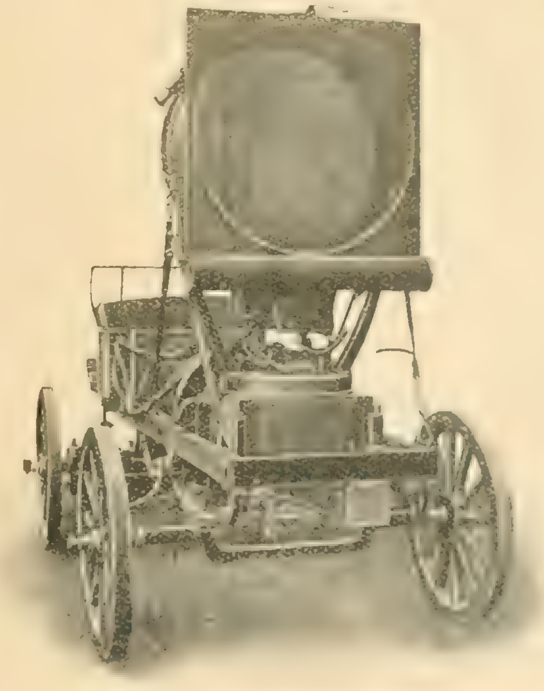


FIG. 5.—FIELD SERVICE PROJECTOR.

Numerous improvements have recently been made in connection with switches and resistances; for projectors the latter should always be of the adjustable type and well ventilated, combined switches and resistances arranged in the projector base being amongst the more recent improvements. Improvements in arc deflecting magnets, arc-centring gear, &c., are more or less of recent date.

Several very efficient types of portable generating sets are now on the market for use with field service projectors, or on ships where electrical equipment is not general. These usually consist of a gasoline engine and multipolar dynamo mounted on a light cast-iron bed-plate.

Some approximate particulars of a double-cylinder four-cycle engine and dynamo are:—Output, 30 to 35 amp. at 110 volts; weight, 650 lb.; length, 42 in.; width, 20 in.; height, 30 in.; R.P.M., 750.

Fig. 4 shows a projector arranged for coast defence. It is controlled electrically from a distance, in such a way that the operator is remote from the beam of light, and also in the best position for observation. Projectors of this class are preferably provided with lamp carriages, to enable the substitution of a new lamp for one whose carbons are consumed to be carried out with the minimum of delay, so as not to interrupt the light longer than necessary.

A characteristic type of Continental field service projector is shown in fig. 5, mounted on its carriage. It is supplied with current from a generating set on another equally mobile carriage. The use of the metallic reflectors has permitted the construction of light and easily manipulated carriages for projectors up to 36 in. in diameter, which are extremely useful in hilly or mountainous countries.

THE EFFECT OF THE PRESENT COAL POSITION ON THE BUSINESS OF ELECTRICITY SUPPLY.

[COMMUNICATED.]

WITHIN the last three years the public have had at least three demonstrations of the fact that the price of coal will be raised on the slightest pretext, and that within a few days of the first advance in prices coal merchants who have entered into quite large contracts to supply regularly week in and week out a stipulated amount of coal of a certain quality, will unblushingly declare that they are unable to obtain the stipulated amount, and that to their intense sorrow they needs must curtail supplies.

This state of things lasts for a short time, when the harassed station engineer almost implores the coal merchant to procure for him coal of any burnable quality at what he is pleased to term, vaguely, anything like a reasonable price, as his stock is showing signs of depletion.

Within a day or two the kindly merchant informs the station man that although he (the merchant) cannot supply the demand himself, yet after considerable trouble he has persuaded the firm of So-and-so to let him have about a two or three weeks' supply at a figure about 60 per cent. or 70 per cent. higher than the engineer has been paying.

Naturally the engineer resents being bitten, but as his place was not originally laid out for coal storage on a large scale, he soon has to come down and accept the coal merchant's prices, which in the few days of haggling have again advanced.

Now this sort of thing is going on all over the country at the present time; therefore, it is hitting each and every district in a most vital part, viz., its electricity supply, at a time when it is of the utmost importance that things should go rapidly and smoothly along their proper path.

There may be in one or two places a genuine shortage of coal or wagons to convey that coal, but to nothing like the extent which the coal merchants pretend. This is proved by the fact that after the engineer has agreed to pay the extortionate prices asked for fuel, he continues to get just sufficient to keep him going at the enhanced prices. Make no mistake, the writer speaks from bitter and costly experience; your coal merchant knows to a nicety what is your storage capacity, and adjusts his tales of scarcity, high prices and impossibility of delivery to suit the exact conditions under which he knows the plant has to work as regards coal.

It is true that he has entered into a business contract to supply so much coal at a certain price, but it is also equally true that he will not supply that amount of coal at that price as long as he can obtain higher prices from other people. In short, he will declare that he cannot get your coal, and therefore must be relieved from his contract. He will also, within an hour of telling this tale, sell the coal he has solemnly agreed to deliver to you, to someone else at a much higher price.

Now, such callous and disgraceful breaking of contracts should not be permitted. The prosecution of such offenders in one or two industrial centres should be taken up by a combination of coal consumers formed for the purpose. This may, perhaps, be a difficult matter, hampered as the supply stations are by being under municipal control in many instances.

In one way, the antics of the coal merchant, resulting in the uncertainty of coal delivery as soon as a slight strike, or rumour of a strike, crops up, should send more power users on to the mains of electricity supply works, and it should be possible in such cases to pick up a good many small and medium power loads at prices between ¾d. and 1¼d. per unit.

This, however, will only shift the burden from the shoulders of the works owner or manager on to those of the supply station engineer. What is necessary is some means of controlling the supply of coal without the intervention of the middle-man, who has shown time and again that he can only be trusted to break his agreements whenever it pays him to do so. This, of course, implies the control of one or more collieries, which at once introduces difficulty.

The municipal ownership of the majority of supply stations stands in the way of concerted and powerful action, as the Local Government Board would not sanction any share in such a venture; again, the case has to be considered from several aspects. Not all the coal raised would be steam-raising coal of the type required, and to market the remainder would necessitate a capable selling organisation, as the ordinary coal merchant would not purchase or sell coal from these collieries on any consideration.

Added to the above difficulty is the one of delivery. Stations on the railway with a siding could make arrangements to supply so many wagons to the railway company, and enter into an agreement with them that these wagons were to be dispatched regularly at certain convenient times as long as it was possible to work the railway. This contract should be in its essence as binding as a Government contract, and it would be worth the while of any power station which had been harassed and bled to pay a little extra to the railway company for the privilege of obtaining such a contract.

Consumers not on the railway would have to provide their own wagons, and might do much good by using electrically-driven coal wagons for this purpose. The batteries could be charged up overnight, and the continued use of the wagons would result in other persons in the town watching the result and obtaining such wagons themselves, and so offering a load desirable in every way to the power station. The original difficulty, however, of obtaining control of the colliery is the greatest difficulty, and to the writer it does not seem possible to surmount this at present.

Many of the largest industrial firms possess their own collieries, and antics such as those at present indulged in by the coal merchants were the cause originally of these concerns entering into the colliery business.

The matter, however, is important for every supply station, whether it has or has not sufficient storage capacity to render itself immune from this evil for some months.

Storage of coal means extra handling, once into and once out of storage at the least; it occupies valuable space, and means that unless the coal is regularly removed from storage and burnt the calorific value will be greatly depreciated, and in turn this demands a regular putting into and taking out of storage of a considerable quantity of coal. There is also the risk of spontaneous combustion to be considered, and the fact faced that its prevention costs money, in that space must be allowed for thorough breaking-up of the coal into fairly small bulk.

The solution of putting the power stations at the pit mouth is very easy to propose, but two important considerations are overlooked. One is that such policy means the scrapping of a good deal of modern and exceedingly valuable plant of large size, and the other is that it means fairly long transmission of the power so generated. The latter problem is not at present a commercial success in these islands, judging from the results attained by the various power companies who have been in the business for several years. Perhaps the easiest and most direct way out of the position would be for the leading men in the power supply industry to meet and take steps either to force one of our existing organisations to move the Government in the matter, or, failing that, to form an association to influence Members of Parliament to take up the passage of a measure putting the supply of coal to power stations on the same basis as the supply of war material; that is, the supply must be maintained at the prices agreed upon and in the quantities promised, even if to do so required the enlistment of colliers in a special manner and at special rates of pay, with the stipulation that refusal to work would be treated as mutiny in the Army or Navy would be treated.

The work of the power stations is vital to the well-being of the nation. The coal merchant has repeatedly shown his indifference to all considerations other than those of profit, and should be treated as an unpatriotic and untrustworthy person.

RUSSIAN TRADE AND ELECTRICAL PROSPECTS.

(Communicated.)

Vital as the present war is to all the Allies, Russia is undoubtedly the country which will profit most by the conflict, for it will complete the work begun by the institution of the Duma and the guarantees for constitutional government; and will make good the loss of prestige and credit sustained by Russia in the Russo-Japanese war. It is effecting consolidation of the people, confirming the stability of the constitutional *régime*, and bringing Russia into close and amicable relations with her Allies. In short, the "awakening" of Russia is being completed by this war, and once peace is declared, rapid industrial development will occur. Hitherto the country has been chiefly agricultural, but the natural wealth is beyond estimation, and there is room for the development of practically every industry. The dredging of rivers and building of railways and factories which have already begun will proceed faster than ever, and with them will now arise an enormous demand for machinery and manufactured products of every kind. Internal resources will be inadequate for some time to come, to keep pace with this rapid development.

There is an immense potential power field in Russia, both in production and utilisation, and in the present state of engineering it goes without saying that a very large percentage of this power will be supplied electrically. The business boom of two or three years back was accompanied by great extension in the use of electricity in Russia. It is now used extensively in textile mills, in oil fields, in electrochemistry and in blast furnaces. Further, the advantages and possibilities of electrical development are fully appreciated by the Russian Government and many municipalities, so that in this vast country, which has recently advanced centuries in decades, and is now prepared to take up to the full extent 20th century industrial existence, without being burdened by any of the impedimenta of gradual evolution, there is an unparallelled field for electrical development. Though some of the equipment required for new and extended central stations, hydro-electric plant and transmission, tramways, railways, telegraphs, factories, streets and homes will be supplied by existing and new Russian firms, there will necessarily be enormous imports of manufactured electrical material of all kinds for years to come, and British firms can accelerate or retard Russian development, gain trade for themselves, lose it to rivals, or compel premature manufacture on the spot, according to the nature and degree of their activity.

Hitherto Germany has enjoyed the major portion of all Russia's foreign trade, actually controlling a large fraction of the exports as well as supplying the greater part of her imports, but the advantages Germany has had in respect of geographical position and excellent commercial organisation will be entirely outweighed in future by her shattered credit, crippled resources, and possibly disintegrated national structure, not to mention the formidable barrier of sentiment which she has thrown up against herself by her ill deeds and which will take years to demolish.

On the other hand there was already, before the war, a strong movement in Russia in favour of English goods (which the amiable German did his best to gratify by selling German-made goods with forged English trade marks). Many English firms had realised and begun to take advantage of the possibilities of Russian trade, and now there should be no hesitation in so doing, for English firms have been more than semi-officially invited to enter the Russian field, and all Russian sentiment will henceforth be more strongly than ever in our favour. We have, however, in the German, a trader thoroughly versed in every phase of organisation and enterprise —honourable and dishonourable. His ability will not be affected by the war and, though his opportunities will be much less favourable, we must remember that the degree of his necessity will be the measure of his efforts, and we have tremendous leeway to make up both in methods and results.

The total value of Russian imports of all kinds was three times as great from Germany as from England in 1910, and by 1914 the ratio was 4 : 1, the respective values being nearly £40,000,000 from Germany and a bare £10,000,000 from England. Our electrical exports to Russia compare even less favourably with those from Germany. In 1912 Germany exported to Russia £230,000 worth of dynamos, motors and transformers, *i.e.*, twice the value of her corresponding exports to England, and about the same value as her corresponding exports (each) to Italy and Argentine. Of this total, machines and transformers up to 220 lb. weight were worth £52,000; from 220 to 1,100 lb. £66,000; and over 1,100 lb. £112,000. The total exports of electrical machinery of all kinds from England to Russia were valued at only £59,900 in 1913. German exports of glow lamps to Russia were valued at £466,000 in 1912, *i.e.*, 50 per cent. more than the value of lamps exported to England, and 25 per cent. of the total exports of this class from Germany. We sent £200 worth of metal filament lamps to Russia in 1913. It is interesting to note that we send about £250,000 worth of belting to Russia (about 15 per cent. more than Germany does), and our wide connection in this class of goods should prove helpful in introducing British electrical equipment to Russian power-users—assuming a certain amount of cooperation among British firms. Immediately before the war Russian electrical imports must have been worth close on £2,000,000 per annum—possibly more —and soon after the war their value is likely to become greater still. There is an immense market positively waiting to be taken—much of it we can take if we get busy now and go the right way about it. But Germany's defeat in the field does not mean that she will give up the Russian (or any other) market without a severe struggle.

Many of the ramifications of German influence and control in the Russian electrical industry have only been realised since the outbreak of war severed some of the hidden arteries which used to feed apparently independent concerns. The great German electrical firms operating in Russia were under direct German control, and had a very complete series of working agreements and "understandings," which permitted them all to do good business yet never allowed any dissension or competition giving outside firms a reasonable chance of success—simply another example of the vast possibilities of co-operation with "competitors." Just as since the war large quantities of electrical goods have arrived in Russia from "neutral" countries, branded artlessly with neutral trade marks which do not suffice to disguise the Germanic origin of the whole; just as since the war German "commercials" travelling with neutral passports (purchased or worse) have sold these neutral goods; so in the years preceding the war many independent firms, "Russian," "Belgian," and others, were German at the core. The institution of really independent concerns was at once crushed by ruthless use of the whole capital and influence of the German combinations and the banks and diplomats supporting them.

Besides availing itself to the full of every legitimate method, German commercialism, like German militarism, has been characterised by highly organised treachery and deceit—underhand machinations being often employed when honest endeavour might have attained the same end with the single objection (in German eyes) that the extent of German dominance would have been prematurely disclosed. It is an established fact that representatives of German firms have given gratuitous and "disinterested" assistance to those responsible for municipal and other electrical schemes in Russia, to such purpose that the ultimate scheme and specification have appeared in such form that German products alone could fill the bill. This and other even more dubious methods do not appeal to the British mind, but with contract after contract, aggregating hundreds of thousands of pounds per annum secured by such means, we must at least add fresh weapons to our commercial armoury.

While it is unnecessary to credit Germany with any particular commercial morality, it would be equally foolish to underrate her commercial ability, and some of her methods should undoubtedly be employed by us. There is no reason, for instance, why our banks should not be as powerful agents in industrial development and association of interest here as in Germany. The commercial activity of German embassies, and the application of "diplomatic pressure" to secure trade for Germany, find no counterpart in our State. Our consular service and the Board of Trade are all right so far as they go—so far as they can go—but fully qualified commercial and technical attachés reporting to a Department of Commerce can alone render the service desirable.

Remote control is quite inadequate in seeking to trade with Russian markets. Without frequent visits by an experienced representative or, better, permanent travelling representatives, it is impossible to gain the necessary intimate knowledge of conditions and developments. For years past Belgian and German firms have been represented in Russia by commercial engineers speaking French, German and Russian, and dealing directly with small as well as large clients. To the energy and intimate knowledge of Russian and Polish trade conditions possessed by their representatives, German firms owe most of their success in this field. The favourable geographical position of Germany is a factor of much less importance than is generally supposed.

There are some British-owned factories in Russia and a number of agents (actual or potential) well versed in the language and trade conditions, and if a British firm do not wish at present to send out a man of their own, they may still be represented effectively on the spot. Indeed, it is advisable in any case to examine closely what co-operation is possible with firms and agents already well-established in the country.

The language difficulty has prevented many British firms from venturing in Russian markets, but the latter are so valuable that the difficulty must be faced and overcome. Circulars and correspondence in English will result in very little business, any thus obtainable being generally already fixed in destination. French and German are chiefly used by Russians for scientific and other publications, for which a wide circle of foreign readers is desired, but Russian is the only language which will permit exporters to get into really close relations with clients and take full advantage of the enormous business to be done with smaller concerns, any one of which, under existing circumstances, is likely to develop much and rapidly in importance, and will naturally continue most of its earlier connections. In the past only too many British firms have employed German "foreign correspondents" in their offices. Surely it is now sufficiently clear why a docile, hard worker and skilled linguist could be obtained at the wage of a junior clerk. It is not flight of imagination or prejudice, but a sober fact, that a high percentage of German clerks in this country used to send home each week business reports which in the aggregate cost their employers far more than they saved in wages.

There is a good demand in Russia for standard electrical equipment of English design and manufacture but, particularly among the smaller traders where price is everything, it is essential to be able to offer apparatus at least as good as the corresponding German lines and at competitive prices.

In the phrase "German goods are adapted to local requirements" (*vide* consular reports without number), lies the reason for order after order going to those who are not our friends. If we are learning better than our take-it-or-leave-it attitude, our improvement is terribly slow. It is totally inexplicable why so many British manufacturers will see no further than the end of their noses, and quite fail to realise that what they lose on perhaps nine out of ten special orders, they recoup handsomely on a steady stream of orders following the tenth special job. The whole matter reduces simply to this, that there *are* firms who will go out of their way to satisfy special requirements, who do this at reasonable prices and yet make an annual profit. Those firms, whatever their nationality, are the ones to whom the future belongs.

It times of peace it was well worth executing special (as distinct from freak) orders, and in the critical years following the declaration of peace it will be yet more worth while, when the tremendous demand for war munitions collapses as suddenly as it arose and the world's trade is *redistributing* itself as it certainly will do. Have not manufacturing firms in this country repeatedly gone to Germany for special work in the past because they could not get the attention they desired at home, and will they never apply this lesson to their own morals?

There is undoubtedly a tendency on the part of the average British manufacturer to ignore or attach insufficient importance to the broader principles and customs of trading in foreign markets. In respecting these, the German excels, and by sheer method and attention to minutiae he succeeds, though it is an unprejudiced fact that he has never been popular abroad.

(*To be concluded.*)

Science and Industry.—The Institute of Industry and Science has, by permission of the Lord Mayor, called a "Conference of Leaders of Industry and Science" at the Mansion House, for Thursday, March 25th, at 3.30 p.m. There will be a discussion on "The Co-operation of Science and Industry."

ELECTRIC COOKING.

By W. R. COOPER, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *March 11th*, 1915.)

So far, in the cooking field, electricity has been chiefly in competition with gas, in smaller houses and flats; in larger houses coal ranges are more usual, because the cooking is more continuous and because hot water is required in large quantities. Naturally the revenue from an electric cooker replacing such a coal range is considerably greater and more profitable than that from a cooker in the smaller class of house, because the large cooking consumer, unlike the large lighting consumer, has an appreciably better load factor than the smaller consumer.

In the example to which the author wishes to refer, the number of persons normally in the household is from eight to nine, and there is a good deal of cooking, though not of an elaborate kind. A fairly large cooker, by Messrs. Purcell & Nobbs, was therefore selected, of which the following are brief particulars :—

		Maximum loading.
Oven	upper, 2,000 watts lower, 1,000 ,,	total, 3,000 watts.
Grill ...		1,500 ,,
Two 8-in. hot plates...		each 1,500 ,,
One 6-in. hot plate ...		750 ,,

The electric heating of domestic water is not a proposition that is financially impracticable. It is a question of tariffs. Pending the taking-up of this matter seriously by central-station engineers, it was thought best to install a separately-fired coke boiler for supplying the hot water.

The average consumption was found to be about 2 KW.-hours per person per day in the winter-time and about 1·6 in the summer. The consumption per week was approximately 110 KW.-hours in the winter-time and, say, 90 KW.-hours in the summer.

Before electric cooking was adopted the average annual cost (based on the two preceding years) with coal was as follows :—

Electrical energy for light and other purposes	£9 0 0
Meters	1 0 0
Coal	13 10 0
	£23 10 0

With electric cooking the result for the year was as follows :—

Electrical energy for light, &c., as above ...	£2 16 3
Electrical energy for cooking (including fixed charge) 5,024 KW.-hours (average price, 1·04d. per KW.-hour)	21 19 0
Meters	1 0 0
Coke and coal	6 13 6
	£32 8 9

In the above no credit has been allowed for certain advantages of the electrical system. The number of KW.-hours for lighting and other uses has been taken to be the same in both cases, and a correction has been introduced for a short period of defective meter working. The net result is seen to be an increase in cost of £8 18s. 9d. per annum over the cost of cooking with coal. The initial outlay was as follows :—

Electric cooker	£23 15 6
Cooking utensils	2 5 0
Wiring for supply to cooker	9 4 5
Boiler and connecting up same	10 6 4
	£45 11 3

Later, a porringer taking 800 watts and having three heats was added, which, with wiring, cost £4. This was found to be a great convenience. The above are list prices.

There are many cookers on the market of lower price than the above. On the other hand, the cost of wiring is undoubtedly a heavy proportion of the whole, and must inevitably remain high so long as engineers adhere to the fashion of using screwed tubing. Wood casing might be employed equally well. The author sees no reason why armoured cable should not be used without further protection.

A main double-pole switch should be fixed in a handy position near the cooker, and a pilot light should be fixed so that the cook cannot help seeing whether the power is on or off.

It is most important to have the branch switches in a position where they are not only easily seen, so that the various heats are ascertainable at a glance, but also easily operated. For this reason it is very undesirable to mount them on the side of the cooker; switches are best placed on the wall behind the cooker, somewhat to one side. The author prefers a small fuse on each circuit to one large one for the whole cooker.

A thermometer should be provided. The usual rough-and-ready method of judging the temperature of an oven is to open the door and thrust in the hand. The oven here considered requires 10 minutes for the temperature, as shown by the thermometer, to rise from cold to 350° F.

It has been freely stated that the loss in weight with coal or gas cooking is, say, 30 per cent., whereas it is, say, 15 per cent. with electric cooking. Actually, it is impossible to give a fixed figure. If there is much fat the loss will be heavy, whereas, if the joint is lean, the loss will be much less.

Figures which the author obtained in the course of ordinary working, and which show the loss of weight, may be of interest :—

Loss When Cooking by Coal.

Character of joint.	Original weight.	Loss.	Remarks.
	lb. oz.		
1. Rolled ribs of beef	4 7	29½ %	—
2. ,, ,,	4 2	29 %	—
3. ,, ,,	3 13	18½	Rather lean.
4. ,, ,,	4 9	23 %	—
Average ...	...	25 %	

Loss when Cooking by Electricity.

Character of joint.	Original weight.	Loss.	Remarks.
	lb. oz.		
1. Rolled ribs of beef	3 14	13 %	—
2. ,, ,,	3 8	14½ %	—
3. ,, ,,	3 13	13 %	Joint lean and rather underdone
4. ,, ,,	4 1	20 %	Joint rather fat
5. ,, ,,	4 1	12½ %	—
6. ,, ,,	4 12	14½ %	Joint rather fat
7. ,, ,,	4 6	14½ %	—
Average ...	...	14½ %	

Extravagant claims in this, as in any other direction, are to be deprecated. It is forgotten that the roasting of joints is but a small part of the total cooking.

The author found that a suitable routine, in the case of joints, is first to raise the temperature to 350° F.; the joint is then put in, the temperature is allowed to fall to 250° F. by switching off, and is kept (by switching on the low heat occasionally) between 250° F. and 300° F.

The energy required to heat an oven is not as great as might be expected. In the present case the oven, with an input of 3 KW., reaches a temperature of 250° F. in 5 minutes, *i.e.*, by the expenditure of 0·25 KW.-hour. For small operations, such as keeping dishes hot, the author has found it convenient to use a hood of tin-plate, preferably double, as shown in fig. 1, which can be placed over any hot-plate as a heating element. It is provided with a low metal stand and deflecting plate so that the heat is not excessive near the hot-plate; or an asbestos sheet may be used to give protection.

It is desirable that an oven should heat up so rapidly that the heat losses have not much time to take effect, after which the input can be reduced simply to supply these losses. For these reasons the time taken to reach a temperature of 300° F. should not exceed 10 minutes.

Accessory apparatus is often desired, and then a plug circuit is inevitable; plugs are sometimes provided with shields, which give some protection. The author thinks, however, that it would be more satisfactory to fit a metal ring round the socket (as in fig. 2) so that the pins are not exposed so long as they are alive. This ring should preferably be earthed. The live metal of the socket for the reception of the pins of the plug is often brought nearer to the surface than is necessary, and can be touched by persons when cleaning.

In portable utensils the pins are often exposed when the socket is in position, if it is not pushed home. These pins should be housed, as indicated in fig. 3.

One of the troubles with flexible wire is the annoying way in which ordinary qualities break on account of being continually subjected to bending. The layman cannot put the matter right without calling in assistance—which means delay and a bad advertisement for electrical methods. Many of the usual twisted flexible cords are unsuitable for this class of work, and special types should be used. These are now becoming available.

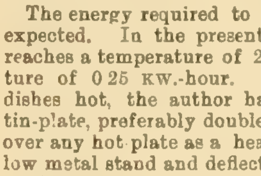


Fig. 1.

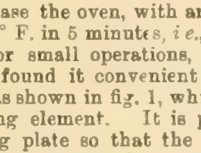


Fig. 2.

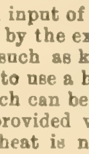


Fig. 3.

Fig. 1.—"Portable" Oven.

Fig. 2.—Protection of Sockets.

Fig. 3.—Protection of Pins by Housing.

The author has recently subjected a number of samples to a bending test. It is apparent from these tests that ordinary flexible wires vary very much in their mechanical properties, and that it is not necessary to depart from the ordinary type to get excellent results.

It is generally recognised that electric cookers should be earthed so as to ensure immunity from shock. There is no question that the earthing should be to a water pipe, and that the effectiveness of the earthing should be tested. Earthing clips and wires should be more substantial than is generally the case. It would be an advantage if such clips carried a red metal label bearing the words "Earth Connection—Must not be Removed."

The mixing of earthed and unearthed apparatus is much more dangerous than to discard earthing altogether. The plain form of wall-plug should not be permitted in the kitchen: there the three-pin variety with earthed connection should be used, and leads should be in flexible metal tubing, the utensil, tubing, and plug being properly connected together. Similarly, tumbler switches with metal covers should not be permitted on cooking apparatus except with an earthed connection.

The Council of the Institution should draw up rules as to earthing. At the same time the standardisation of socket connections on electric irons and similar apparatus might be considered. Manufacturers should realise that there is nothing to be gained by every manufacturer having his own size and spacing of pins. To the user it is exasperating to have to buy a particular socket connection for a particular piece of apparatus.

Occasionally the consumer is fortunate enough to have the offer of a very low flat rate. More generally, however, the tariff involves a primary charge which may depend on the rateable value of the house or upon the amount of lighting and plant installed, and, further, a secondary charge of so much per KW.-hour consumed. As a possible consumer the author objects to paying a heavy primary charge when he may be using only a cooker. In comparing the cost of electric cooking with coal cooking, this heavy charge may be sufficient to deter him from making the experiment with a system of which, as a householder, he has no first-hand experience. That is the attitude that must be borne in mind.

That the primary charge provides for the fixed charges of generation for the lighting load is a fair basis on which to go. In that case it should bear some relation to the maximum lighting load. During the last few years many station engineers have complained that the lighting load was much reduced through the use of metal-filament lamps; yet there seems to be no tendency for the percentage charged on the rateable value to be reduced.

If the assessment basis is found to be generally expedient, then the author would suggest that the rateable value should be treated as an elastic quantity, subject to the discretion of the engineer. It is obviously absurd that a consumer should be made to pay a larger primary charge than is necessary simply because he has a garden. The engineer should remember that a high assessment probably carries a higher load factor with it, and he should, therefore, try to meet the consumer, as far as possible, on the primary charge.

The second point that has impressed the author is the great importance of a low secondary charge, such as 0·5d. This is important, because cooks are often wasteful, and the householder soon finds that it is less serious to waste a halfpenny than a penny. Moreover, such waste is all to the good for the station; it means a higher load factor, and for that reason merits a lower price after a certain quantity of electrical energy per KW. has been consumed. In the case here discussed, some of the tariffs in use by certain members of the Point Five Association would have shown very little difference in the total cost between electricity and coal. This fact is surely an achievement.

In the case of the cooker, to which reference is here made, over a period of 13 months, the oven showed no defect, and the grill only gave one partial failure. The hot-plate is the most vulnerable part of an equipment. Maintenance is a subject of vital importance to the consumer. If, say, a hot-plate, or an oven, goes wrong, he does not like to be kept a week or more for the repair to be made. Moreover, he would like to know quite definitely how much the maintenance is going to cost him per annum. In a question which is of equal importance to the station engineer and to the manufacturer there should be co-operation between the two. The manufacturer should be prepared to quote a reasonable figure for maintenance. It may very possibly cost him more than this amount, but he is still seeking experience and should be prepared to pay for it. The station engineer on his part is anxious to keep the consumer satisfied. He should, therefore, be prepared to carry out the maintenance on behalf of the manufacturer at practically cost price; but the manufacturer should not expect more than this.

There are still some station engineers who think that the diversity factor of a cooking load is not high. On the other hand, it is sometimes stated that the diversity factor is as high as 20. This figure, however, is based on the maximum possible load of the apparatus, and it would seem more reasonable to take the consumer's maximum as being about 75 per cent. of the maximum possible. Thus the figure of 20 would drop to 15, which means that the load factor of the individual consumer is under 7 per cent.

In the case referred to at the beginning of this paper, the maximum possible load is about 8·5 KW. The average consumption per day (omitting a period of absence in summer) is about 14½ KW.-hours, giving a daily load factor of 7·1 per cent. If the working period of 15½ hours per day is taken, the load factor becomes a little over 10 per cent. Since the product of load factor and diversity factor cannot exceed 100, it follows that the diversity factor of this particular type of consumer could not be greater than 10, but it might reach that satisfactory figure. It may well be that the larger apparatus shows the smaller diversity factor: but the load factor being higher, the desirable form of load (*i.e.*, 100 per cent. load factor on the distributors) is obtained with a smaller number of consumers. Owing to a lack of appreciation of these principles, people sometimes talk of impossible load factors of over 100 per cent.

The above remarks are supported by records which the author has taken, one of which is reproduced in fig. 4. It is evident from these that the load is well distributed throughout the day, the consumption in any part of the day varies considerably, and the character of the load varies from day to day. Consequently the combined loads of, say, half-a-dozen consumers of this precise type would give a much better curve than any of the curves taken individually, because the "Tuesday" of one consumer may be the "Friday" of another. Fig. 5 is the composite or average curve which shows clearly the individual diversity of consumers having the same daily time-table. Actually the diversity would be greater owing to different houses having a different time-table. When, in addition, we remember the diversity of different classes of consumers it becomes evident that the cooking load is one that is very desirable. The lighting peak and the cooking peak do not appear to coincide, and the average load from 6.30 p.m. to 8 p.m. is less than would be expected.

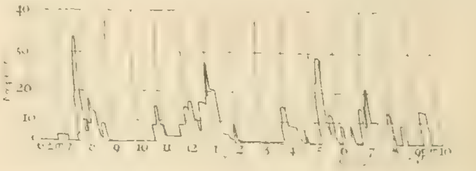


Fig. 4.—Typical Day Cooking-load Curve.

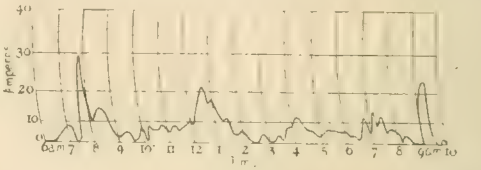


Fig. 5.—Composite Curve of a Week's Cooking-load Records.

Discussion in London.

Mr. George Wilkinson (Harrogate), who opened the discussion, said the first thing that struck him was the title of the paper; he was unaware that members of the Institution were well acquainted with the subject. He thought that, generally speaking, the supply engineer had been too careful when he initiated new tariffs; commercial people were prepared to take some risk during the early years, but station engineers often fixed their prices on the basis of existing conditions instead of making an estimate of future output and basing the price on that. He had recently altered his own house and installed electrical apparatus throughout, and now used a 12-gallon electric water heater, thermostatically controlled, which gave a supply of hot water at 180° F., night and day, suitable for drinking or washing purposes. This was for a family of six and it required 12·8 units per day, giving a load factor of about 50 per cent. On the question of tariff, if a ½d. per unit was a fair price for a 25 per cent. load factor, surely ¼d. was fair for 50 per cent. If he had to start again, he would use a 25-gallon water heater with a small heater, controlled in the same way, thus increasing the load factor. He had found that the water from a coke boiler was unpleasant in taste, for drinking, but the water from the electric heater could be used in kettles, &c., and thus saved the use of hot plates. He had experimented with a "set pot" electrically heated, but found radiation losses too expensive. The ordinary wall plugs could be superseded by large switches in the kitchen, with advantage. He considered that the question of maintenance of cooking apparatus was a serious one, and did not think it could yet be recommended without qualification by the engineer; but the apparatus had been greatly improved. His experience was with four cookers, the last one for 18 months, and one hot plate had broken down three times in that period. It would pay the manufacturers to further improve this apparatus, so that it could be recommended as confidently as in the case of modern heaters.

Mr. C. H. Wordingham was inclined to think that the station engineer knew too much about electric cooking to adopt it in his own house, and considered that greater reliability was necessary before it could be generally adopted. He had always been surprised at the claims made as to saving in loss in weight of meat by electric cooking; this loss was due to the use of too high temperatures with any form of cooking. The difficulty of economically heating water electrically was a serious drawback, and he urged that they should give up that idea or it might hinder the progress of cooking: they must recognise the limitations. He, personally, did not see the use of 12 gallons of hot water; unlimited quantities were required, and he did not believe that any juggling with tariff would facilitate electric water heating. The author seemed to use the coke stove for keeping things hot and then called it electric cooking; he must pay heavily for his rapid heating, as the KW. went up and the load factor went down in such a case. He wished to draw their attention to the question of standardising cooking apparatus, which had formed the subject of a recent leader in the Electrical Review. The sub-Committee of which he was a member had considered this matter. He felt that plugs must be standardised, but as for cooking apparatus, it was quite a different matter. The makers had been approached, but there was a great diversity of opinion amongst them, and they were not eager. He could not help thinking that certain things could be standardised in regard to oven sizes and hot-plates, and it would be most helpful if the manufacturers who were present would give their views.

Mr. Allen (Wolverhampton) said there appeared to be very few remarks in the paper, which could come from a non-technical consumer. He did not see how the fact of using a large cooker led to a better load factor. In his experience an energy consumption of 1·6 units per head per day was the usual thing for a family of six. The author gave a fearful and awful bill for apparatus, but it was quite abnormal, and he was astonished that he had put it in. He agreed with his remarks on wood casing and earthing, but it was not his experince that people did not mind paying a lump sum for a cooker. The pilot light was being generally used, but the thermometer was a complication; they had cooked without it for 50 years, and could continue without it. As regarded the saving in weight of meat cooked electrically, he had always understood that it was the better temperature regulation which was possible, which led to this saving. The author's suggested earth-rimmed plug might be more dangerous than the ordinary one, and he had not referred to the flexible which had an embedded steel wire, and was now becoming common, nor to C.T.S cable, which was suitable. He agreed that the use of earthed and unearthed apparatus together was dangerous, and to be avoided. The rateable value system of charging was the best understood tariff, and the best one for introducing electric cooking, in his experience. It was, he thought, always an optional tariff, and the author could probably have had a flat rate if he wanted.

Mr. R. S. Downe said the point of view of most consumers in regard to electrical cooking was that it must be obtainable on reasonable terms. The various testimonials which he had received were more convincing than the paper. If the author had lived in the Brompton and Kensington area he could have paid 5s. or 7s. 6d. per quarter rental for his installation, fixed and wired, and would have had utensils supplied free, or if he desired to purchase, he would have had to pay £14 for the installation, including wiring, instead of the high sum of £35. Electric cooking would have to be carried out on exactly similar lines to the gas-cooking business all over the country, and in the immediate future an installation would not exceed £10 in cost. He agreed with Mr. Wordingham that electric water heating was too costly, and at his company's restaurant coke-fired boilers were now used, giving twice the amount of water for 7s. a week as against the electrical cost of £1. He considered that the gas people had prepared the way for electric cooking, and it would be adopted on an extensive scale in the near future. In his area they had about 100 cooking installations installed (during the past three years), and the progress was becoming rapid owing to personal recommendation. There was no doubt about there being in practice a considerable saving in shrinkage of meat by electrical cooking. As the result of inquiry he was informed that with the coke-fired ovens at Cadby Hall (Messrs. J. Lyons & Son's headquarters), there was a loss in weight of meat cooked over the year of 30 per cent. A test on a large scale of electric cooking showed only 18 per cent. loss, representing a saving of some 10s. worth of meat in that case as compared with the ordinary process. The average consumption of energy per cooker in his area was some 2,500 units a year; or 1½ units a head per day for five persons. It was estimated that at least 1,200 consumers in the area could adopt electric cooking, and taking an installation at 5 kw, the extra 6,000 kw. of load would only come on to the peak to the extent of 1,000 kw.

Mr. Grogan thought it possible that the author had been too much in the kitchen judging by the excessive energy consumption; he did not agree that the large consumer was better than the smaller one, as regards the cooking load, as the latter had the better diversity factor and load factor. He was glad the author had not adopted electrical water heating, as the result would have been awful; but the electrical method was satisfactory as regarded convenience and if a small quantity of water was sufficient. From his experience, a family of five should require from 1,500 to 2,500 units per annum for cooking and allowing the author another 1,000 units, or 3,500 units, this should be sufficient for seven people, so that his energy consumption was much too high. He knew of a Manchester household of similar size which took 65 units per week for cooking, as against the author's 110 units. He asked, was this paper going to help electric cooking? He himself looked upon it as a murderous submarine attack on the splendid progress made in recent years. The author had paid extravagantly for his installation; why should he inflate the bill by the cost of the coke boiler? He had apparently mentioned hiring of apparatus as an afterthought; there were some 30 or 40 towns hiring out electric cookers, and that was the only way to do the business.

Mr. Duncan Watson said the paper gave them the opportunity to correct the views put forward. His sympathy was with the engineer who was unable to offer a suitable tariff for cooking. He had heard that much more efficient apparatus was to be introduced shortly; at present maintenance was rather a serious matter.

Mr. Haydn Harrison had not found the paper to have much reference to the "consumer," as usually understood. As a user of electric cooking, he had turned up his bills for gas, coal and electricity for the past five years, during which period he had adopted electric instead of gas cooking, and it was not at all easy to tell when he changed over. His district was supplied by a company which did not encourage electric cooking, and charged 1½d. per unit for the supply and 5d. per unit for lighting, but despite this high price and the fact that gas was only 1s. 9d. per 1,000 cb. ft. the change over had not made any appreciable addition to the cost. He was afraid the paper would not be rightly read, and that it would be taken to mean that the author had made a loss of £9 after spending £45 on apparatus.

Mr. W. M. Mordey suggested that if the principle of the thermos flask could be adapted in the electric oven, a considerable saving in energy would result once the right temperature had been obtain.

Mr. Pinkney said the author's energy consumption for cooking was very high; in his own family 1·3 units per head per day were required over the first period of six months, and he was convinced this would drop to 1 unit or less, yet the author took 2 units with a "careful" cook. He was afraid the thermometer would not be used, although it would be advantageous if it were.

Prof. Morris said it was important that electric cookers should be hired, as apparatus suitable in one area might be unsuitable in an adjoining one, if the householder moved. He agreed that electric water heating was best left alone for the present, and that attention should be concentrated on cooking. He had found the cost of a coke boiler to be 3d. a day for a family of five or six and this could not be touched electrically. The same family required 1¾ units per head per day for cooking. A big scale thermometer would be a useful accessory if it could be mounted with the switches on the wall. He found that cooks did not understand what shocks were.

Mr. A. H. Seabrook felt that it was a case of "saving us from our friends"; he strongly deprecated the publication of such doubtful results. The large cooking consumer was infinitely worse than the small one in the matter of load factor, and in the matter of cooking load he would prefer, say, Ilford to Marylebone. In Marylebone there were one or two consumers using electric water heating; they were satisfied with the cost and that was all that mattered. The initial cost of the author's installation was utterly ridiculous; he (the speaker) could not find a householder who would buy a cooker—the hiring practice was too firmly established. There was no more sense in running a cooker on a single fuse, than there would be in running, say, a small town in the same way. He found that thermometers were soon taken off cookers, and that the Scott Ram hand-shield plug was quite satisfactory. He thought that the earthing of cooking apparatus was compulsory. The author's curves showed a non-peak load, with the largest demand in the morning. He mentioned that Messrs. Selfridge had now placed an order for an installation for staff cooking, which would be the largest in the world.

Mr. Nichols Moore said the author's paper should indicate to engineers what they had to deal with. He considered it futile to make random statements as to the saving in weight of meat by electric cooking; the author's figures showed a saving, but they were not cooking joints all the week, and the saving in £ s. d. did not amount to a great deal. He found in his own case that a "domestic" tariff with a secondary rate of ½d. per unit showed a slight saving in cost over flat-rate charges.

Mr. Gillott said he understood that the American navy had scrapped all cookers with top and bottom heaters, owing to the fat firing with the bottom heat. In his own case, with seven in the family, it required ·97 unit per head per day for electric cooking. Why had the author debited all the fixed charges to electric cooking? This seemed unfair.

Mr. F. C. Raphael said the author had made the mistake of generalising from a particular case, and he was afraid much too great publicity would be given to his unfortunate experiments. The author's experiments on flexible had been forestalled by work already done in this direction.

Mr. Cooper replied very briefly, owing to the lateness of the hour; he felt justified in his paper in view of the contradictory nature of the discussion. He had regarded it as an optimistic paper! He agreed that electric water heating was very convenient.

ELECTRICITY APPLIED TO MINING.

By C. P. SPARKS, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *February 25th*, 1915.)

(*Continued from page* 378.)

A winder driven by a direct-coupled induction motor is erected at the Abercwmboi Colliery. The duty for which it was designed when fitted with a tail rope of equal weight to the winding rope is as follows:—

Depth of shaft	240 yards
Output of coal per hour	180 tons
Net load of coal per wind	50 cwt.
Number of trams per wind	2
Time of wind	35 sec.
Time of each complete cycle	45 sec.

The 3-phase motor is wound for 3,000 volt working pressure and has its rotor mounted on a continuation of the drum shaft. The continuous rating of the motor is 375 b.h.p., the maximum horse-power developed during the acceleration period being 700 with a power factor of 0·75.

A liquid controller is provided for starting and regulating the motor and is interlocked electrically with the oil-break main and change-over switches for reversing the motor. The resistance in the rotor circuit is determined by the height of the liquid, which is varied by a sluice valve connected to the controller. The liquid is cooled by pipes in which water is circulated, and is pumped from a storage tank in the base of the controller by a small electrically-driven centrifugal pump.

The winder is controlled by one lever which is connected to the main stator switch, the controller, and the brake engine.

The controller can maintain a minimum motor speed of 2.5 r.p.m. with one-tenth normal torque for 15 minutes for rope examination, etc.

The drum brakes are of the post type, and are weight-loaded air-operated with the Whitmore patent self-adjusting and variable-load appliances, by which the driver can apply any desired load upon the brake according to the amount that the foot lever is pressed down.

The air supply for the brake cylinder is provided by an electrically-driven compressor set. This set consists of a compressor direct-coupled to a 3-phase motor with automatic starting and stopping, controlled by the pressure in the receiver, the working value of which is 60 lb. per square inch.

Should the power supply fail either through failure of the main supply or the operation of the overload main-switch relays, the brakes are automatically applied and the winder drum is brought to rest.

A dial depth-indicator is used, with which is incorporated the overwinding gear. The latter in case of an overwind applies the brakes and cuts off current from the winding motor.

This winder has been in satisfactory operation for the last six years. The "peak" due to the sudden application of a load of 750 K.V.A. every 45 or 50 seconds is satisfactorily dealt with at the power station by the Tirrill regulator. The number of units per ton of coal wound without a balance rope, is 1.6 when winding 25 cwt. of coal.

Pumping.—The steam plant has been supplemented or displaced by single-lift centrifugal pumps, and in place of pumping continuously, the main pumping is now confined at the Elliot Pit to 8-12 hours out of the 24 by enlarging the lodge rooms, the pumping in the other valleys being confined where possible to the night shift. This has a marked effect on the load factor of the power houses, and in the Rhymney Valley it has provided the continuous load necessary for the economical use of gas-engine plant.

The largest pumping station is at Elliot Pit, the pump room being situated at the foot of the up-cast shaft and containing three Westinghouse-Sulzer centrifugal pumping sets; two of these are driven by 950 B.H.P. 3-phase motors, and the third by a 1,000 B.H.P. motor, the following being the respective duties:—

	950 B.H.P.	1,000 B.H.P.
Gallons per hour	81,000	87,000
Head in ft. (manometric)	1,690	1,690
Full-load r.p.m.	1,475	1,475

The 1,000-B.H.P. pump is of Messrs. Sulzer's 6-stage type with special cast-iron casing and bronze impeller and guide wheels, and the makers' patent balance-disk method of taking up end thrust. The motor is of the slip-ring rotor type with liquid starter, the stator being built in a turbo-alternator frame. The windings are designed to give a temperature rise not exceeding 35 degrees C. above the inlet temperature of the air which passes through the pump room at the rate of 10,000 cubic feet per minute.

Owing to the confined nature of the pump room and the size of the pumping plant, two 17½-in. fans, one being in reserve, are erected in the passage way leading to the up-cast shaft and discharging into it; incoming air is brought through a special heading driven into the down-cast shaft. An air filter consisting of cloth stretched on wooden frames is erected at the incoming end of the pump room, and suitable dampers are provided at each motor for controlling the supply of air.

The system of forced lubrication employed for the pumps and motors consists of oil tanks fitted with submerged "spur-wheel" pumps, chain-driven by small 3-phase motors mounted on the covers of the tanks and supplying oil to the various bearings. Each pump is fitted with an oil filter which can be withdrawn and cleaned while the pump is in action.

The overall efficiency of the above set tested at full duty was 71.9 per cent.

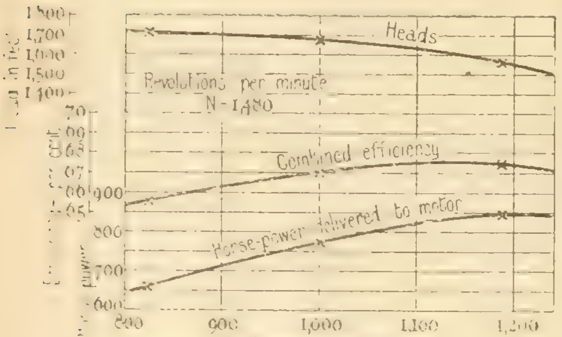


FIG. 6.—CURVES OF TEST RESULTS, 800 B.H.P. CENTRIFUGAL PUMPS, BARGOED.

PUMP DATA.

Head	...	1,660 ft.
Capacity	..	60,000 gallons per hour.
Speed and Type	..	Sulzer 8-stage, 1,480 r.p.m.

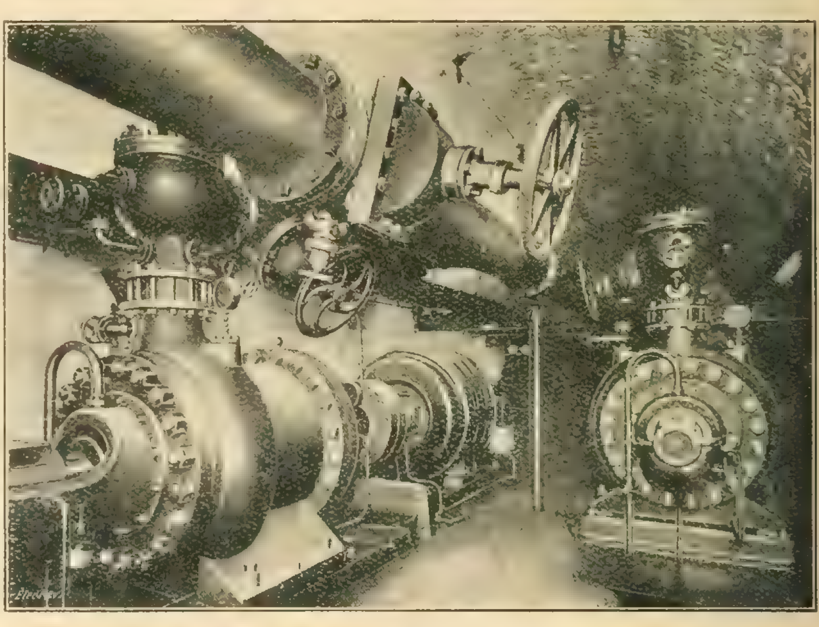


FIG. 7. PUMPING STATION, ELLIOT PIT, SHOWING WESTINGHOUSE-SULZER PUMPS.

Ventilation.—Up to a few years ago the general colliery practice was to use low-speed fans; latterly a considerable number of centrifugal high-speed fans have been employed.

All the principal fans of the Powell Duffryn Co. have duplicate motors as a stand-by to allow for cleaning and repairs. These fans are driven by induction motors, and in order to give flexibility in the volume of air the fans are rope-driven, to allow the pulley ratio to be varied.

At the new Britannia Colliery, the fan employed is designed for the full air output for ventilating the workings when the latter are fully opened out, but until this time has arrived it will run at speeds to suit the development. The electrical equipment consists of a rotary converter and continuous-current motor, the latter being direct coupled to the fan shaft. Speed variation is obtained by hand regulation of the field rheostat. The stand-by motor in this case is of the induction type, the fan being rope-driven.

Compressors.—Although the efficiency in transmission and conversion is low, compared with electricity, compressed air is largely used underground where danger may arise from dust, gas, or falls, for all small power drives. The Powell Duffryn Co. erect the main compressor plant in the winder house so that it can supply all requirements, the separate air systems being interconnected so as to reduce the percentage of reserve plant.

As the air requirements are intermittent it is desirable to run the electrically-driven compressor at a variable speed. Large variable-speed compressors are at present only operated by continuous-current motors.

The compressing plant at Britannia Pit consists of three electrically-driven compressors, two running at constant speed driven by induction motors:—

Cubic feet of free air per min.	2,500	3,500
Motor r.p.m.	243	240
Brake horse-power	410	550

A further compressor plant capable of dealing with 5,000 cubic feet of free air is being added, driven by a continuous-current motor. The latter will be supplied from a 1,100 KW. 6-phase rotary converter which runs at 500 r.p.m. The speed of the motor is automatically varied by controlling the rheostat according to the air pressure in the delivery pipe.

At Abercwmboi the compressor is of the Belliss enclosed forced-lubrication type, driven by a 3-phase induction motor. The stand-by compressor is driven by a 140-B.H.P. induction motor.

Haulages.—Owing to the intermittent nature of haulage loads, the necessity for high torque at starting, and the tendency of all haulages to be used together towards the end of the shift, this load is one of the most costly to supply unless a large number of haulages are worked from the same power house. With induction-motor drive the speed is nearly constant, consequently the power demand is proportionately increased on gradients, thus decreasing the already poor load factor with this class of load. Owing to the position of haulages it is undesirable to employ continuous-current motors, which involve with an alternating-current supply a special converting plant.

The usual form of drive is single-reduction gearing for the larger powers when room can be safely provided, and double-reduction gear for the smaller haulages or when space is limited.

The original controllers were of the oil-immersed drum type with contactors controlling the metallic resistances. These were not only costly but occupied considerable space. Where water is available all larger controllers are now of the liquid type.

The liquid controllers consist of a tank or tanks in the bottom of which are mounted contacts connected to the rotor slip-rings. Corresponding movable contacts are carried on vertical rods actuated by a lever or by a hand wheel, the resistance in circuit being proportional to the distance apart of the fixed and moving electrodes in the electrolyte. The stator reversing-switches are fixed in the framework carrying the tank and are mechanically connected to the lever or hand wheel operating the electrodes. The liquid is cooled by pipes through which water is circulated.

The chief advantages of the liquid type of controller are the finer adjustment of the speed, especially at starting when taking up slack on the rope and shackles, and its simplicity of design, resulting in fewer working parts and greater ease of inspection. The principal disadvantage is the necessity for a supply of cooling water. The latter difficulty can be overcome where no water is available by fitting a system of radiator cooling pipes and a small motor-driven centrifugal pump. While this method works satisfactorily, it adds considerably to the first cost.

Owing to the heavy duty imposed on reversing switches of both types of controllers a special design is called for, as the frequency of operation under conditions of maximum load is much higher than that required from any other switch. To prevent overheating and formation of carbon deposit it has been found necessary to design these switches on generous lines, with an increased area of contact and a big head of oil as compared with standard switches of the same rating.

The smaller motors up to 30 B.H.P. used for driving the various auxiliaries on the surface are of the standard protected 3-phase type, wound for 500 volts. The majority of them have slip-ring rotors with liquid resistances for starting, this type of rotor being preferable to the squirrel-cage type, on account of the reduced switchgear maintenance.

Transmission System.

Experience has proved the reliability of overhead transmission with bare conductors for colliery supply. Apart from the saving in first cost, the main risk through the use of cables is avoided, namely, subsidence.

To secure safety it is advisable to screen the overhead conductors at all points where they cross traffic. The efficiency of screening is dependent on reliable earthing, which is best secured by a continuous, stranded earth-wire of substantial section, effectually earthed at each end and connected to intermediate earth-plates every 300 or 400 yards. In order to minimise risk, all main conductors round the pit head should be run as armoured cable.

The overhead system used by the Powell Duffryn Company in the Aberaman Valley was described in the previous paper.* The following modifications have been made to meet the developments in the last nine years:—

All collieries in the Aberdare Valley are now supplied by a system of 3,000-volt ring mains, protected on the Merz-Price system.

The section of the main feeders of hard-drawn copper has been increased to 0.15 sq. in. (19/12 S.W.G.), the wires being grouped in a triangle, for single circuits 3 ft. 6 in. vertically and 4 ft. 6 in. horizontally; with double circuits the conductors are carried on three cross-arms, the circuits being spaced 4 ft. horizontally and the phases 3 ft. vertically apart.

The pilot wires for the Merz-Price system consist of either one or two 3-core 7/21 S.W.G. paper-insulated lead-covered cables, suspended from galvanized steel catenary wire, 7/14 S.W.G., by raw-hide suspenders, these conductors being carried at the extremity of a fourth cross-arm fixed at about 4 ft. below the main conductors.

The average length of span is 100 ft.

Little depreciation is noticeable at the base of the creosoted wood poles, which have been erected over 10 years.

The overhead wires radiating from the Middle Duffryn power station have been displaced by 3-core paper-insulated lead-covered armoured cables to a point well clear of the power station, washery, and railways. The overhead wires branch from brick towers, in which the choking coils and horn-gap lightning arresters with liquid resistances are placed.

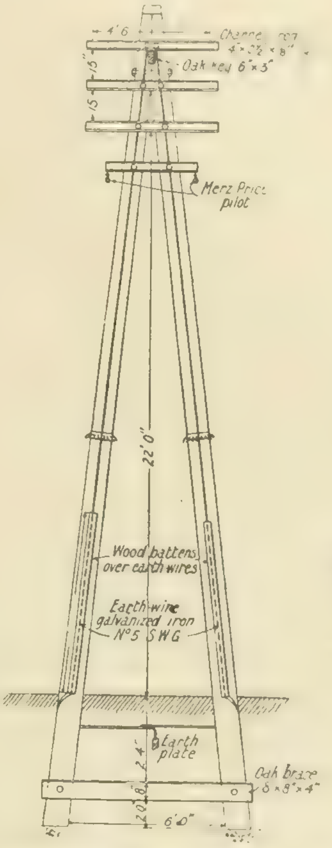
The Rhymney Valley 10,000-volt transmission lines run from Penallta to Bargoed, a distance of 3½ miles. Duplicate circuits are run between Penallta and Pengam on the same "A" and "H" poles, and between Pengam and Bargoed on separate poles, the two pole lines being about 30 ft. apart. This allows the Britannia Colliery, which is completely electrified, to be supplied from either of two power houses by two sets of duplicate transmission lines, grouped on three independent pole lines.

Wood poles are employed 36 ft. long, the maximum diameter at the base being 11½ in. and at the top 7½ in., and the pole being buried in the ground 5 to 6 ft.

The conductors are hard-drawn copper, 0.25 sq. in. section (37/13 S.W.G.). The phases are spaced vertically above one another, 15 in. apart, the two sets of transmission lines between Penallta and Pengam being 4 ft. 6 in. apart (figs. 8 and 9), and the average span being 100 ft.

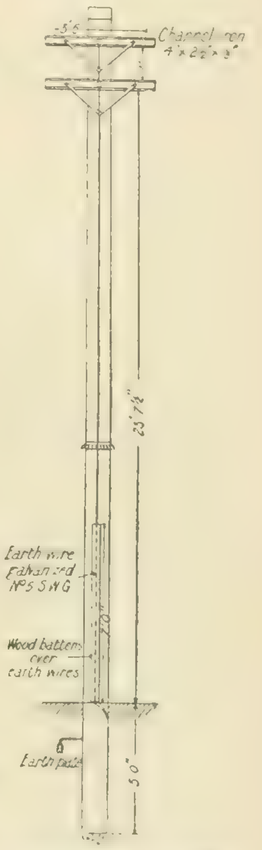
The insulators of the double-petticoat pin type are carried on three channel irons of section 4 in. × 2½ in. bolted to the poles, each insulator being subjected to a test pressure of 55,000 volts under standard precipitation, and a pressure of 75,000 volts when dry.

Each circuit is protected on the Merz-Price system, as at Aberdare, the catenary wires acting as the earth connection.



A pole carrying two sets of lines.

FIG. 8.—10,000-VOLT TRANSMISSION LINES.



Pole carrying one set of lines.

FIG. 9.—10,000-VOLT TRANSMISSION LINES.

The overhead lines are connected to the generating station and sub-stations by 3-core paper-insulated lead-covered and armoured cables 250 yards in length.

Two duplicate sets of 0.2 sq. in. hard-drawn copper (37/0.082 S.W.G.) 3,000-volt lines connect Bargoed with Elliot Pit and New Tredegar. These are also protected on the Merz-Price system. As the demand increases, the pressure on these lines will be raised to 10,000 volts.

The distance between the Middle Duffryn power station and the new Britannia Colliery is approximately nine miles. The transmission line will be constructed for a working pressure of 30,000 volts. In the first instance, however, the line will be worked at 20,000 volts, supplied through three 2,200-K.V.A. single-phase oil-insulated water-cooled step-up transformers connected so as to give 3,000 volts mesh to 30,000 volts star, and 30,000 volts star to 10,000 volts mesh. When working at 20,000 volts the transformers will be connected mesh to mesh, the ratio being adjusted when connected mesh to star by cutting out part of the neutral ends of the star winding.

The transmission line will be controlled by switchgear on the 3,000 and 10,000-volt systems, the transformers being connected direct to the transmission lines through isolating switches.

When working with transformers mesh to mesh, supplementary star transformers with the neutral earthed will be used to operate the protective system, the Merz-Hunter split-phase control being used, and the switchgear being actuated in the event of a line fault by balanced transformers connected in series with the split-phase conductors. Time-limit overload relays will be used to protect the 3,000 and 10,000-volt systems.

The power factor and the pressure drop on the transmission line when supplying from one end will be controlled by hand-regulated static boosters star-connected on the 3,000-volt system at Middle Duffryn.

The transmission lines will consist of six 0.073 sq. in. stranded conductors, each comprising 7/11 S.W.G. hard-drawn copped wires arranged on normal spans with the phases 5 ft. apart vertically, the split phases being at 4 ft. horizontal centres.

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* See Elec. Rev, April 20th, 1906.

The conductors will be carried on pin-type insulators mounted on three channel irons, these being protected by insulated sleeves so as to prevent birds operating the protective gear. Steel poles will be used, and the average length of span on straight runs will be 120 yards. For railway and road crossings a special construction will be employed, with double insulators and heavy-section screening.

A continuous earth-wire of 7/13 S.W.G. hard-drawn copper will connect the metal-work of the entire system, each transmission pole having a galvanised iron earth-plate electrically connected to the main structure of the pole.

The end connections for the transmission line will consist at each end of not less than 300 yards of 0.1 sq. in. split-phase paper-insulated lead-covered double-wire-armoured cable, the armouring being connected to the continuous earth-wire at each end and to the main earth connections at the Middle Duffryn power station and Britannia Collieries.

Fig. 5 (p. 377) shows the route of the 20,000-volt transmission line. With the completion of the latter the Britannia Colliery will be fed from three power houses by three independent routes. The annual load factor of the entire undertaking will be as high as 55 to 60 per cent., while the reserve plant in either valley will be available for the whole undertaking.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Consulting "Engineers."

Concerning consulting engineers and others mentioned by "Station Engineer" and "Ero," may I remind your readers that as far back as the Victorian Era your Correspondence columns found space for the discussion of the status of the hangers-on who impede the positive achievements of our industry, even now that it is demonstrated that the workers have outrun them in their own sphere?

There are works and factory engineers, with more electrical schemes on hand (in addition to their own routine work) than may be found in any of the top-floor back offices of the consultants. Men of the line prefer the lead of these electrically-equipped mechanics to the buffoonery of the so-called consultants whose quantities and specifications are redolent of 1885, and whose initiative is as obsolete as are their methods of measuring up a job of the looped-in type, which they often do not understand. Before me now are the specifications and quantities for a job just completed without them, they being ignored for the following reasons:—

The much "stock-phrased" specifications ridiculously divorced modern practice from the plans and quantities.

The schedule becoming useless by the discovery to the consultant and his client alike that the lighting of areas and the adaptation of power were matters nowadays better understood by the worker in practice than it was conceived by the consultant whose mental attitude towards the industry harked back to the days of the tree system and two-pole machines.

During the last three months the writer has had to return to stores huge quantities ridiculously unnecessary, and to requisition other quantities applicable by the rules and regulations but not provided for. Even since December last we have had to refuse point-blank to run mains in the same conduits carrying circuit wires, as directed—this on a split 200-volt D.C. system.

We have removed crossings shoved up into ceilings to obtain flat ceiling effects, and prevented the use of fibre in the crossings of casings, etc., none of which was objected to by a consultant (of *too* long standing).

We have fought stiff wordy battles to persuade a "specialist" that H.V. I.C. distributing boxes, etc., ought not to be fixed on the wood surfaces of flue hoists where brick or stone walls were available.

We have been "eccentric" enough to demonstrate the unwisdom of arranging a 400-volt power net-work upon the same panel as 200-volt lighting circuits, as well as being wicked enough to disagree to the fixing of pairs of S.P. lighting switches on the same base block and connected to dis-boards on opposite sides of three wires.

And, to be brief—were it not for the law of libel, much more could be said; it is sufficient, however, that there are men directing matters electrical who, being unable to *do* what they know *how* to do, are solacing their own mediocrity by occasionally escaping from their top-floor back offices to harass an industry which is forging ahead in spite of them. "Station Engineer" as well as "Ero" need be careful lest they, too, might get elbowed out of the way like

J. B.

The Government Electric Power Station at Bangkok.

In a letter dated January 4th, 1915, your correspondent "H.E.F." made certain comments in regard to this plant which, in fairness to all the parties connected with it, stand in need of some correction.

The specifications upon which the tenders were submitted were drawn up by the Siamese Government's electrical engineer, Mr. Shaw, and invitations to tender upon a definite size of plant were issued to all the well-known electrical manufacturing concerns in Great Britain, Germany and America. These facts will dispose of your correspondent's suggestion that German engineers were responsible for the size of power station and will show that in the competition for the contract, all firms, regardless of their nationality, were placed on the same footing.

It may be of interest to your readers, and satisfying in some measure to the patriotism of your correspondent, who fears for British enterprise, to point out that while it is true that the A.E.G. secured the contract, their tenders were prepared by British engineers under the supervision of the British manager of the A.E.G.'s foreign department, and British enterprise sent out a British engineer to Siam to carry out negotiations in regard to the A.E.G.'s tender, which resulted in their securing the contract.

It is not correct, as your correspondent states, that the price quoted by the A.E.G. was much below that of all other firms competing; neither is it correct to suggest that the final cost of the plant has been increased by charging the Government with a large number of extras. If the total cost of the power station has exceeded the original Government estimate, it is partly due to unforeseen difficulties in regard to the erection of the buildings and extensions to the original scheme. The erection of the power station and its operation during the guarantee period have been carried out under the supervision of British engineers, so that German brains have had very little to do with the inception and carrying out of this scheme. This statement is due to the British engineers engaged upon it. When it is added that, although the contract was carried out by the A.E.G., who built the steam turbo-generators, the boiler-house plant was supplied by Messrs. Babcock & Wilcox, Ltd., and the switchgear and transformers by the British Thomson-Houston Co., the history of this plant may be judged in its right light. There has been no dispute, as your correspondent suggests, between the parties concerned in regard to the boiler furnaces. There was a natural desire on the part of the Government officials, the main contractors, and the boiler makers to utilise all the experience obtained in other boiler plants in Bangkok with paddy-husk furnaces, and this led to certain modifications in the original design, which the results fully justified.

In a recent letter from Bangkok informing the contractors of the successful conclusion of the tests, it is stated that as regards the boilers, the trouble taken to secure success has been fully justified, as the paddy-husk consumption has been reduced to a figure which has surprised the officials represented at the tests; moreover, with the new furnaces, an almost smokeless chimney has been obtained.

While the size of the plant may be too great for present demands, Mr. Shaw's faith in the growth of electrical enterprise in Bangkok will be justified sooner or later. Want of faith in the possibilities of electrical development has perhaps been one of the causes of the slower growth of the electrical industry in England than in Germany and America.

Bangkok.

[The fact that Mr. Shaw has not replied to the comments above-mentioned is due to his absence on active service as an officer in the armoured-car division.—EDS. ELEC. REV.]

Government Control of Factories.

Everyone has noticed the number of ridiculous statements which have been appearing in the Press recently and which has for its culminating feature the control of factories by the Government. For instance, in the House of Commons last week, it was stated there were no firms "not already engaged on Government work" in this country who could make similar goods to Siemens. We have recently, on two separate occasions, made applications to the War Office to be placed on their list of contractors, but owing to the fact that fifteen years ago one of the officials of this company offered a couple of theatre tickets to a War Office official, for this serious offence we were struck off the list. We have only one official now working for this company who was with them at the time. The directors are a totally different body of gentlemen, and yet the War Office cannot see its way clear to put us on their list. This is surely visiting the sins of the fathers, etc. The peculiar part of the whole business is that about 75 per cent. of our present output is war material through sub-contractors. We have even had a visit from one of the Government officials asking us how many men we could spare the War Office for machining ammunition, etc., and yet, in spite of all this, we are not respectable enough to be on the War Office list. It makes one feel inclined to side with those who are working for a business Government.

Walsall Electrical Co., Ltd.,
V. DELEBECQUE, *Works Manager*

Walsall, *March 12th*, 1915.

Coke Fuel for Steam Raising.

Our attention has been called to the letter signed "Engineer and Fuel Expert, London Coke Commission," who, we believe, is Mr. Nickoll (of the Gas Light & Coke Co.). The remarks he attributes to Mr. Horace Boot are incorrect, inasmuch as what Mr. Boot said at the meeting of the South Metropolitan Electric Light & Power Co. was, as correctly reported in your previous issue, that if Mr. Bowden thought he was going to get the same output from the boilers by using coke breeze as he previously could when using coal, it could only be achieved by forcing the boilers, which forcing seriously diminished the life of same. On the other hand, no doubt, by increasing the number of boilers and burning coke breeze at about 6s. or 8s. per ton, economy can be gained, as we have on several occasions intimated to our clientele.

We venture to think these remarks will be confirmed by every boiler user who has tried various classes of fuel.

Horace Boot & Partners.

London, S.W., *March 15th*, 1915.

Showroom Windows.

The writer in your issue of last week, under the heading of "Showroom Windows," has raised our expectations, and I hope will be able to fulfil them.

A good number of supply managers are interested in this question of how to dress showroom windows. The writer states that with irons, kettles, toasters, radiators, cookers, "nothing should be easier than to make an attractive display," and he finishes the article by whetting our appetite for "suggestions."

The showroom window is perhaps one of the most difficult things to deal with, that is, assuming it is a fairly large shop window. To get a continuous series of displays sufficiently attractive "for nobody to pass the shop without glancing in," as your writer mentions, requires a good deal of invention and ingenuity, when novelty has to be obtained year after year. However, your writer comes along in optimistic style, and I am sure a good many readers will be anxiously awaiting any useful hints.

May I suggest that, as we have had in technical journals quite a plethora of vague generalities, your writer should put his suggestions in a series of cut and dried specifications for a series of windows lasting over a year?

By specification I mean, not a general hint, but a detailed list of the exact apparatus to be put into the window, together with any ornamentation and any special showcards, sufficiently in detail for the specification to be put into the hands of any showroom assistant, so that by following it literally he could obtain exactly the effect that the writer would recommend. The writer should assume that there is a large shop window absolutely blank—floor, ceiling and sides.

As the writer claims to have had a very large amount of practical experience, it would also be of assistance if he could give the exact cost of dressing each window, exclusive of the actual electrical apparatus.

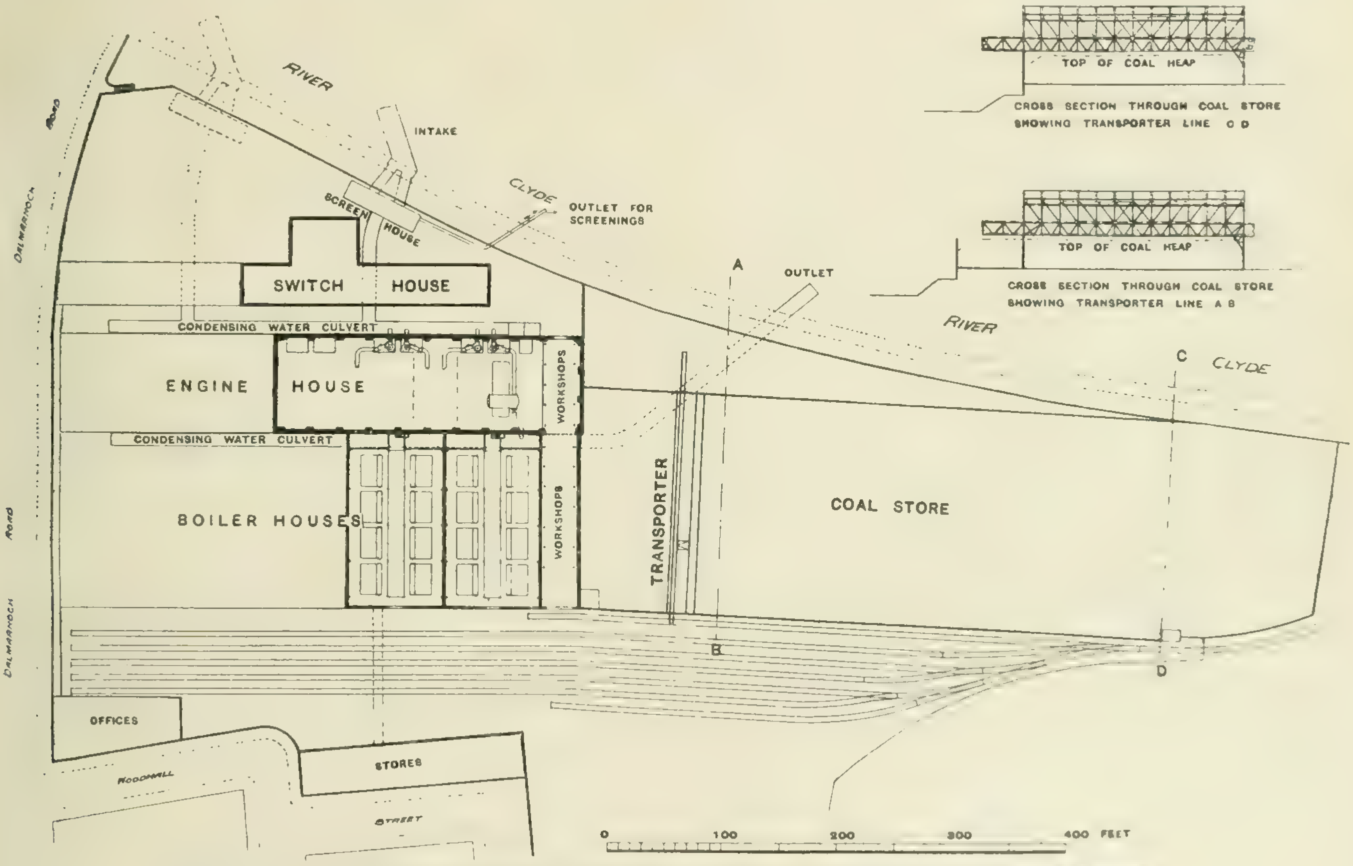
If he gives something of this kind it will certainly be practical, at least.

Electric Supply.

GLASGOW ELECTRICITY WORKS.

Mr. W. W. Lackie, Chief Engineer to the Glasgow Town Council's Electricity Department, has issued to the members of the Electricity Committee descriptive notes on the new works at Dalmarnock Bridge, of which the following is an abstract:—

The site of the Dalmarnock Road electricity works has a total area of 13¾ acres, the total cost being £27,112, and is admirably suited for its purpose. An ample supply of condensing water is obtainable from the River Clyde, and railway sidings are already laid on to the site. The first portion of the works, which is now under construction, consists of a water intake, a screening house, two water culverts (one for the inlet water and one for the outlet water), switch house, turbine room (75 ft. × 240 ft.), two boiler houses (each 150 ft. × 84 ft.), workshop and store, and a complete coal-handling plant capable of dealing with 100 tons of coal per hour. Contracts were placed for the excavation of the ground in April, 1914, and subsequently, in August, for the water channels and concrete foundations. These contracts amount to a total of £48,000. The contract for the coal-handling plant has also been placed, and the cost of this portion of the work amounts to £24,800. Offers will shortly be asked for the first portion of the buildings, and specifications for the first instalment of the plant are practically ready. This plant will consist of two 10,000-kw. turbines and one 15,000-kw. turbine, coupled direct to a.c. generators. There will also be three 1,000-kw. turbo-sets for driving auxiliary machinery; and all the necessary condensing plant and circulating pumps. It is proposed to continue installing plant units of 15,000 kw. as the demand increases, but units of 30,000 kw. can be installed if found desirable. The ultimate capacity of the Dalmarnock works will be at least 140,000 kw. It is intended to transmit electricity from the works at a pressure of 20,000 volts (three-phase alternating, 25 periods per second) to existing distributing centres at Port Dundas, St. Andrew's Cross, Govan, and Partick The energy will be transformed there from 20,000 to 6,500 volts, and distributed at this pressure to existing sub-stations where again it will be transformed to low-pressure current for the general supply throughout the city. Ducts are now being laid from the works to Cathedral Street sub-station, and the existing spare ducts from Cathedral



Sketch Plan of the New Glasgow Electricity Works and Site, at Dalmarnock Bridge.

Street to Port Dundas will be used for continuing the supply to Port Dundas. Ducts will require to be laid from Dalmarnock works to the existing sub-station in French Street, a distance of 1,200 yards; spare ducts already exist running from French Street sub-station to St. Andrew's Cross works. Ducts will require to be laid from St. Andrew's Cross works to Govan immediately, and later on additional mains from Port Dundas to Partick. It is hoped that the first part of Dalmarnock works will be ready to deliver energy at the beginning of the winter of 1916-17.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

RUSSIA.—The Board of Trade have received a translation of an article published in the January number of the monthly organ of the Moscow factory owners and manufacturers giving particulars of certain projected modifications of the Russian Customs Tariff which, it is understood, have been under the consideration of the Russian Government. H.M. Ambassador at Petrograd, in forwarding the translation, states that the information furnished in this article is in no way official, but is probably substantially correct. It appears that the proposals for tariff modification in their latest and revised form include the following :—

(1) The "Conventional" (*i.e.*, Treaty) rates of duty resulting from the Russian Commercial Treaties with Germany and Austria are to be abrogated, and the goods covered by those rates are to be dutiable at the "General" Rates (i.e., higher), rates of duty increased by 10 per cent. (except as regards certain goods mentioned, of which glassware is probably the only one of interest to the electrical trade, the duty on which is to be increased by about 30 per cent.).

(2) No change is to be made as regards goods the duties on which are fixed by the Russian Commercial Treaties with France, Italy and Portugal. These duties are also applicable to British goods.

(3) All other goods and those other than certain named, but not of interest to the electrical trade, are to pay the existing "General" tariff rates of duty increased by 10 per cent.

The effect of these alterations on British goods is not yet quite clear from the details available, but the Board of Trade promise to publish in due course a translation of the tariff showing in detail the effect of these proposals. Meantime, it would seem that, with the exception of goods covered by the Treaties with France, Italy and Portugal, British goods will still be dutiable at the same rate as German goods, and that the duties in both cases will be considerably higher than heretofore.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

3,241. "Ceiling roses and the like electrical accessories." R. T. Grocott. March 1st.

3,244. "Electric lamp holders and similar couplings." A. A. Schashke. March 1st.

3,261. "Electric light fittings." G. Maurice & F. T. Cash. March 1st.

3,277. "Porous radio-active bodies and process of producing same." R. J. Tugwood (Radium Therapy Corporation, United States). March 1st. (Complete.)

3,283. "Electric controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co., United States). March 1st. (Complete.)

3,284. "Electric motor controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) March 1st. (Complete.)

3,300. "Electric conductors or cables." W. E. Hitch. March 2nd.

3,302. "Electric dry cells." A. E. Sampson. March 2nd.

3,303. "Electrical alarum switch." T. P. Dunkerley. March 2nd.

3,321. "Electric means of attacking submarines and other war ships, and also of attacking Zeppelins or other aircraft." R. P. Williams. March 2nd.

3,326. "Secondary electric batteries or accumulators." W. S. Naylor. March 2nd.

3,329. "Sanitary telephone mouthpiece." Ed. M. Jenkins. March 2nd. (Complete.)

3,364. "Manufacture of electric insulating materials and the like." March 2nd. W. E. W. Richards.

3,366. "Telephone exchanges." International Electric Co., Ltd., R. G. le Noir, & E. [illegible]. March 2nd.

3,369. "Electric insulators." Soc. Ceramica Richard-Ginori. (Convention date, March 5th, 1914, Italy.) March 2nd. (Complete.)

3,379. "Electrical device to be used on taxi cabs and the like." E. J. Matthews, H. Richardson, & F. Henry. March 3rd.

3,386. "Railway signalling apparatus for automatically warning the engine-driver or guard as to the position of the signal and including means for telephoning to the train from the signal cabin, and for automatically stopping the train from running past a signal at danger." E. Sutton. March 3rd.

3,409. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whittaker. March 3rd

3,411. "Means for connecting electrical conduits to their fittings." A. Meers & F. R. Baker. March 3rd.

3,433. "Reactance coils." P. Torchio. March 3rd. (Addition to 11,116/14.) (Complete.)

3.434. "Magnetic compasses." W. B. Ritchie & R. H. McDowell. March 3rd.

3,439. "Sparking plugs for internal-combustion engines." Soc. Industrielle de Delle. March 3rd. (Convention date, May 8th, 1914, Belgium.) (Complete.)

3,442. "Method of and apparatus for burning carbon electrodes." Georg Mendheim (firm of). March 3rd. (Convention date, March 4th, 1914, Germany.) (Complete.)

3,445. "Telephone or other electrical transmitter or receiver diaphragms." B. A. Pilkington. March 4th.

3,455. "Methods of laying wires, cables, pipes and the like underground." E. H. Hobling. March 4th.

3,490. "Electric switchgear." F. Waller. March 4th. (Complete.)

3.500. "Automatic electric circuit breakers." H. H. Groves & H. Brittan. March 4th.

3,502. "Induction motors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 4th.

3,505. "Distribution or fuse boxes for electric circuits." F. B. Holt. March 4th.

3,507. "Means for receiving signals by sound." Marconi's Wireless Telegraph Co., Ltd., & R. D. Bangay. March 4th.

3,513. "Electric heating element." Cable Accessories Co., Ltd., & F. H. Reeves. March 4th. (Complete.) (Addition to 24,565/13.)

3,520. "Electric signalling." International Electric Co., Ltd., H. E. R. Roose, & R. G. le Noir. March 4th. (Complete.)

3,521. "Portable electric battery lamps." M. Goodfellow & New British Ever-Ready Co., Ltd. March 4th. (Complete.)

3,523. "Electric signalling systems." International Electric Co., Ltd., H E. R. Roose, & R. G. le Noir. March 4th. (Complete.)

3,524. "Transformer for use with polyphase generators for high-frequency currents." L. Rouzet. (Addition to 519/15. Convention date, March 14th, 1914, France.) March 4th. (Complete.)

3.546. "Wireless control for operating machinery." J. J. Denton & A. G. Macculloch. March 5th.

3,554. "Electric torches." S. J. Levi. March 5th.

3,565. "Arrangements for operating switching devices by electric current impulses. O. Imray (Siemens & Halske Akt. Ges., Germany). March 5th. (Complete.)

3,569. "Method and apparatus for the electro-deposition of metals." C. E. S. Bell & L. G. Scott. March 5th.

3,570. "Electric controller." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) March 5th. (Complete.)

3,614. "Flat joint for teapots, coffee-pots, kettles and the like in electroplate ware." G. Edwards. March 6th.

3,627. "Electric batteries." F. J. Beaumont. March 6th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

26,068. Gyroscopic Compasses. J. B. Henderson. November 13th.

26,160. Gyroscopic Compasses J. B. Henderson. November 14th.

28,933. Reversing and Braking of Alternating-current Motors. Akt. Ges. Brown, Boveri, et Cie. December 15th. (December 27th, 1912.)

1914.

174. Machines for Generating Electrical Energy. C. T. Mason. January 3rd.

901 Electric Railway, Tramway, and like systems. J. A. F. Aspinall. January 13th.

1,940. Magnetos for use on Internal-combustion Engines. Humber, Ltd., and J. A. Cole. January 24th.

2,739. Dischargers for producing Electric Oscillations. R. C. Galletti and R. Manzetti. February 2nd.

3,191. Radio-telegraphic and Radio-telephonic Receiving Systems. G. O. Squier. February 6th.

3,722. Electric Heating Apparatus. A. F. Berry. February 12th.

3,831. Systems of Electrical Distribution. British Thomson-Houston Co. (General Electric Co.). February 13th.

4,184. Method of Manufacture of Heating Conductors for Thermic Telephones from Platinum Wires treated by the Wollastone Process. P. de Lange. February 18th. (May 8th, 1913.)

4,203. Method of Manufacture of Heating Conductors for Thermic Telephones from Platinum Wires treated by the Wollastone Process. P. de Lange. February 18th (June 3rd, 1913. Addition to 4,184/14.)

4,235. Electric Conductors British Thomson-Houston Co. (General Electric Co.). February 18th.

4,236. Electric Lifts M. D. Scott & Medway. February 18th.

4,323. Electric Telemotors for Reproducing Movements at a Distance. W. H. Scott. February 19th.

4,489. Machine-switching Telephone Exchange Systems. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). February 21st.

4,735. Electrically-operated or Controlled Presses. A. H. Railing, A. Peacock, & T. H. Hutchinson. February 24th.

4,815. Long-stroke Electro-magnets and Reciprocating Electro-magnetic Mechanisms and the like. F. T. Chapman. February 24th.

5,431. Electrical Switches. B. D. Horton. March 3rd.

5,668. Eyes for Ropes, Wires, Cables, and the like. F. R. Beckett. March 6th.

6,573. Structures of Insulating or Fire-resisting Material. Turner Bros., Ltd., and H. R. Turner. March 16th.

8,821. Electric Cut-outs. British Thomson-Houston Co. (General Electric Co.). April 7th.

10,251. Indicators. F. G. Brettell (Apple Electric Co.). April 25th.

11,165. Electrical Energy Supply Installations. A. P. Lundberg, G. C. Lundberg, P. A. Lundberg, & G. Pegg. May 6th.

11,840. Electric Switches. F. E. Wilson. May 13th.

13,058. Lamp Reflectors. W. C. Wise. May 27th.

14,027. Illuminating Apparatus. Aktiebolaget Lux. June 10th. (June 16th 1913.)

14,474. Electric Fuses. W. D. Hensell. June 16th. (June 18th, 1913.)

15,598. Antiseptic Protectors for Telephones. T. Lamb. June 29th.

18,810. Electric Primers. C. F. Lindsay. August 18th. (September 8th 1913.)

1915.

516. Means for Operating the Collapsible Cover for the Upper Deck of Omnibuses, Tramcars, and the like. F. H. Beck. January 12th. Addition to 3,657/14.)

THE

ELECTRICAL REVIEW.

VOL. LXXVI. MARCH 26, 1915. No. 1,948.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: March 26th, 1915. [No. 1,948.

Page
The War and Electricity Supply Extensions 425
Lead 426
The Wire-Drawing Industries 426
Lubrication Troubles 427
Potentiometer Rheostats and Rheostats with Protective Resistance, by L. Boothman (*illus.*) 427
Correspondence—
  Consulting "Engineers" 429
  Trouble with Oil 429
  Trade with Russia 429
  Employment for Disabled Soldiers 429
  Coke Fuel for Steam Raising 429
Indian Notes 429
New Electrical Devices, Fittings and Plant (*illus.*) 430
Legal 430
War Items 431
Business Notes 432
Notes 438
City Notes 441
Stocks and Shares 449
Market Quotations 450
Exports and Imports of Electrical Goods during February, 1915 451
Russian Trade and Electrical Prospects (*concluded*) 452
Electricity Applied to Mining, by C. P. Sparks (*illus.*) (*cont.*) 454
Diesel Engine Breakdowns 456
Automatic Protective Switchgear for A.C. Systems 456
The Practical Rating of Electric Incandescent Lamps (*illus.*) 457
Hiring Powers for Cooking Appliances 459
Foreign and Colonial Tariffs on Electrical Goods 459
British Electrical Patents Applied for or Communicated by Residents in Germany, Austria or Hungary 460
New Patents Applied for, 1915 460
Abstracts of Published Specifications 460
Contractors' Column ... ... Advertisement page xx

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 938; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

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THE WAR AND ELECTRICITY SUPPLY EXTENSIONS.

IN a leaderette in our last issue we ventured to sound a note of warning to municipal electricity supply committees, respecting the necessity for husbanding their resources when subjected to the annual temptation to utilise surpluses in relief of local rates. This is only one of the many important matters that electricity supply authorities are compelled to consider, consequent upon the prolonged duration of the war and the national financial problems entailed thereby. Students of our news pages will have noticed during the last few weeks that electricity supply engineers are being required to hold up their plant and mains extension schemes, and the Government Departments responsible for the control of municipal and financial policy have indicated that not only in new provisional orders granted this year will there be a clause inserted prohibiting expenditure upon such schemes during the war, but also existing works will not be allowed to spend capital upon new plant unless it can be proved beyond question that national needs in war time make such a course imperatively necessary, and, in brief, if new consumers cannot be served from existing facilities then they "must wait" until peace is restored.

Electricity authorities thus find themselves in a position such as they have never occupied before, and one that was never anticipated. The matter may not be one of immediately serious concern to manufacturers who are chock-a-block with Government war contracts, and after the war there may be a rush of works extensions orders, but the position is one of both immediate and serious concern to the municipal electrical engineer and his Committee, and there will be many anxious periods and a variety of new problems arising from it.

It will be remembered that the Treasury has refused to allow the L.C.C. to grant loans amounting to £28,000 to Borough Councils for electricity extensions, paving, &c. The Treasury has written to the Council pointing out that it is desirable that capital expenditure should be restricted to the narrowest possible limits, and that the approval of the Treasury is now necessary for all fresh borrowings. This is particularly serious news for those undertakings that have allowed themselves a small reserve of plant, though for several months it has been clear that all avoidable capital expenditure would have to be postponed till after the war. The normal increase of business in most localities necessitates the constant provision of new plant, and there is also the need for replacement of plant that becomes obsolete. The latter item is one of those that would naturally be deferred, even though the increasing cost of various stores might have given greater relative importance to the installation of more economical plant. Doubtless a sympathetic eye will be turned to the many undertakings whose demand has increased by reason of the extra power requirements of factories that are engaged on war contracts. The general desire will be to avoid doing anything that will embarrass the Government at the present time, nevertheless it will not be without regret that the supply station man will see himself deprived of the load which he expected to secure from the additional factories we all hope to see springing up as a result of the war on German trade initiated by the Government themselves. In point of fact, the co-operation of supply authorities in providing cheap power would reduce the capital required by these factories, for the extra money for the purchase of private plant will have to be found, and it can be safely said that to produce this extra power through the medium of the existing electric supply concerns would in the long run be the most economical course.

The decision is one that will have far-reaching effects, and it would be interesting to hear the views of the industry at large on the subject. One result that it will have immediately is the concentration with greater activity than ever on the sale of energy for valley load purposes, and although the lighting has to bear the bulk of the capital charges, it will have to take care of itself. For one thing, such supplies as are within the restricted outdoor lighting areas will have a breathing space, but those who were hoping to get new plant installed for next winter's load, and have a narrow working margin, will be looking forward to the end of the war with increased eagerness.

There are ample signs that the Treasury policy indicated will be enforced all over the country. Tariffs are already undergoing revision, and other changes also may be necessary, for applications for current under the Acts regulating supply can only be refused on the ground of an extension beyond the stipulated distance, and then only contingent upon the applicant refusing to bear the extra cost, or failing to find satisfactory securities. The question may be raised whether an increased charge should be imposed temporarily to discourage undesirable business, or whether a special clause or order can be obtained to cover the point. The first is a course which, it is to be hoped, may be avoided; the fact that the price of gas has already been raised in several districts on account of the higher price of coal offers an opportunity to demonstrate the stability of electricity supplies, and to command the confidence of the public. Even more desirable is this in the case of charges for power and domestic uses. Increasing the latter especially would tend to cripple and discourage a number of new ventures in cooking and heating appliance manufacture and would lay this promising market open to foreign manufacturers.

We shall watch the development of the policy of the Treasury with concern, for as we have repeatedly stated, the reserve funds available in most electricity undertakings are not all that could be desired. The Finance Committee of the L.C.C. is communicating with the Treasury to obtain a clear understanding as to its views and, meanwhile, the L.C.C. is abstaining from making advances to local authorities and is postponing the completion of any loans which have already been agreed to.

Whatever may be the outcome, the importance of developing to its fullest extent the capital already laid out is very plainly indicated. Every service must be made to produce its greatest possible yield, and every horse-power of plant its largest daily output.

Lead.

There has been a rather remarkable outburst of strength in the lead market within the past week or so, which took operators completely by surprise, for they did not expect any serious alteration in the main outlines of the position. In the early part of March the supplies coming forward were of quite satisfactory dimensions, and there was some falling off in the volume of business awaiting settlement. There was at the same time, however, a disposition to realise on the part of holders of speculative parcels, whose attitude was doubtless induced by the poverty of export demands and the almost complete abstention from buying of the home trade. A sudden heavy demand, however, sprang up for war supplies, practically the whole of which came from the export markets, notably Russia and France, and this, combined with the difficulty experienced in obtaining deliveries, on account of the congestion at all the ports, where the truculent attitude of the British working man has been deliberately exercised, with the effect of further disorganising trade and checking the successful pursuit of our military and naval operations, forced a very sharp rise in prices. It at once became apparent that dealers were short of lead, and the price was rushed up under the influence of the pressing requirements, which had to be satisfied, more particularly for the earlier available material. There was not so much doing in connection with forward shipments, and the prices of these did not respond to anything like the extent witnessed in connection with earlier shipments, the idea being that considerable supplies of lead are available abroad, notably in the United States and Spain, while output in Australia is increasing. There should, therefore, with any resumption of even very moderate shipping facilities, and with a less impossible attitude on the part of labour concerned with the arrival and discharging of vessels, be a considerable easing down in the position. It is a disgraceful commentary upon the Trade Union system with which industry is being cursed in this national crisis, that it takes from three to four weeks to discharge vessels arriving here from abroad, even when they contain material necessary for the production of munitions of war. Within the last day or so the more acute phases of scarcity seem to have passed, and there has been a slight relaxation in the stringency, partly arising from the fact that there have been supplies of metal offered from North America. Here again, however, the shipping position militates seriously against the resumption of normal conditions, for sellers in America are unwilling to make sales on c.i.f. terms, as they prefer to throw the onus of shipment on to buyers, who, on their part, regard this as an innovation in the trade, and decline to do business on f.o.b. terms. The broad outlines of the position are: increasing production abroad, huge demands for war purposes, poor general consumption, and a state of affairs in the shipping trade and in labour practically unparalleled in history. When labour recognises the fact that its very existence is at stake, and that by its recalcitrant attitude it is worth a good many army corps to the Kaiser, we shall be nearer the day when prices, not only of metals but of food stuffs also, will reach a level more in accordance with that justified by intrinsic conditions.

The Wire-Drawing Industries.

Like almost every other important section of the industrial world, the wire-drawing trades are at present being taxed to the utmost to keep pace with the demands from the home markets, as well as from Holland and Sweden in particular. The enormous increase in exports to these two countries of late suggests that these markets, hitherto neglected by this country in the face of the push and enterprise of German firms, are well worth better attention in the future. Unfortunately for the enterprise of the manufacturers of copper wire, &c., in this country, everything at the moment seems to be against the development of these important fields. The tremendous War Office and Admiralty requirements in all copper and bronze productions, the railway and shipping congestion problems, the shortage of skilled labour, and the endless declaration formalities to be gone through before shipment can be made, are questions of such moment that only under the greatest difficulties is a portion of the requirements of these two countries being met, while orders for substantial lines in many cases have perforce to be refused.

The depletion of the ranks of skilled labour, in this as in other trades, has seriously hampered the productive capacity of the important wire manufacturers, &c., throughout the country. It is gratifying to note, however, that the warnings from the War Office and the Admiralty regarding the necessity for increased production, and the distribution of the war-service badges, have had a salutary effect upon prospective recruits whose skilled labour is so urgently needed for the requirements of the Government.

Lubrication Troubles.

When a new engine or turbine is first set to work, there is certain to be trouble with bearings in perhaps a majority of cases. This is because so many constructors neglect the proper cleansing of castings. The writer has seen sent out from an important engine works a main bearing cap of which the oil box was thickly coated with foundry sand more or less adherent to the iron. Castings are never properly cleaned of sand even externally by the still common methods of steel brushing and coke rubbing, and in steam ports and passages it is hopeless to expect cleanliness from such antiquated methods. "Sandblasting" with chilled steel pellets will clean a casting externally, but cannot be relied on for the internal cleansing of ports or oil receptacles. Thus it is that lubrication troubles are so usual when starting up new sets. Of course, modern fashion, there is probably some kind of filtration scheme in the oil cycle, but of what use is this when between the filter and the bearing there is a sandy place of some sort?

Some engineers strongly favour the pickling of castings as the most effective way of removing sand. The castings are first roughly cleaned and fettled, and then hosed with weak hydrochloric acid. Where sand is present this spreads the acid by capillary action, and the result of a few hours of acid action is to remove all sand and leave the iron surfaces clean and free also from the hard siliceous scale which is so destructive of turning tools and other tools, especially millers, and is also most injurious to lathe-bed surfaces and other working surfaces of all machine tools. When the acid treatment has done its work the castings are washed by warm water, and this may be dosed with soda to neutralise any unspent acid. Special attention should be given to all internal parts such as box beds, which act as oil receptacles, as well as to steam and exhaust passages. The oil of any circulating system becomes dirty with use. Dirt comes over from the boilers with the steam and finds its way into turbine bearings in spite of all the constructive care to guard against this. The atmospheric dust gets in somewhere and there may be leakage at oil coolers. There is also the microscopic metallic waste from bearings. All these sources of dirt are quite enough to call for filtration, apart from the gross carelessness which is shown by the presence of foundry sand. Lubrication experts will bear out the truth of the above. Is it not a fact that they are very frequently called on to defend the virtue of the oil they have supplied, owing to the lubrication troubles with newly started plant? Oil may sometimes be at fault if it has been chosen wrongly, but more usually sand, which ought never to have found itself so far from the foundry, is to blame.

Organic oils deteriorate with age owing to their property of absorbing oxygen; this causes them to become gummy or resinous, and thus to lose their lubricating quality. Mineral oils, which are not, chemically speaking, oils, do not absorb oxygen, and are free from this deterioration. It was once partly suspected that even mineral oils underwent some sort of molecular destruction or deterioration, but there appears to be nothing to support this idea, and it can only have arisen from the fact that used oils become thickened and blackened more or less. This discoloration and increase of viscidity is purely mechanical, and can be removed by filtration through proper media such as packed cotton waste. Oil thus filtered is restored to its original purity, and in any circuit of oil usage containing a filter in circuit, the initial oil remains indefinitely, and merely requires to be brought up to the initial volume from time to time, to make good the deficiency due to small losses such as may arise from creep along shafting, small leakages and such wastage as occurs when filtering material is changed.

Enormous quantities of oil are wasted by careless use, and there can be no doubt that much fine machinery is very seriously damaged by the neglect of the very elementary precautions to which attention is drawn above.

POTENTIOMETER RHEOSTATS, AND RHEOSTATS WITH PROTECTIVE RESISTANCE.

By L. BOOTHMAN.

This article is intended to be supplementary to "Notes on Regulating Resistances" published in the Electrical Review of February 13th, 1914.

Potentiometer Rheostats.—The "summation watt" capacity of any potentiometer rheostat is given by:—

Maximum field amperes multiplied by excitation voltage, plus the constant watt loss due to the rheostat resistance being across the supply mains.

In the previous article an outline method of figuring the data for a potentiometer was given, but the following has many points of superiority. After the preliminary calculations are made for obtaining the current in field and in rheostat, and curves for these drawn, they can be utilised for other rheostats having a different number of steps, whereas the original method necessitated commencing with a definite fixed number of steps. The calculations are also less involved and any error made is automatically checked.

The following is a practical example and is self-explanatory with reference to the accompanying diagram, fig. 1 (p. 428):—

Excitation voltage V = 440 to 480.
Booster field resistance F = 500 ohms cold, 608 ohms hot.
Maximum field current C = ± ·96 ampere.
Total resistance in rheostat R = 2,000 ohms = S + P.

Series resistance S.	Parallel resistance P.	B = P × F.	A = P + F.	Combined resistance B/A.	Total resistance R = B/A + S.	Total amps. = V/R.	Multiplying factor P/A.	Current in field
0	2,000	1,000,000	2,500	400	400	1·2	·8	·96
20	1,980	990,000	2,480	399	419	1·15	·8	·92
50	1,950	975,000	2,450	398	448	1·07	·796	·85
100	1,900	950,000	2,400	396	496	·97	·792	·77
200	1,800	900,000	2,300	391	591	·81	·784	·64
400	1,600	800,000	2,100	381	781	·61	·762	·47
800	1,200	600,000	1,700	353	1,153	·41	·71	·296
1,200	800	400,000	1,300	308	1,508	·32	·62	·195
1,600	400	200,000	900	212	1,812	·265	·44	·118
1,800	200	100,000	700	143	1,943	·247	·287	·070
1,900	100	50,000	600	83·5	1,983·5	·242	·167	·04
1,950	50	25,000	550	45·5	1,995·5	·241	·091	·022
1,970	30	15,000	530	28·4	1,998·4	·24	·056	·013
2,000	0	0	500	0	2,000	·24	0	0

In the first column are arbitrary figures taken for the "S" resistance to give the most suitable points on curves which are shown plotted in fig. 1.

By dividing the total field current ordinate in fig. 1 into the number of steps of the rheostat to be used, the amount of ohmic resistance and current capacity required at each step is obtained. Boosters are usually designed with practically a straight-line load saturation curve over their working range, and the ordinate in fig. 1 can be divided into equal divisions, thus giving equal current (*i.e.*, equal voltage) increments per step. In the case of generators for Ward-Leonard control, by reference to the load saturation curve of the machine, plotted between armature voltage and field current, suitable field current points can be obtained to give equal armature voltage variation per step, *i.e.*, equal speed variation of motor per step.

Rheostats with Shunt Field Protective Resistance.—It is usually required that the protective resistance be so designed that with all rheostat resistance in circuit, *i.e.*, in parallel with same, the field being cold, the minimum field current, that is, minimum voltage is obtained. Also the total ohmic resistance in the rheostat should be so large that the watt loss in the same under these conditions is negligible. Then if the rheostat is cut out of circuit, the protective resistance in series with field will give the minimum voltage on the generator, and this resistance must also be capable of giving rough regulation by means of short-circuiting more or less turns as required. In these circumstances, it therefore will have to be capable of carrying the actual field current. This point I have found is often ignored by some manufacturers, and the protective resistance is designed for its normal working current only, which considerably reduces the cost.

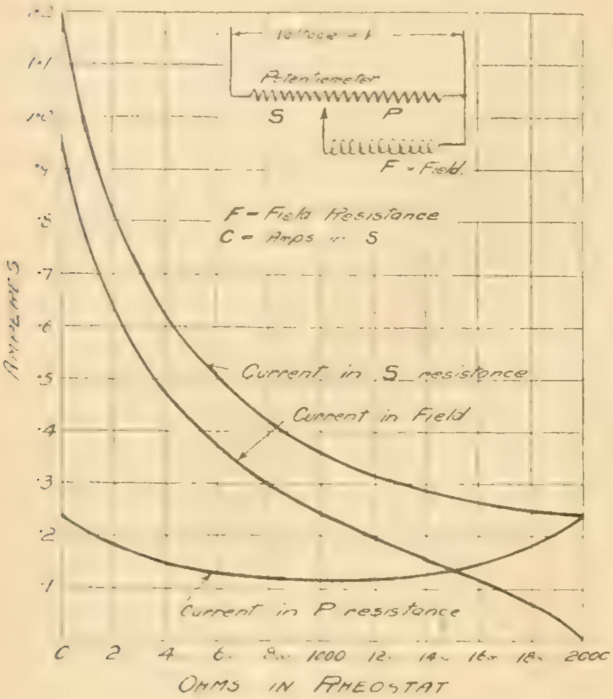


Fig. 1.

A close approximation to the summation-watt capacity of the regulator rheostat used in parallel with protective resistance is given by :—

$$1{\cdot}07 \times \frac{\text{Rheostat resistance} \times \text{max. field amps.} \times \text{min. excitation voltage} \times \text{protective resistance.}}{(\text{Rheo. res.} \times \text{prot. res.}) + (\text{rheo. res.} \times \text{field res.}) + (\text{prot. res.} \times \text{field res.}).}$$

The summation-watt capacity of the protective resistance, to fulfil the above conditions, should equal the summation-watt capacity of an ordinary type field regulator that is used in the usual manner in series with the field; but under normal working conditions this capacity is not used to the full extent.

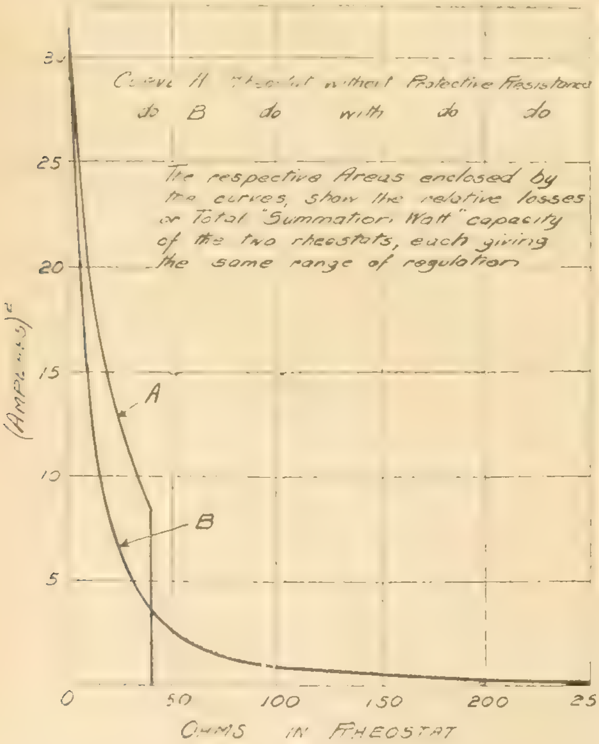


Fig. 2.

In the original patent specification 21,707/05, by Thomas Edge, covering this arrangement of control, a statement appears that by this method a smaller rheostat can be used, but that is not borne out in practice. This is graphically shown in fig. 2, wherein the relative summation watts for the ordinary type and this type of regulator appear, the respective areas being practically equal ; the figure relates to the following example, but is true for others.

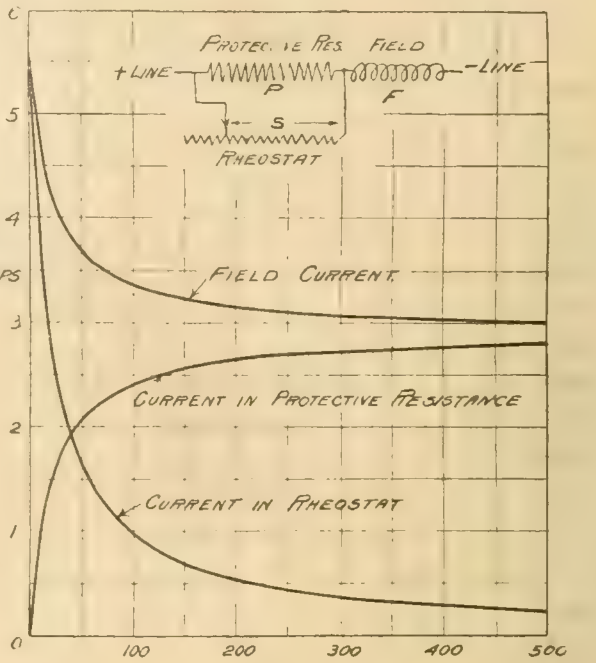


Fig. 3.

A simple method, similar to that given for the potentiometer, to obtain ohmic resistance and current capacity per step of this type of regulator, is as follows :—

D.C. generator, 225 volts. Voltage range, 210 to 240.

Field resistance, 39·4 cold, 45·6 ohms hot (F taken as the mean resistance).

Field amperes, C 5·1 max., 2·7 min.

Field protective resistance, P = 210/2·7 − 39·4 = 40 ohms.

Total regulator resistance, S = 1,000 ohms.

The various curves are shown plotted in fig. 3.

Regulator res. in circuit S.	A = S + P.	B = S × P.	Combined resistance B/A.	Total resistance, R = B/A + F.	Field amperes, C = 240/R.	Multiplying factor, P/A.	Current in S C × P/A	Current in P C − (C × P/A).
0	40	0	0	43	5·6	1·0	5·6	0
10	50	400	8	51	4·7	·8	3·76	·94
20	60	800	13·3	56·3	4·27	·66	2·85	1·42
51	90	2,000	22·2	65·2	3·7	·445	1·64	2·06
100	140	4,000	28·6	71·6	3·36	·286	·96	2·4
200	240	8,000	33·4	76·4	3·15	·167	·52	2·63
300	340	12,000	35·4	78·4	3·07	·117	·36	2·71
500	540	20.000	37·1	80·1	3·0	·074	·22	2·8
600	640	24,000	37·6	80·6	2·99	·062	·18	2·81
800	840	32,000	38·2	81·2	2·96	·048	·14	2·81
1,000	1,040	40,000	38·5	81·5	2·95	·038	·11	2·81

The voltage taken throughout the range is the maximum of 240, but this is not strictly correct, as with all rheostat resistance "in" the voltage of the generator would be 210.

Electrical Supplies for Neutral Markets.—Messrs. J. & W. B. Smith, of London, E.C., have just lately secured a very large contract from the Government of a neutral country for the supply of electrical accessories. Amongst other lines, they are supplying Edison screw lampholders, both ½-in. and batten type, ceiling roses, special D.P. cut-outs with safety plugs, both with and without switches, and 6 and 10-ampere plugs, for heating as well as lighting. We understand that their prices were only slightly higher than the old German prices, and at the conclusion of the war they hope to be able to secure a renewal of the contract, even against German competition.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Consulting "Engineers."

With reference to Mr. Stevens's letter of the 2nd inst, question No. 3 he answers himself; I might also add that should there be any doubt as to my statement being correct, perhaps he will try the experiment of assuming the rôle of a medical man or lawyer.

My aspirations do not necessarily include the degree of B.Sc.; it would, however, be a desirable qualification for a consulting engineer to hold.

In my humble opinion, a consulting engineer should not only be a first class mechanical and electrical engineer, but he ought, in addition, to be able to handle matters concerning finance and commerce (so far as they related to his profession) in an expert manner.

Station Engineer.

Trouble with Oil.

I thank your correspondents for the trouble they took in answering my inquiry. We have got over the difficulty by closing up the H.P. guide apertures altogether, and fitting a small sliding door in front for examination, &c. The set was a new one, and there is another one of the same size a little distance away which has given no trouble. This was simply due to the fact that the draught on the second machine was not strong enough to draw the vapour down.

Inquirer.

March 16th, 1915.

Trade with Russia.

With reference to the above matter which you dealt with recently, may I be permitted to add a few remarks, as I have been to Russia on business for a Swiss firm in 1905, a German firm in 1909 and 1911, and for a Franco-American concern in 1912 ?

I found that there was a good business to be done in practically all electrical apparatus and accessories, but that there were only two methods of doing business: (1) By buying orders among the ordinary Russian agents or dealers; (2) by long credit among the Russian Jews. The former are the most awkward to deal with, as you have to face the absurd position created by the fact that quality does not count at all, they simply giving the order to whoever pays the most for it. The latter class, however, have the business entirely in their hands in some neighbourhoods. Again, quick delivery and continuous supply of accessories and general stock in the case of agents is a great factor which holds trade in Russia, once the bribery or credit terms have been arranged, as a person will naturally buy a cheap and more or less unreliable article, which goes "off" soon, if he can replace it immediately, rather than a good one which he will get stranded over should it fail. Agents and dealers thus lean towards manufacturers who will keep them up in stock and deliver regularly.

There is, of course, the question of suitable advertisement literature, which is extremely important, but I will leave this in case any of your readers have special questions on this subject.

During all my visits to Russia the Germans were most active and successful in respect to dynamos, motors (A.C. and D.C.), lamps, accessories, general plant, and heavy automobiles. Orders were bought if necessary and almost any long credit terms arranged, while delivery and general treatment were satisfactory; so the "Fatherland" got home.

In concluding, I would add that I have yet to come across a Russian who is averse to dealing with British manufacturers, but, on the whole, I found they considered it rather inconvenient and generally impossible. In fact one man told me in St. Petersburg, "It is difficult to know what they sell." I believe, however, that Britishers will stand a very good chance of getting a hold in Russia within two years of the conclusion of peace, but they should be ready to start in full activity right on the ex-German pitch immediately the last-named prospective happy event becomes a reality. If they will not see to it that they get the aforesaid hold, German goods will re-assert themselves, because it is simply "palm-oil" or long credit which are the real assets in Russian business. The country where the goods originate does not matter.

Arthur M. Turner.

London, S.W., *March 22nd*, 1915.

Employment for Disabled Soldiers.

Disabled and partially-disabled men who have become so during the present unfortunate war are already being discharged by the War Office unfit for further service. Such men have pensions according to the extent of their disablement, but in the case of a partially-disabled man it is not sufficient to keep him.

There is an excellent opportunity for the makers of electric vehicles to benefit materially, and assist one section of the partially-disabled men, by designing and supplying a vehicle which can be satisfactorily operated by a one-legged man, who in all other respects is medically fit, and would therefore be quite capable of undertaking the driving and control of a battery vehicle, whereas he could not attempt a petrol-driven one.

It merely becomes necessary for the vehicle control to include only one foot pedal, which should be arranged so that it could be operated either by a right or left foot as the case may be. As far as I am aware, most of the battery vehicles have two or more foot pedals. The Edison, for instance, has two large ones and one small one, one of the large pedals being the running and traffic brake, the other one, together with a small auxiliary, being the standstill brake, for which a man requires one foot to press it down and the other foot to lock it. This could be got over by having an ordinary foot pedal for the running brake and a toothed quadrant hand-brake similar to those used on ordinary chassis. The hand-brake could, if desired, be interlocked with a main switch so that the circuit was broken immediately the hand-brake was applied, and that the hand-brake could not be released until the controller handle had been brought to the "off" position, but this is a point which is a matter for discussion.

We are about to commence a battery 'bus service in Loughborough, and hope quickly to increase the number of vehicles as the "electric" grows in public favour, and I shall be quite prepared on my part to give such men as I have referred to an opportunity of providing for and supporting themselves if the vehicle makers will do their bit.

W. H. Allen,
Engineer and Manager,
Loughborough Corporation Electricity Department.
Managing Director,
Loughborough Road Car Co., Ltd.

Loughborough, *March 22nd*, 1915.

Coke Fuel for Steam Raising.

As the largest makers of special furnaces for burning coke, and other fuels, may we be allowed to confirm the recent letter of the expert of the London Coke Committee ?

We have for some 30 years fitted several thousands of boilers for burning this fuel at gas works and elsewhere, and during this period we have never heard of any deleterious effects on the boiler plates. Boilers fitted over 25 years ago with our furnaces are still in operation and working efficiently, and we are, on repeat orders and new work, supplying more furnaces than ever before.

It would be interesting to know what the general working conditions were of the boiler on which Mr. H. Boot bases his strictures. If the life of this particular boiler was short, does he know that it would have been longer if ordinary fuels had been burnt ? There may well have been other reasons.

For **Meldrums, Ltd.**
A. BENHAM, *London Manager.*

Westminster, S.W., *March 25th*, 1915.

INDIAN NOTES.

[FROM OUR SPECIAL CORRESPONDENT.]

Calcutta Port Trust.—At a recent meeting the Calcutta Port Commissioners decided to take all their current from the Calcutta Electric Supply Corporation. This will mean scrapping a seven-year old generating plant at the Kidderpore Docks.

It is estimated that for 1916 the Port Trust will require 3,000,000 units for the Docks and 850,000 units for the riverside berths at Garden Reach. For the years 1917 and 1918 a total of nearly two million units will be required for the latter, and after some few years about 2½ million units annually will be required for the new King George's Dock. When the entire Dock accommodation is finished, in several years the probable total requirements will be not less than 20 million units a year for Docks alone. For the Calcutta Jetties the Commissioners are at present taking about 750,000 units per annum.

This extension means good business for the Calcutta Electric Supply Co. The rate per unit settled upon has not been disclosed; but for quantities such as the above an exceedingly low rate may be expected.

At present there are murmurings here and there that Calcutta Supply Co.'s rates for lighting and fans, namely, 5½ annas and 3 annas per unit, are too high. The Trades Association have taken the matter up, and put their views before the authorities. It is anticipated, however, that no serious further reduction to the public will be made. One alternative suggested is a flat rate for both fans and lights—this would at any rate save to the consumer the additional capital outlay necessitated by having to wire buildings with two distinct circuits, one for fans and one for lights.

Reductions might also be made in meter rents; and an especially irritating charge, particularly to owners and occupiers in the suburbs, is that for connections from overhead or underground mains to premises—this is often a very large item, totalling up very frequently to a large percentage of the entire cost of the wiring and fittings.

"*Henley System.*"—This metal-covered wire system is practically ousting the other systems from the market—namely, teakwood casing and conduit—for wiring installation work. It looks neat, and if well and carefully put up is certainly attractive and not expensive. Time has yet to tell whether it will be as lasting as the older, if more clumsy, systems.

Lahore.—The Lahore Electric Supply Co., under the new and enterprising managership of Mr. H. B. Stone, is showing promise of justifying itself. The demand for current for light, fans and factory motors is daily increasing, and large extensions to the generating plant are under way.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Brilliant" Suction Cleaner.

Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., have just placed on the market the "Brilliant" electric suction cleaner, which we gather has met with a remarkably good reception.

Special attention has been given to the mechanical and electrical design of the high-speed motor with which the cleaner is fitted, and also to the conformation of the fan blades, which are of cast aluminium. The motor is of the vertical spindle type; bronze alloy bearings are fitted and self-oiling grease cups. The diamond-shaped shoe is a patented feature of the machine, and this shoe is fitted with castors which allow the machine to run very easily over carpets and rugs, and at all times to suck in the air regardless of the thickness of the carpet. The shoe is also fitted with a revolving brush which picks up lint and threads. A series of extra attachments can be supplied and the machine can be adapted as a blower.

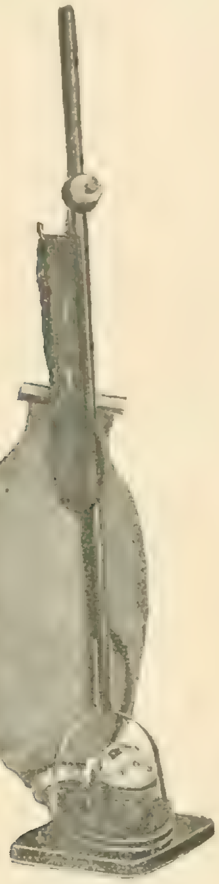


Fig. 1.—"Brilliant" Electric Suction Cleaner.

This cleaner, which is described in a leaflet which the Simplex Co. have issued, weighs 8 lb. only, and its price is about the lowest we have heard of for this type of machine.

Electro-Medical Apparatus.

In a price list recently issued by the General Electric Co., Ltd., 67, Queen Victoria Street, E.C., a variety of apparatus for electro-medical uses is described, including induction coils with or without the necessary batteries, apparatus for electrolysis, epilation, &c., and cautery knives. A powerful electromagnet used in the practice of ophthalmic surgeons to withdraw magnetic particles from the eye is listed.

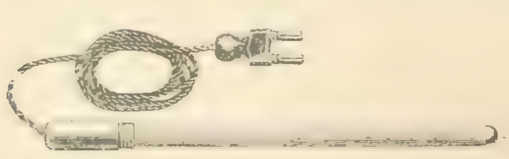


Fig. 2.—Dental Lamp.

Numerous special kinds of lighting equipment are necessary, one of which we illustrate; this is the smallest dental lamp manufactured, and is claimed to be a great improvement on any other form. It is made entirely of glass, and can be sterilised after each operation.

LEGAL.

R. L. Jones & Co., *v.* Orpheum, Ltd.

(*Concluded from page* 353.)

Mr. Wm. Barber, A.M.I.E.E., gave evidence in relation to the motor and generators supplied to the defendants. He said that the motor was a good one, but that it was placed in the worst possible place, viz., under the stage, which acted as a sounding box. If he had had the fixing up of the motor he would have placed it outside the auditorium. Even placed as it was, the difficulty as to noise might have been obviated by placing the motor in a case lined with felt, but that would have been carpenters' work, to be done by the employer. He had seen the motor at work at a time when the theatre was empty, but if it had been full he would probably have had to listen to detect the sound complained of. He had examined both generators, and had seen one working. He put the load on the machine, and ran it at full load, but it was not sparking badly. In all generators there was bound to be some sparking, but in this case there was not more than the normal sparking of a good generator of the kind running at full load. The machine was in excellent condition, and when it was running the vibration was certainly not such as would injure the building. Had there been any serious vibration it could easily have been cured by placing the motor upon matting which would only have cost a shilling or two. Any generator would be liable to go wrong if it was not in skilled hands; dirt or neglect or not properly adjusting the brushes would tend to the destruction of the machine.

In cross-examination by Mr. Rowan Hamilton, the Witness said it would not be his duty to point out the position in which a machine should be placed unless he were in sole charge of the job. In that case he would suggest where it should be placed, but if he were under the direction of an architect, professional etiquette would tend to prevent him from making a suggestion. Some gentlemen would be much offended if he spoke to them upon what they would consider an elementary point. The life of a motor-generator ought to be quite a number of years, but whether they got out of order or not depended much upon the manner in which they were worked. A damp situation, such as a new building, would affect the machine prejudicially. He had had cases of burning out in which he could place no blame upon anyone.

Mr. Rowan Hamilton: I am glad to hear you say that.

Mr. Walter Henry Jarvis, electrical engineer in the employ of Messrs. Baxter & Caunter, Ltd., of 219, Tottenham Court Road, said that his firm were electrical contractors for Admiralty work, for the Metropolitan Asylums Board, for the London County Council, and for other bodies, and they were sole London agents for Newtons, Ltd., manufacturers of motor-generators. He visited the Orpheum Theatre, at Croydon, on the previous Monday and inspected the two generators. In one he found that the solder had been melted, and a wire detached, which caused an open circuit, and led to a good deal of sparking. The condition in which he found the generator was due to overloading. He repaired the machine and ran it for about a quarter of an hour at full pressure, and during that time no defect was disclosed. The only way in which he could account for the defects which he found was that there had been overloading. He saw the machine again on the following Saturday, when it was running at full load quite satisfactorily.

Mr. Rowan Hamilton, in opening the case for the defence, admitted that the defendant would have to pay a certain amount towards the generators, but contended that owing to the way in which they broke down, and the unsatisfactory way in which they did their work, they were entitled to a reduction in the price. With regard to the motor, he said his case was that it was quite useless, and had not been used since it was first put in and tried.

In support of his statement Counsel called evidence to show that neither the motor nor the generators were satisfactory, and that the former made a great deal of noise when working.

Mr. Verey, the Referee, in giving judgment on Tuesday, March 16th, said that counsel for the defence had taken every point which he could possibly have taken, but had failed to satisfy him. It was an admitted fact that after the motor and generators were delivered some little repairs were required, but when those repairs had been done the generators ran from May to November without any complaint being made. Then when the solicitor wrote for money the defendants put in a plea of noise and damage to the building. It was for the defendants, when they refused to pay, to show that the machines were defective; but after considering the evidence he came to the conclusion that they had failed to prove that the generators were defective, or that there had been any breach of contract. The plaintiffs were, therefore, entitled to recover the full amount which they claimed in respect of the generators—£96 11s. 10d. The motor rested on a different footing. The defendants were entitled by the contract to have a motor properly made and of good materials, but they said that supplied was too noisy. When the theatre was designed no place was provided for a motor, as at that time it was not intended to have a motor to raise the curtain. The defendants afterwards changed their minds and ordered a motor, and by direction of Mr. Booth, the architect, it was put under the stage. That was not a good place, and several suggestions were made as to a means of keeping out the noise. The plaintiffs, however, were not allowed to do anything, and he considered that they had not been guilty of any breach of contract, and they were entitled to the full amount claimed. Judgment would, therefore, be for £136 11s. 10d., the £96 11s. 10d. paid into Court under Order 14 to be paid out in part satisfaction of the judgment.

Judgment was entered accordingly, with costs.

WITHHOLDING E.T.U. FUNDS.

At the Salford Police Court recently, E. S. M. Karslake, electrician, of Southampton, was summoned by the Electrical Trades Union for withholding £18 10s. 11d., the moneys of the Union. It was stated at the outset that the Southampton police had served a summons on the defendant, and the latter had written to the Salford Chief Constable, stating that he was willing to attend Court, but that he had no means to get there. It was decided to go on with the case.

Mr. Reed, for the Union, said the prosecution was taken under Sec. 12 of the Trade Union Act of 1871. Defendant was the branch treasurer of the Union at Southampton, and the Union's registered office was at 137, Great Clowes Street, Broughton. The prosecutors did not ask for a penalty, but simply wanted to recover their moneys. On December 15th, 1913, which was about the time the moneys should have been paid over to Mr. Rowan (the secretary of the Union), a telegram was received from the defendant in the following terms:—"Robbery, E.T.U. money. Police informed." Following a meeting of the Committee of the Union, the secretary wrote, asking defendant for details in explanation of his telegram, and on December 27th defendant wrote a letter, stating that he had been called home from his work to find that the house had been broken into. The Union communicated with the Southampton police, and inquiries had been made. An examination of the premises revealed no signs of any breaking in, and the police, said Mr. Reed, did not believe defendant's story. Application was subsequently made to defendant to pay the money —whether stolen or not defendant was responsible for the safe custody of it—but without success, and a summons was issued on February 28th. There was an enormous pressure at all Government dockyards and at other places, and there was no reason why an order should not be made for the payment of this money by defendant. It was a serious case for a Trades Union with branches all over the country if their moneys were to be withheld in this way.

The Chairman (Sir Wm. Stephens) said the prosecutors seemed to have been extraordinarily patient with this man. The Bench had decided to make an order for defendant to pay £18 10s. 11d., and 20s. costs, or in default six weeks' imprisonment, the committal not to issue for 14 days.

WORKMEN'S COMPENSATION.

At the Ashton-under-Lyne County Court, on March 18th, sanction was given to a settlement of a case between Robert Dodd, a packer, of 30, Brook Street, and the Tudor Accumulator Co., Ltd., Dukinfield. It was stated that Dodd had contracted lead poisoning, and, although the firm disputed liability because the man had not been doing any work in connection with lead for 12 months, they had agreed to pay £75 and an agreed sum for costs in settlement. For the applicant it was stated that the terms were satisfactory, and Judge Brown gave his sanction.

CONSOLIDATED LANGLAAGTE MINES, LTD., v. VICTORIA FALLS AND TRANSVAAL POWER CO.

At the Bloemfontein Appeal Court the appeal in this case was recently heard. In the lower Court plaintiffs were awarded £36,269, less the present value of £25.750 recoverable at the close of the life of the mine, which was fixed by consent at 22 years, the amount awarded thus being £29,328 with interest. The Appeal Court, by a majority, has arrived at the decision that judgment should be given for the plaintiffs for £19,000 and costs, but the costs of the appeal are to be borne by the plaintiffs. The case was a claim for damages sustained by the plaintiffs by reason of the failure of the defendants to supply in terms of an agreement additional power required.

BRITISH INSULATED AND HELSBY CABLES, LTD., v. CRITTALL MANUFACTURING CO., LTD.

On Monday last, Mr. Muir Mackenzie, in this case, gave judgment for the defendants, with costs of the action. Judgment on the counterclaim was entered for the plaintiffs, with costs of the counterclaim. We shall report the judgment in our next issue.

HAMILTON v. MARCONI'S WIRELESS TELEGRAPH CO., LTD.

After 15 days' proceedings, the hearing of this case was concluded on Tuesday. His Lordship proceeded to sum up, but the Court adjourned before he had finished.

WAR ITEMS.

Feeling in the U.S.A.—The following interesting extracts are from a Sydney University Engineering Graduate now in the service of the General Electric Co. in America—Mr. J. P. Tivey, B.A., B.E. We quote from the *Sydney Morning Herald*, January 23rd:—

"Once and for all let me tell you that if popular opinion in America had its way to-day, then America would be fighting side by side with England. I have just been for two months travelling over the United States, and speak from my own personal knowledge of the intense and bitter anti-German feeling. This is true even in St. Louis, which is perhaps the largest German settlement in America. So bitter is the whole of the American Press that the German Ambassador has protested several times to the President. I may say that the English cruisers on patrol duty in the Atlantic were supplied from New York. And the authorities winked at it until the German Ambassador again protested at the breach of neutrality. If you have any chance, you should flatly deny as a foul calumny any statement that America is not entirely sympathetic with the Allies. I am in no 'half-friendly' country, but in the midst of very warm friends of our country and cause. Your remarks about South America are quite wide of the point. The greatest trade with that country by far is held by England, whose financial interests there are so great that South America is little more than an English dependency, and America knows it. They are seeking to take the German trade with that country, but frankly realise that they cannot take England's, nor do they appear anxious to try. Yes, the President is a pacificist, and a good thing for Germany, or that perjured country would have another foe to fight. I feel very strongly on this point. Some foul liar or German sympathiser is trying in Australia to impeach America. Deny it, just as you would deny the most hideous lie ever told. You have heard the song 'It's a Long Way to Tipperary.' That song is sung nightly in practically every theatre and picture show in the U.S.A., and is usually encored three or four times."

The Trade Position in Canada.—The following has been received at the Commercial Intelligence Branch of the Board of Trade from the office of His Majesty's Trade Commissioner for Canada, under date February 25th:—"The financial situation has improved to some extent and has brought about a general improvement in business. Although this improvement emanates primarily from the rural centres, the influence of war orders on industry is also apparent. It is somewhat difficult to generalise with regard to collections, but from all reports and opinions available, although the improvement so far noted seems small, the consensus of opinion is that in the next few months collections will improve, owing to the growing prosperity of the agricultural community. Commercial failures for January have been heavy, which would point to the fact that a great many of the smaller firms who were existing on speculative lines are being ousted from the market. . . . The wholesale hardware trade appears to be picking up gradually, and should soon be on a normal basis; a pronounced activity in lines of this nature is expected to be felt towards the beginning of next month (March). Many business men are of the opinion that there will be considerable activity in the building trade throughout the Dominion in the coming spring. Generally speaking, the situation in the markets of the Dominion is improving, and British manufacturers who are desirous of retaining their hold, as well as those who are desirous of introducing their manufactures, should take advantage of the present position in order to become firmly established, so that when commercial activity generally assumes a more normal basis they will be strongly fortified and well able to meet their competitors."

Allowances to Dependents.—In a report just issued the Tynemouth Electricity Committee draws attention to a decision of the Council, arrived at in September last, whereby a gratuity, payable weekly, was granted to the dependents of the two naval reserve men who left the works to join one of the three cruisers which were torpedoed in the North Sea. In this connection the electrical engineer reports that the widow of one of the men is earning her own living, but that the widow of the other would be unable to do so for some time to come. The Committee has decided to terminate the present arrangement as regards the former case, on the expiration of three months from the present time, and to continue the arrangement for a further period of 12 months, as regards the widow of the other late employé. The electrical engineer has experienced difficulty in securing men for the switchboard and in the mains department. In this connection the Committee has adopted the recommendation of the engineer as to the appointment of a man for the switchboard, and has decided to give the chairman plenary powers to fill up the vacancies in the mains department.

Russian Mica and Wolfram.—A Petrograd paper says that the Russian electrotechnical industry, so largely dependent on Germany, has suffered also from the want of mica, which used to be imported from that country. Now, however, successful experiments are being made in Moscow in the handling of mica, of which large deposits exist in Siberia and of finer quality than that hitherto imported from Germany. A Petrograd paper say that wolfram is being produced in Transbaikalia along with mica.

Magazines for the Forces.—We have received a copy of the second number (April) of *Khaki*, the monthly magazine with cabled news sheet. It appears to be still more interesting, both in its literary features and its illustrations, than the March issue. The publishers have decided to extend their policy so that the paper may be sent free, not only to Overseas soldiers, but to the British Army and Navy.

A Melbourne Electrical Contract.—According to the *Sydney Morning Herald* the Melbourne City Council at a meeting held early in February had before it a request from Messrs. Siemens Bros. Dynamo Works, Ltd., asking it to reconsider its decision, "That tenders be invited for the 5,000-KW. plant, excluding plants of Austrian or German manufacture or capital," with a view to excluding the company from the operation of that resolution. The company's general manager for Australasia also wrote stating that if such action were to be universally adopted it would cause the company to be shut down, entailing great hardship upon a large number of British employés and their dependents. The Council decided merely to receive the letter, but "no definite policy is laid down for the future."

Germans and Australian Trade.—According to the Sydney newspapers, German firms are continuing to try to do business with Australian importers through Swiss, American and Italian agents. The letters are written at German factories and give addresses of such agents to whom orders may be addressed. Such communications have been under consideration at the Perth Chamber of Commerce meeting, and the President said that the Germans who sent them out evidently took the addressees for a pack of fools. "They were asking British merchants to supply them with the money necessary to build more battleships and Zeppelins, for the purpose, to put it bluntly, of murdering their relations and friends."

The Sydney correspondent of the *Times*, quoting an Australian newspaper article, says that Germans in Australia scoff at the idea of a *post bellum* boycott. "They frankly declare that their troops, before an evacuation of the occupied territory, whether forced or by treaty, will destroy all factories and machinery and all means of manufacturing commodities in Northern France and Belgium. Thus, at the end of the war, the world will be compelled to purchase in Germany stuffs and other goods which were formerly the produce of the devastated districts."

Hospital Lighting.—Mr. E. M. Ashley has given the electric lighting installation for the St. John Voluntary Aid Detachment Hospital, Roe Lane, Southport.

Personal.—The supplement to the *London Gazette* for March 17th contains the information that Second Lieut. H. Clifford Palmer (manager of the G.E.C. Publications Dept.) has been appointed captain (temporary) in the London Scottish, otherwise known as the 14th (County of London) London Regiment. The appointment dates from March 4th. Captain Palmer has recovered from the effects of his recent operation.

In the *London Gazette* the following appears:—

Territorial Force.—*London Electrical Engineers.* Sapper Geo. Ernest Owles to be Second Lieutenant. March 20th. Ernest Christopher Levett to be Second Lieutenant. March 20th.

Lieut. Harry Byng, third son of the late Mr. Gustav Byng, who our readers will remember as the founder and late chairman of the General Electric Co., Ltd., was married very quietly on Monday, March 22nd, at St. Mary's, Bryanston Square, to Miss Evelyn Curtis, of Boston, U.S.A. Lieut. Byng, who is in the Border Regiment, had only just returned from the front on five days' leave, and is now on his way to the front again.

Roll of Honour.—The *Times* states that Rifleman Basil Heathcote Clarke, Queen Victoria's Rifles, who was killed in action in France on March 6th, was a member of the office staff of the London Electric Supply Corporation, Ltd.

Private Seth Bond, an electrician at Fleetwood Electricity Works, has died in Northern France from a wound in the head caused by a hand grenade. He volunteered for service with the 5th King's Own Royal Lancaster Regiment, at the outbreak of the war, and had been at the Front five weeks.

BUSINESS NOTES.

Cold Galvanising.—Electro-galvanising is now an industry of considerable importance; every shipyard of importance and every dockyard throughout the world has an electro-galvanising plant for the coating of boiler tubes, and the process is also largely used for coating iron and steel when it is important that the tensile strength should not be affected, and for machined and finished work which has threads or screws cut upon it, or accurately fitting parts, as these are not filled up, as is the case if they are coated with zinc by the hot process; the coating of zinc is also evenly distributed. Mr. Cowper-Coles, who erected the first plant at Messrs. Cammell Laird's yard at Birkenhead in 1893, informs us that he has recently made important improvements in the process, especially in regard to the coating of small articles—such as bolts, nuts and tubes—and has erected a plant for this purpose at Sunbury-on-Thames.

Book Notices.—*Port of Hull Annual*, 1915. Hull: H. E. C. Newham. 1s. net.—This is a 70-page, fully illustrated publication, wherein the editor and publisher has endeavoured to bring together, for the information of allied nations, particulars of the magnitude of the facilities, and the extent and variety of the manufactures produced in "this quarter of England." The letter-press is partly given in both the English and French languages, and deals with such matters as the immense dock facilities of Hull, statistics of shipping trade, list of Hull-owned steamships, coal trade in 1914, grain trade, imports and exports, and so forth.

Tables Annuelles de Constantes et Données Numériques. Vol. III, Année, 1912. London: J. & A. Churchill. Price 28s. 6d. net.—This volume contains the record of constants and data published in 1912 in connection with all branches of chemistry, physics and technology, under the supervision of an international Committee of distinguished scientists, assisted by national Committees, and supported with subventions by all the principal Governments, as well as by numerous scientific societies, companies and individuals. In the present issue of this monumental work the facilities for reference have been improved by the addition of an alphabetical index to the substances dealt with, other than chemical compounds. While it is not practicable to give a complete index in each volume, the International Committee purposes publishing one for the whole of the first five volumes when these have been issued.

Regarding the contents of the body of the work it is impossible to enter into detail; we are confronted with an enormous mass of the results of research, covering the whole universe. From the alphabetical table we take the names of Coals, Concrete, Galalith, Graphite, Gutta-Percha, Insulating Materials, Paper, Porcelain, Rubber, and Steel, as representing subjects of interest to many of our readers. As an example of the contents, the section "Conductivity of Electrolytes" extends over 19 pages, and "Electromotive Forces" over 23. The labour involved in preparing the copy, in the very difficult type-setting, and in the arduous proof-reading, must have been enormous. We could wish that a further improvement might be made—that the chief table of contents should be arranged in some sort of alphabetical order instead of order of position; this would not require any greater space, although the items are given in four languages, and would obviate a good deal of inconvenience.

Commencing with this issue, an important departure has been made; in order to facilitate the use of the data by specialised trades, &c., it has been decided to issue some of the sections separately, each forming a bound volume complete in itself. We have received three such sections relating to electrical matters, and these will be reviewed more fully in later issues.

Business Prospects in India. By A. T. Stewart. London: Francis Hodgson. 2s. net.—We briefly referred to the author's Russian pamphlet in our last issue. The present one is a companion, in the same series, which will appear in the course of a few days. A good deal of information is given respecting various classes of imports, concerning Germany's growing control over exports of India's raw material, and showing the Indian imports from Germany and Great Britain comparatively. The author holds that just now, when British prestige is so high with the people of India, we should proceed to overhaul and reconstruct our trading system with the country. The methods adopted by German traders in their efforts to oust us commercially from India are reviewed, and it is suggested that we must not be afraid to take a leaf out of our rivals' books. For the electrical trade, co-operation between a number of English firms in a conjoint attack is recommended.

The second issue of the *Electric Vehicle*—the official organ of the Electric Vehicle Committee—has just appeared, and copies can be obtained from the publishers, at 13, Fisher Street, Southampton Row, W.C.; the Committee hopes that central station managers will distribute them amongst users of all kinds of vehicles in their respective districts. The number contains many interesting items, not least of which is a list of "electrics" in use and on order in Great Britain, which now extends to a total of 483; in December it was 100, but only part of the increase represents new items, the remainder being apparently due to information received since the first list was compiled. None the less, it is an impressive total, and full of promise for the future. We note that in the United States the total is no less than 75,000. An interesting item is an illustrated description of a wayside boosting device, provided by Mr. A. C. Cramb at Croydon for a special service of electrical vehicles.

"First Principles of Production." By J. Taylor Peddie. London: Longmans, Green & Co. Price 5s. net.

"*Bulletin* de la Société Internationale des Electriciens." Vol. V, No. 39, February, 1915. Paris: Gauthier-Villars. Price 3 fr.

"The Mathematical Analysis of Electrical and Optical Wave Motion." By H. Bateman. London: Cambridge University Press. Price 7s. 6d. net.

"The War and the Parting of the Ways." By C H Luke. London: Sampson Low, Marston & Co., Ltd. Price 1s. net.

For Sale.—The Receiver for debenture-holders of the British Prometheus Co., Ltd. (in voluntary liquidation), invites offers for the purchase of the business as a going concern. Newport Corporation has for disposal 18 tons of old lead battery plates. Particulars are given in our advertisement pages to-day.

Catalogues and Lists.—MESSRS. SIEMENS BROS. AND CO., LTD., Woolwich.—16 page pamphlet (No. T 535) containing a fully illustrated description of their "Autophone" system—an automatic telephone system for large business houses, factories and institutions.

MESSRS. LANDIS & GYR, Elgee Works, Stonebridge Park, Willesden, N.W.—Leaflet describing their prepayment meters—ampere-hour meters for D.C. circuits, and watt-hour for single-phase circuits.

GILBERT ARC LAMP CO., LTD., Sphere Works, St. Albans.—Four-page illustrated price list of fittings for half-watt nitrogen filled and metal-filament lamps. Various types for street, railway, works and shop lighting are shown

The General Electric Co., Ltd., 67, Queen Victoria Street London, E.C.—24-page catalogue (O section, ninth edition) of electro-medical apparatus, novelties, &c., including apparatus for electro-therapeutics, battery lighting sets, battery fans, cells, galvano-cautery apparatus, measuring instruments, medical lamps, vibro massage, &c. All articles are well illustrated and prices are clearly shown.

Citroen Gear Co., Ltd., 27, Queen Victoria Street, London, E.C.—One of the best prepared catalogue publications that we have received since the war began. Sixty-eight pages of thick art paper are filled with excellently produced and printed half-tone pictures of mining, pumping, electrical, rolling mill, marine, and textile machinery, machine tools, rubber machinery, compressors, turbines, electric traction, equipment and motor-cars, on which the Citroën gears are used. The letterpress discusses all of these applications briefly, and gives an account of the evolution and advantages of the gears, together with an account of how they are cut, and of the works in which they are made.

The Cable Accessories, Ltd., Britannia Works, Tividale, Tipton.—Bound catalogue of 112 pages, containing illustrations and prices of a host of different types and designs of "Revo" water-tight electric light fittings. They are designed for metal filament and half-watt lamps, and for all kinds of situations—mills, shop windows, street lighting, ships, and so forth. Single light fittings, cluster designs, cargo lights, bulkhead lights, bracket arms, hand lamps, replacement fuses for street lighting fittings, and other manufactures, are included in what should be a very useful catalogue.

Messrs. A. P. Lundberg & Sons, 477 to 489, Liverpool Road, London, N.—List (S 28) is the firm's revised and enlarged "Marvel" switch list (12 pages). Various standard uses and methods of connection of "Marvel" and "Marvel intermediate" switches are detailed, and a number of modifications are diagrammatically shown. Prices of surface, flush, and pendant patterns are tabulated.

Messrs. Millns Electrical Co., 37 and 38, Strand, London, W.C.—Pamphlet giving tabulated prices and particulars, and a specification, of M.E.C. interpole dynamos and motors, from ¾ to 76 B.H.P. Copies of the pamphlet will be sent on application. The business has been started by Mr. Percy M. Millns, who until recently was chief sales engineer in the machinery department of the Adnil Electric Co., Ltd.

Messrs. W. T. Glover & Co., Ltd., Trafford Park, Manchester. An illustrated pamphlet, entitled "Hints on Electric Cables for Collieries," written by Mr. W. T. Anderson, giving the reasons which have led the firm to advocate the use of vulcanised bitumen cables for mining work.

British Thomson-Houston Co., Ltd., Rugby.—Illustrated price-list No. 2,155 gives particulars of B.T.H. A.C. loom motors—squirrel-cage, three-phase, 50 cycles.

British Engineering in China.—*Eastern Engineering* states that a very powerful and well-organised corporation, comprising some of the best known engineering firms in Great Britain, has lately come into existence for the purpose of co-operative working throughout the Chinese Republic. Such firms as Sir William Arrol & Co., Ltd.; Brooks & Doxey, Ltd.; John Brown & Co., Ltd.; Cravens, Ltd.; Callender's Cable and Construction Co., Ltd.; Dorman, Long & Co., Ltd.; Thos. Firth and Sons, Ltd.; R. and W. Hawthorn, Leslie & Co., Ltd.; Hulse and Co., Ltd.; W. S. Laycock, Ltd.; Simon Carves Coke Oven Co., Ltd., together with a number of other manufacturers having complementary interests, have, after a careful study of the conditions of trading now ruling in China, joined forces to form a company, which, registered in London under the title of "Representation for British Manufacturers, Ltd.," has, during the past year, established a joint account organisation for covering the important centres of the Chinese Republic, with head offices in London and Peking, and branches at Shanghai, Hankow, and Canton.

Prices Advance.—Messrs. Veritys, Ltd., announce that from March 1st their electric light fixture list, Vol. III, second edition, is subject to an advance of 10 per cent.

Fire.—On Tuesday night a serious fire occurred at the works of Messrs. Alldays & Onions, at Birmingham.

Social.—The annual supper of the employés in the meter department of Messrs. Ferranti, Ltd., Failsworth, took place at the Star Inn a few days ago, about 50 persons attending. Mr. J. C. Leadbeater presided.

Alleged Stealing.—The three men who were charged with being concerned in the theft of X-ray apparatus from London hospitals, as mentioned in our issue of March 12th, were, on 19th inst., committed for trial.

Liquidations.—The Central Wireless Co., Ltd. A meeting of creditors was held on Monday last at 45, Newhall Street, Birmingham. Liquidator, Mr. R. B. Earle.

Consolidated Diesel Engine Manufacturers, Ltd.—We have received a summary of the accounts of the liquidator (Mr. Wm. B. Peat) from July 7th, 1914 to January 6th, 1915. The receipts have amounted to £12,482, less payments to execution and other secured creditors £208, and payments per trading account £2,656, leaving £9,618. On the payments side there are Board of Trade and other fees, law costs of petition, liquidator's fees, and salaries, wages and other charges, after the deduction of which, together with £157 in respect of preferential creditors, there remains a balance of £8,155.

Roundhay and District Electric Lighting Co., Ltd.—A meeting will be held on May 4th, at 34, Albion Street, Leeds, to hear an account of the winding up from the liquidator, Mr. W. Smith.

Bankruptcy Proceedings.—J. P. K. Clark (G. Driver and Son), electrical and mechanical engineers, Hythe Road, Willesden, N.W. Adjudication order March 16th.

Trade Announcements.—Messrs. Pyne, Hughman and Co., have removed from Lyons Range to Grosvenor House, Old Court House Street, Calcutta.

Messrs. E. Brook, Ltd., announce that their London office was yesterday removed to 11, Queen Victoria Street, London, E.C. Telephone No.: City 4468. The premises are central and commodious, and will enable a larger stock of single, two and three-phase motors to be carried than was formerly the case.

The Metal Information Bureau (L. H. Quin) has removed to larger premises at 7, East India Avenue, London, E.C. Telephone No.: Avenue 3825. Telegrams: "Quinirage, Led, London."

The A. & A. Electrical Co., Ltd., has removed to 51, Whitcomb Street, Leicester Square, London.

LIGHTING and POWER NOTES.

Aldershot.—Proposed Loan.—The U.D.C. has decided to expend £8,350 on the provision of additional generating plant, &c., at the electricity works, and to apply for a loan of £8,500.

With reference to a suggested supply of current to the parish of Hale, the clerk has advised that an order will be necessary, together with the consent of the Farnham E.L. Co., who have power to supply. Further inquiries are to be made into the matter.

Australia. — The Romsey Shire Council has been authorised to supply electric light to Lancefield.

The Brunswick Municipal Council has decided to borrow £10,000 for electricity purposes.

The annual report of the Melbourne Electricity Supply Committee shows gross receipts amounting to £164,000, an increase of 9·6 per cent. over last year, and a gross profit of £84,796, or 11 per cent. increase, the net profit being £21,051.

Barnet.—Workhouse Lighting.—The Guardians have decided not to invite tenders at the present time for the supply of electrical plant for lighting and heating the whole of the institution, but to ask the North Metropolitan Electric Power Distribution Co. to supply a draft agreement for lighting and heating during a period of seven years, at 1d. per unit, plus a yearly sum of £50. An electric lift is to be installed at the new Infirmary at a cost of £250.

Basingstoke.—Power Supply, &c.—The Corporation has received an application from Messrs. Thornycroft & Co. to supply their vehicle and engine works with electric power to the extent of a minimum of 250,000 units per annum, at 1¼d. per unit, for four years certain, subject to a formal agreement and to the consent of the L.G.B. to the necessary loan to carry out the work. Earl Curzon, of Hackwood House, and Mr. L. de L. Simonds, of Audley's Wood, are to take a large supply of current for lighting purposes.

Bedford.—Additions and renewals of cables are to be carried out by the Town Council, at a cost of £715. The electrical engineer has been instructed to construct a sub-station in Campbell Road.

Blackrock (Co. Dublin).—Proposed Loan.—The L.G.B. has intimated to the Council that, before considering the proposal to borrow £13,000 for an electric lighting scheme, it would require complete plans and specifications; these have now been supplied.

Bootle.—Year's Working.—The electricity surplus for the current year will amount to about £3,017, or £1,061 more than estimated; the income from sales increased 9 per cent., while working cost remained almost stationary. It is proposed to transfer £1,500 to the rates account, and the balance to the reserve fund. The estimated surplus for the next financial year is only £1,142, owing to increased charges due to the war amounting to £2,694.

Bradford.—War Bonuses.—The City Council has decided to grant war bonuses to all employés for a period of six months from March 1st, in amounts varying from 1s. to 3s. per week, which will involve a cost of £15,000.

Brighton.—Increased Prices.—In consequence of the increased cost of coal, &c., the T.C. has increased the various flat rates for private lighting by ½d. per unit; the maximum demand rate from 6d. and 2d. to 6d. and 3d.; the rate for public lighting by ¼d. per unit; and the power rate from 1d. to 1·10d. per unit, discounts being abolished.

The T.C. has decided to renew the condenser tubes of No. 2 turbine set, at a cost of £590.

Burnley.—Year's Working.—The electricity profits were £[illegible], compared with an estimate of £5,970. An increase in the price of electricity was approved. The surplus on the tramway undertaking for the past year was £3,500.

Bury.—The Electricity Committee has decided not to proceed with the extension at the Chamber Hall power station at present

Cardiff.—Fly-wheel Wreck.—The power station at Cardiff was severely damaged on Sunday last by the bursting of a fly-wheel, weighing 70 tons, which wrecked an engine, and led to the complete suspension of the tramway service. The damage is estimated at £20,000.

At an emergency meeting of the Tramways and E.L. Committee, Mr. Arthur Ellis, the city electrical engineer, said one large engine had been entirely wrecked, and, in his opinion, it would pay to replace it with modern plant, rather than repair it. He had no doubt that the engine speed suddenly increased, and the bursting of the fly-wheel and generator followed, shattering the end wall and most of the roof. It was necessary to give temporary cover to the remaining plant, but the greatest difficulty was the 20-in. circulating water pipes, which had been broken, flooding the basement and damaging the foundations. As soon as the concrete was removed the waterworks department were prepared to erect new pipes, so that the new plant could be run. The large battery at the Hayes station had kept going the lighting of the city and most of the public buildings, until the old generating plant could be started. He hoped that they would have the lighting service restored fully by Tuesday (last) and be able to start a restricted service of cars. It appeared that the engine had only been on load five or 10 minutes, when the driver noticing something wrong, had barely time to warn the staff to get clear. An observer outside the station said he saw a huge volume of black smoke shoot upwards followed by a number of projectiles, and immediately after the power station was hidden in a cloud of steam.

Chislehurst.—The U.D.C. has been informed by the Chislehurst Electric Supply Co. that there is no prospect of a redution in the price of current in the near future, owing to the unremunerative lengths of main laid, and that the widely scattered area did not allow of any fair return on the capital expended.

Continental Notes.—Norway.—It is reported from Skein that the Hollen municipality has decided to expropriate the Eidsfos waterfall.

According to a report from Stavanger the work of harnessing the large waterfalls at Saude was to be started last month.

At Enebak to the north of Kristiania a new municipal electrical station, with a capacity of 1,000 h.p., has been completed.

Spain.—A concession has been granted for the establishment of a plant to utilise the water power of the River Rambla de Almohoga at Almohoga (province of Teruel) in the generation of electrical energy for power purposes.

Russia.—Electric Power in Oil Fields.—The output of electricity in the Baku oil field increased from 20,000,000 kw.-hours in 1906 to 53,000,000 kw.-hours in 1912.—*Financier.*

Faversham.—The T.C. has adopted a recommendation from the Electric Supply Committee not to increase the cost of energy.

Galashiels.—The Galashiels and District Electric Supply Co. has now commenced supplying customers. Two mills are taking all the power for their plant, and a third is having the necessary equipment installed: other consumers for power and light have been connected up. The company's works are situated at Galafoot, and the plant installed has a capacity of over 2,000 h.p.

Glasgow.—The Markets Committee has decided to retain the present arc lighting in the markets and to light the extension of the fish market by electricity.

Gresford.—Proposed E.L. Scheme. — An influential meeting has been held to discuss a proposed scheme for the provision of a public electric light supply for the district, which is one of the beauty spots of Denbighshire. The proposal is to form a company, with a capital of £5,000, made up of 4 per cent. preference shares and ordinary shares of £1 each, which it is thought will be forthcoming without any difficulty, and the matter is relegated to a local Committee for further investigation of the financial aspect of the scheme.

Grays.—L.G.B. Inquiry.—On March 17th an inquiry was held into the application of the U.D.C. for a loan of £600 for service connections, mains and meters, and £142 excess expenditure. There was no opposition.

Henley-on-Thames.—Prov. Order.—The T.C. has decided to oppose the application of the Reading Electric Supply Co. for power to extend its lighting order to the borough.

High Wycombe.—Restricted Lighting.—The T.C. having asked the Electric Light Co. for a reduction in the charge for current for arc lamps in view of the reduced lighting now being given, the company has allowed a rebate of 1d. per unit from January 1st last. The present scale of reduced lighting saves seven units per hour, and the allowance for six months will be approximately £27.

Huddersfield.—For the second year, the Electricity Committee has transferred to the borough rate an amount equal to the produce of 1d. in the pound, after making full provision for depreciation. The tramway department has provided an amount equal to 4d. in the £ in relief of the rates, or ½d. more than last year, whilst transferring at the same time substantial sums to the depreciation and contingencies fund.

Hull. — Extension Scheme. — The Electricity Committee, on the advice of Mr. H. R. Hooper, L.G.B. Inspector, has decided to modify its scheme for extending the generating plant, and to defer that portion recommending the installation of a 5,000-kw. turbine unit and condenser, also one boiler and the coal-handling and water-cooling plant, thus reducing the sum required to £26,445.

Application is to be made to the L.G.B. for sanction to a loan of £20,000, and the balance is to be paid out of reserve.

India.—At the meeting in London of the Mysore Gold Mining Co. it was stated that owing to prolonged drought, the electric supply from the Cauvery plant was restricted during the year, and the reserve steam plant had to be used.

The Mysore Government is now building a dam on the Cauvery River to provide sufficient storage to prevent a similar state of affairs in the future.

Lees.—Messrs. J. B. Lord & Sons have asked the U.D.C. to sanction their having a supply of electricity for lighting from Oldham, and have been informed that they must first make application to the Oldham T.C., who could then apply for the consent of the U.D.C.

London. — Fulham. — The Electricity Committee recommends that the charge for electrical energy be increased by the addition of 5 per cent. to all accounts rendered.

Hackney.—The Finance Committee of the B.C. recommends that the estimated surplus of the electricity undertaking for the year ending March 31st, amounting to £1,952. be transferred to the credit of the general rate fund.

Westminster.—The City Council has decided to continue the contracts with the Charing Cross, the Metropolitan, and the St. James's and Pall Mall Companies for the supply of energy to the Council's buildings.

Morecambe.—New Plant.—The T.C. has decided to purchase a new evaporative condenser for the electricity works to cope with the increasing demands.

Nantwich.—The R.D.C. has decided to consent to the application of Crewe T.C. for an order enabling it to supply electricity to Wistaston. Current will be supplied at a price equal to gas at 2s. 8d. per 1,000 cb. ft., which is less than the present charge for gas.

Newton Abbot.—Restricted Lighting.—Owing to the restricted public lighting, the Urban Electric Supply Co. has offered the U.D.C. a reduction in the lighting account of £200 to the end of the year.

Perth.—New Plant.—The Electricity Committee has considered several offers for plant for the extension scheme at the electricity works, but on account of the cost has been unable to come to any decision. The engineer is to visit the Midlands to inspect a generating plant which has been in use only a short time, and can be obtained on satisfactory terms.

Salford.—Ratepayers and War Bonuses.—The decision to grant war bonuses to Corporation employés in certain departments was criticised at a meeting of the local Ratepayers' Association on Monday. As a class (said one of the speakers) some workmen were being paid 7s. a week more at the present time than was being given for similar labour by the best employers in the district. It was urged that the Corporation should, by means of adequate reserve funds, have consolidated its position to enable it to deal with any situation that might arise.

Tunbridge Wells.—L.G.B. Inquiry.—An inquiry was held on March 16th into the application of the T.C. for a loan of £7,520 for electricity purposes. Provisional tenders have been accepted, with increases on the engineer's estimates amounting to £617, and this sum was asked to be added to the loan applied for. The Inspector (Mr. H. R. Hooper) suggested that no extensions should be carried out until the war was over, but the town clerk urged that the application should not be refused, but adjourned. Mr. Hooper said he did not think he could pledge the Board to do that, and urged that the works should be carried on as at present, certainly for another year. The town clerk said he could not withdraw the application without a special meeting of the Council, and he again suggested that it should be postponed. Mr. Hooper replied that postponement would carry the suggestion that the L.G.B. agreed with the principal that the extensions were necessary, and he did not think it would take that view.

U.S.A.—Electric Cooking.—In view of the success attained with all-electric cooking in a large apartment house on Irving Street, Worcester, Mass., built by the same concern, the Colonial Real Estate Co. of that city will equip a new eighteen-suite apartment now under construction with electric ranges. As in the Irving Street property, no coal ranges will be provided, and service will be supplied through a separate meter at a rate of from 3 cents to 4 cents per kw.-hour. In the latter suites the monthly cost of energy for domestic cooking has averaged from $2.50 to $3 per family, three persons constituting the average household. The Colonial Co. is so much pleased with the results of electric cooking that all future buildings erected by it for apartment service will be provided with electric ranges exclusively.—*Electrical World.*

West Ham.—Proposed Loan.—The electrical engineer has reported on the position with regard to loan sanctions as influenced by the war, and recommends an application for a strictly limited amount in regard to one of the sanctions which is nearly exhausted and estimated to be sufficient for 12 months. The Electricity Committee has accordingly agreed to make application for a loan sanction in regard to £3,000 for mains work, but the expenditure is only to be incurred as required in connection with additional fresh demands for electricity supply.

Willesden. — The U.D.C. has been recommended to afford a stand-by supply to the Guardians, for a period of not less than seven years, at an annual charge of £45 plus 2d. per unit for energy supplied. In view of the reduction of street lighting, and the number of lamps in stock, the Electricity Committee has decided to suspend the resolution allocating £500 per annum for the renewal of arc lamps for the year 1914-15, and to assign from the current year's expenses only the actual amount expended in renewals (£30).

Winchester.—January Outputs, &c.—With reference to our note in last week's issue, the outputs given were, of course, for the last and previous Januarys, and not, as stated, year's outputs: the estimated output for the year ending March 31st next is over a million units, an increase of at least 50 per cent. since the Corporation took over the undertaking from the Electric Light Co.

Windsor.—Sewage Pumping.—The R.D.C. is obtaining expert opinion as to the best means of sewage pumping for the Ascot district main drainage scheme. The systems to be considered are:—(1) Electricity; (2) Diesel engines; (3) semi-Diesels; (4) suction gas.

Wombwell.—L.G.B. Inquiry.—An inquiry has been held into a proposal to supply gas to Great and Little Houghton. On behalf of the Little Houghton Council, it was stated that the Houghton Main Colliery Co. proposed to light the place by electricity, though it was admitted that nothing had been done during two years.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. System.—The T.C. has decided by 19 to 12 to discontinue the P.A.Y.E. system of cars on the tramways. In the course of discussion it was suggested that the fare question had been confused with the matter of certain constructional features to which objection was taken. The Council also discussed at length the question of the tramway manager's patents, &c., the matter being finally dropped.

Bristol.—Tramway Purchase.—The Tramways Option Committee of the Council, on the suggestion of Sir John Snell, has instructed Mr. C. P. Sparks, consulting electrical engineer, Mr. P. Addie, the city valuer, and Mr. L. S. McKenzie, the city engineer, to make an independent joint valuation of the portion of the Bristol tramway undertaking which is purchasable by the Corporation, on what are known as "tramway terms." The option to purchase arises during the present year.

Cheadle and Gatley.—Tramway Lease.—The U.D.C. has agreed to lease the tramways to the Stockport T.C. from March 4th, 1904, to March 3rd, 1925, with an option to renew the lease at the expiration. Provision is made for electrical equipment.

Continental.—Spain.—Application has been made to the Spanish Government for a concession for the construction and working of an electric tramway between the town and harbour of Valencia.

Dundee. — Tramway Arbitration. — Evidence was heard in Edinburgh in the arbitration between the Dundee, Broughty Ferry and District Tramway Co. and the T.C. on the price to be paid for the portion of the district tramway line between the eastern boundary of Dundee and the western boundary of Broughty Ferry as they existed in 1904. The claim by the company is for £14,500, and the T.C. maintains that this sum is greatly in excess of the value of the subjects in question. Mr. Stephen Sellon, in his evidence, put the total value at £17,000. Mr. George Balfour, the managing director of the company, was examined on the various items of the claim. He said the figure for Parliamentary expenses was £1,100. The cost of raising capital was put at £3,000 by Mr. Sellon; he put it at £1,500, representing 10 per cent. on £15,000. It cost him more to raise the capital in 1905. The inquiry was adjourned until May 7th. The claim of £980 for overhead equipment has been settled for £640.

Edinburgh.—A conference took place last week between a Sub-Committee of the Tramways Committee and the directors of the Colinton Tramways Co. regarding the Colinton Tramways and the lines which the Corporation is seeking powers to construct.

Glasgow.—Female Conductors?—A deputation of the Women's Suffrage National Aid Corps has approached the Tramways Committee in support of a proposal that, in view of the scarcity of men to act as car conductors, owing to the war, women should be employed in that capacity at the same wages and on the same conditions as men. Mr. Dalrymple has reported that he is still 300 men short of his regular staff, and that conductors and motormen are working practically seven days a week.

Liverpool.—Year's Working.—The annual report of the Corporation tramways for the year ending December 31st shows that the revenue amounted to £722,307 and the operating costs to £473,678, leaving a gross profit of £248,629.

The net profit was £134,821, a decrease of £19,341 compared with the year 1913, this being attributed to an increase of £11,000 in rates and taxes, an increase of £10,000 in wages account (including allowances to dependents of employés who are at the front), and the supplying of $1\frac{3}{4}$ millions of free passes (representing a value of £8,232) to soldiers and sailors. Although the profit had decreased, the contribution in relief of the rates was the same as last year. The number of passengers carried during the year was 145,656,374, an increase of over $1\frac{1}{2}$ millions compared with the previous year; the receipts were £684,026, an increase of £6,145, and the mileage 13,657,888, an increase of 215,283 miles.

London.—L.C.C.—The Highways Committee recommends that, owing to the difficulty which is experienced in obtaining suitable men for motormen and conductors, and because learners are apt to leave before their training is completed, the pay of motormen and conductors, while learning, be 3s. 6d. per day for a period of six weeks, as a temporary measure during the continuance of the war.

Morecambe.—Upon the recommendation of the Tramways Traction Committee, the Council has decided not to proceed with the investigations which had in view the adoption of some system of power traction to replace the present horse vehicles. This decision has been arrived at on account of the increased cost of materials consequent upon the war.

Musselburgh.—Tramway Dispute.—At the instance of the Industrial Commissioners, Prof. Lodge, last Friday, held an inquiry into the circumstances of the Musselburgh tramway "lock-out." At the close it was stated that a deadlock had been reached on the question of the reinstatement of the six dismissed men.

Newcastle-on-Tyne.—Tramway Estimates.—At a recent meeting of the City Council, Ald. Rodgers discussed the position of the Committee's estimates in view of the demand by the tramway men, in common with other municipal workers, for an advance of 5s. per week on account of the high cost of living and the high rents. Since the estimates of the Tramways Committee were prepared, he said, everything had changed. The actual income for the closing year would be £280,000. During the coming year it was proposed to open the Newburn and Forest Hall lines, and the income had been estimated at £282,000. The traffic expenses for the last year was estimated at £72,000, but that had been considerably increased by concessions to the men in July last, amounting to £5,000. He mentioned other increased expenditures, and remarked that, apart from the bonus given by the Tramways Committee to the rates, the undertaking was paying £16,900 in rates. The first surplus at the end of next year, he estimated, would be £121,900, as against £110,250. From that sum £82,500 had to be taken for interest and redemption of loans, leaving £39,400 at the end of the year. They were paying the dependents of the men who had gone to the Front, the original estimated cost of which was £8,000, but since then the allowances had been increased, and that amount had risen to £9,500.

An advance of 5s. per week to the tramway-men would mean £18,000. The various charges against the undertaking, in view of the increases asked for, and with the £18,000 for the rates, totalled £64,236. To meet that they had a surplus of £39,000 odd, and that would result in a deficiency of £24,824. Any bonus granted to the men would have to come out of the £18,000 voted to the rates. In any case, the tramways would show an adverse balance next year. After discussion, it was decided to give war bonuses of 2s. 6d., 1s. 6d., and 1s. for six months from April 1st.

South Africa.—Judging by the South African papers, Germiston's railless traction venture has so far not realised expectations. It would appear that the system is running at a loss of £60 or so a week, exclusive of loan charges which are stated to be £3,500 per annum. A week's receipts averaged 7·7d. per c.m., and expenditure 12·6d. The Boksburg undertaking for January showed a gross surplus of £62; the T.C. is endeavouring to get power at industrial rates, when it is estimated that all charges will be covered.

Warrington.—The Corporation has decided to pay a war bonus to all employés in receipt of wages of and exceeding £1, but not exceeding £2 per week.

West Ham.—Proposed Loans.—The T.C. is to apply for sanction to borrow £3,000 in respect of the difference between the revised estimate for the purchase of 15 bogie cars and one single-truck car, and the amount already sanctioned: and £10,000 in respect of car equipments, after having deducted £18,000 to be provided out of the reserve fund.

TELEGRAPH and TELEPHONE NOTES.

A Daring Cable-Cutting Exploit.—Reuter recently reported that on the 7th inst. H.M.S. *Amethyst* was entrusted with the difficult task of cutting the telegraph cable connecting Kilid Bahr with Chanak, at the Narrows of the Dardanelles. She reached her objective undetected, lifted and cut the cable, and started on her return journey before she was discovered. She then had to run the gauntlet of the guns of the forts on both sides of the Narrows, and became the target for a veritable hell of fire. She raced at full speed towards the entrance of the Straits, all the time exposed to heavy fire, but although frequently hit, she succeeded in getting beyond the range of the guns after a very narrow escape.

Direct Telegraphy to Russia.—It is reported from Stockholm that rumours are in circulation there concerning a direct telegraphic connection between Great Britain and Russia, which is alleged to have been established by an English cable steamer in January, 1915, from the North of Scotland round Scandinavia to the Russian coast, where a continuation to the Russian telegraph system was effected by means of a provisional overhead line in a southwardly direction. It is considered to be noteworthy in this connection that the Russo-English telegraph service *viâ* Norway has ceased since January 20th. On the other hand, the Swedish telegraph director Curman is credited with the statement that a high official of the Danish telegraph administration on returning recently from Russia had informed him that the cable in question had actually been laid. A diminution of the telegraph service between England and Russia, however, has not been recorded in Stockholm.

Grangemouth.—Owing to fire in a building, the lower part of which was occupied by the local telephone exchange, telephone communication with the town was entirely suspended for several days recently to permit of the necessary repairs.

Norway.—The town of Tönsberg has adopted the automatic telephone system of the Western Electric Co, with satisfactory results.

Telegraph Messengers.—The experiment of employing girls in the capacity of telegraph messengers in the Liverpool suburban post offices is being tried. The demand for boys greatly exceeds the supply, and the problem of Liverpool girl unemployment is acute.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—April 6th. U.D.C. Motor-generators or converters, one H.T. switchboard and L.T. panels, and one H.T. feeder pillar. See "Official Notices" March 19th.

Aldershot.—April 20th. U.D.C. One 400-KW. D.C. turbine set, complete with surface condenser and circulating pumps, &c. One water-tube boiler with chain-grate stoker. See "Official Notices" to-day.

May 4th. Steam and other pipework. Water-softening plant. See "Official Notices" to-day.

Australia.—MELBOURNE.—April 28th. Electric lighting material for car repair shops at Jolimont, including steel conduits, cable, switches, lampholders, &c., and trucks of 4.000 lb. capacity, driven by storage batteries. Copies of the specification can be seen at the Commercial Intelligence Department of the B. of T., Basinghall Street, E.C.

April 19th. 13,560 yards of lead-covered cable for the City Council. See "Official Notices" to-day.

April 19th. 13 tons of bare hard-drawn copper cable for the City Council. See "Official Notices" to-day.

June 2nd. Electric lighting material for cars (Contract 28,187). Tender box, Railway Offices, Melbourne. Particulars at Contractors' Room, Spencer Street. Deposit ½ per cent. of amount of tender.

QUEENSLAND.—June 1st (instead of March 16th). P.M.G. Switchboard for Warwick. See "Official Notices" to-day.

Bray.—April 6th. U.D.C. Stores for electric light works. See "Official Notices" March 19th.

Bridgend.—April 8th. U.D.C. 400-KW. steam alternator. See "Official Notices" March 19th.

March 30th. U.D.C. Small steam coal for the power station. Forms of tender from the Manager, Electricity Works.

Brighton.—April 12th. Corporation. Surface condenser. See "Official Notices" to-day.

Carlisle.—March 31st. Corporation. Twelve months' supply of jointing materials, oils, and general stores. Forms, &c., from City Electrical Engineer, Victoria Viaduct.

Dundee.—March 29th. The Corporation Electricity Department invites tenders for stores.

March 30th. Corporation Electricity Department. Centrifugal pumps, and laying cast-iron pipes.

Edinburgh.—March 29th. Corporation. Three, six or twelve months' supply of insulated cables, arc lamp carbons, fuse boxes, meters, &c., for the Electricity Supply Department. Forms of tender (10s.) from the Electrical Engineer's office, Dewar Place.

April 12th. Corporation. Water-tube boilers for Portobello Supply Station. See "Official Notices" March 19th.

Harrogate.—March 29th. Twelve months' supply of electrical fittings and sundries for the Harrogate Wells and Bath Department. Forms of tender from F. J. C. Broome, General Manager.

Glasgow.—March 24th. Electric lighting installation at Shakespeare Public School, Maryhill, for the School Board. Specification from the School Board Offices, 129, Bath Street.

London.—March 31st. L.C.C. Installation, 218 wiring points, 265 lighting points, at Derington Road Elementary School, Lower Tooting, S.W. See "Official Notices" March 19th.

ST. PANCRAS.—May 11th. Constructional steelwork at power house, for B.C.

Manchester.—March 29th. The Lancashire and Yorkshire Railway Co. invites tenders for 12 months' supplies of signal, telegraph and electric fittings (Section 32), signal, telegraph and electric light wires (Section 33), steel plates, Siemens (Section 39) steel sheets, Siemens and Electrical (Section 41). Particulars and forms of tender from Mr. Waring, stores superintendent, Osborne Street, Manchester.

New Zealand.—WELLINGTON.—April 30th. Supply of a three-unit exciter set and 1,600-KW. generator for the Lake Coleridge Hydro-electric scheme. A copy of the specification can be seen at the Commercial Intelligence Department, B. of T., London, E.C.

Sheffield.—April 12th. Supply of motor-van (petrol or electric) to carry one ton, for the Corporation. Specification (10s.) from the Cleansing Superintendent, Town Hall.

Spain.—The Spanish Post and Telegraph authorities in Madrid are at present inviting tenders for the erection of a telephone line between Barcelona and La Junquera, a distance of about 97 miles.

Sunderland.—April 1st. Corporation. Electrical stores, overhead line, &c., for the Tramway Department. Forms of tender from Mr. A. R. Dayson, Tramway Manager.

Whalley.—April 5th. Lathes, vices, electrical instruments, &c., for the County Asylum. See "Official Notices" to-day.

CLOSED.

Aberdare.—The U.D.C. Electricity and Tramways Departments have placed contracts for 1915-16 as follows:—

Cables, joint-boxes, &c.—Callender's Cable & Construction Co., Ltd.
Meters.—Landis & Gyr, Ltd.
Paints.—Navigation Paint Co., Ltd.
Lubricating and other oils.—Vacuum Oil Co., Ltd.
Uniforms.—Jas. Smith & Co. (Derby), Ltd.

Australia.—The following contracts have been placed:—

P.M.G.'s Department, Sydney.—
- 75 miles of twisted-pair outside distributing wire, £968.—B.I. & Helsby Cables, Ltd.
- 4,000 lineal ft. of glazed earthenware four-duct conduit, £321; 13,000 ft. of nine duct ditto, £2,387.—Brunswick Brick, Telegraph & Pottery Works Pty.
- One naut telegraph cable, single core, £141; one ditto (item 5), £416; 1½ nauts cable, ditto, £218.—Siemens Bros. Dynamo Works, Ltd.
- 3 miles of paper-insulated lead-covered cable, 52 pairs, £783; 5 miles ditto, 208 pairs, £2,995; 1 mile ditto, 312 pairs, £730; 9½ miles ditto, 416 pairs, £10,299; ¾ mile ditto, 208 pairs, £474.—B.I. & Helsby Cables, Ltd.
- 4 miles of paper-insulated lead-covered cable, 260 pairs, £4,668.—Noyes Bros. (Sydney), Ltd.
- 8 miles of paper-insulated lead-covered cable, 78 pairs, £1,020.—Laurence and Hanson Electrical Co., Ltd.
- 3 miles of paper-insulated lead-covered cable, 26 pairs, £518; 4 miles ditto, 39 pairs, £828.—W. T. Henley's Telegraph Works Co., Ltd.

Aust. Mining Standard.

N.S.W. Public Works Department.—
- Electrically-driven centrifugal pump, for Homebush abattoirs, £763.—Haes & Eggers.

Prahran & Malvern Tramways Trust (Victoria).—
- Tudor battery, £2,817.—Elder, Smith & Co. —*Tenders.*

The following contracts were recently given out by the Commonwealth P.M.G.'s Department:—

- 10,400 English metal-filament lamps.—Australian General Electric Co.
- 80 tons of H.D. copper wire, for Queensland, £3,429.—Laurence and Hanson, Ltd.
- Telephones, micro-telephones and other apparatus.—James Paton & Co.
- 200 detectors, £520.—British General Electric Co., Ltd.

Barnsley.—The Education Committee has accepted the tender of the Corporation Electricity Department, at £44, for laying cable from the sanatorium and installing electric light at the new open-air school.

Blackburn.—With reference to the notice appearing in our last issue, we are informed that the contract for A.C. meters has been placed with the British Westinghouse Co., Ltd. Messrs. Chamberlain & Hookham will supply only the D.C. meters.

Coventry.—The Corporation Electricity Department has placed a repeat order with Messrs. Ed. Bennis & Co., Ltd., for eight chain-grate stokers, 7 ft. wide × 13 ft. 6 in. centres, for B. & W. boilers.

East Ham.—A short while ago the Town Council accepted the tender of Messrs. Allen & Son to provide an electric motor for the sewerage works, for £620. The firm have now written to the effect that they cannot supply the apparatus for less than £682. The responsible Committee has agreed to the increased price.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

War Office.

Dry batteries.—British L. M. Ericsson Mfg. Co., Ltd. ; Siemens Bros. & Co.
Distributing boards.—General Electric Co., Ltd. ; Park Royal Eng. Works, Ltd. ; W. Sanders & Co. ; Falcon Electrical Works.
Resistance coils.—Gambrell Bros., Ltd. ; Muirhead & Co., Ltd. ; Nalder Bros. & Thompson ; W. G. Pye & Co. ; Siemens Bros. & Co.
Conduits and fittings.—Credenda Conduits, Ltd.
Dynamos.—Electric Construction Co., Ltd.
Electric sets, &c.—Austin Motor Co. (1914), Ltd.
Galvanometers.—Edison & Swan U.E.L. Co., Ltd. ; W. G. Pye & Co. ; Record Electrical Co., Ltd.
Telegraph instruments (parts of).—Bullers, Ltd. ; Stuart & Moore ; Taylor, Tunnicliff & Co., Ltd. ; Tyer & Co. ; Walter's Electrical Mfg. Co., Ltd.
Electric lamps.—Brimsdown Lamp Works, Ltd. ; Bulpett & Sons, Ltd. ; Dick, Kerr & Co., Ltd. ; Edison & Swan U.E.L. Co., Ltd. ; Graham and Latham, Ltd. ; E. Griffiths & Sons ; Pope's Electric Lamp Co., Ltd. ; Worsnop & Co., Ltd.
Electrical machinery.—Siemens Bros. Dynamo Works.
Telephone sets and parts.—Automatic Telephone Mfg. Co., Ltd. ; Gent and Co., Ltd. ; International Electric Co., Ltd. ; New Phonopore Telephone Co., Ltd. ; Walter's Electrical Mfg. Co., Ltd.
Transformers and switches for electric light.—Ferranti, Ltd.
Brass tubes.—A. Emanuel & Sons, Ltd.
Copper tubing.—Hudson, Edmunds & Co., Ltd. ; C. M. Powell Bros.
Steel wire, &c.—B.I. & Helsby Cables, Ltd. ; Whitecross Co., Ltd.
Works services.—Electric light installation at R.E. Camp, Halefield, Edmundson Electricity Corporation, Ltd. ; electric light installation at Hearson Camp, Foot & Milne, Ltd. ; electric light installation at Military Hospital, Devonport, Foot & Milne, Ltd. ; electric light installation at Shorncliffe, G. Weston & Sons, Ltd. ; electric light and power installation at King George Hospital, London, T. Clarke and Co., Ltd.
Internal electric wiring.—At Bulford and Sling Camps, A. V. Gifkins and Co., Ltd. ; at Perham Down, V. G. Middleton.
Underground cable (Codford and Sutton Veney).—B.I. & Helsby Cables, Ltd. ; W. T. Glover & Co., Ltd.

Post Office.

Annual contracts for laying conduits (short lengths, not continuous).—City of London, J. A. Ewart, Ltd. ; Finsbury and Holborn, O. C. Summers ; Westminster and Chelsea, F. G. Brummell.
Laying ducts and pipes.—Boxmoor, May, Mortimer & Co. ; Burgh Heath, J. Mowlem & Co., Ltd.
Telephone exchange equipment, automatic order wire, selection system.—Avenue Exchange, Siemens Bros. & Co., Ltd.
Telephone exchange equipment extensions.—Greenock, Western Electric Co., Ltd. ; Streatham, Western Electric Co., Ltd. ; Victoria, S.W., Peel-Conner Telephone Works, Ltd.
Protective apparatus (lightning and power).—British L. M. Ericsson Mfg. Co., Ltd.
Telegraphic apparatus.—Murray Printing Telegraph Systems ; Park Royal Eng. Works, Ltd. ; Reid Bros. Engineers, Ltd. ; Siemens Bros. and Co., Ltd.
Telephonic apparatus and parts.—Automatic Telephone Mfg. Co., Ltd. ; B.I. & Helsby Cables, Ltd. ; British L. M. Ericsson Mfg. Co. ; Gent and Co., Ltd. ; Karabon & Co., Ltd. ; Peel-Conner Telephone Works, Ltd. ; Phœnix Telephone & Electric Works, Ltd. ; Siemens Bros. and Co., Ltd. ; Western Electric Co., Ltd.
Submarine cable.—Henley's Telegraph Works Co., Ltd. ; I.R., G.P. and Telegraph Works Co., Ltd. ; Siemens Bros. & Co., Ltd. ; Telegraph Construction & Maintenance Co., Ltd.
Telephonic cable.—B.I. & Helsby Cables, Ltd. ; Siemens Bros. & Co., Ltd. ; Western Electric Co., Ltd.
Enamelled copper wire.—London Electric Wire Co. & Smiths, Ltd.

H.M. Office of Works.

Electric cables and wire.—Union Cable Co. ; W. T. Henley's Telegraph Works Co., Ltd.
Vacuum cleaners.—Sturtevant Eng. Co., Ltd.

India Office.

Cables.—Siemens Bros. & Co.
Cells.—Chloride Electrical Storage Co.
Copper bolts.—T. Bolton & Sons.
Electric lighting material.—J. Stone & Co.

Crown Agents for the Colonies.

Insulators.—Bullers, Ltd.
Parts for telegraph poles.—F. Morton & Co., Ltd.
Telegraph poles.—Bullers, Ltd.
Copper line wire.—Shropshire Iron Co., Ltd.

Helsby.—The Parochial Committee has accepted the tender of the B.I. & Helsby Cables, Ltd., for the electrification of the pumping station and sewerage works, the amount for the pumping station being £159, and for the sewerage works £186.

Huddersfield.—The tender of Messrs. J. H. Taylor and Co. for electricians' work in connection with Bradley Sanatorium has been accepted. The Electricity Committee has accepted the tender of Mr. Wm. Wood for supply of coal.

London.—The Education Committee proposes to accept the tender of Messrs. Matthews & Yates, Ltd., at £90, for installing silent-running fans at the Old Montague Street School, Whitechapel.

The tender of Messrs. Toy & Winslow has been accepted by the Metropolitan Asylums Board, at £70, to execute sundry electrical works at the South-Western Ambulance Station.

L.C.C.—The Highways Committee reports that all the tenders received for the supply of two additional 8,000-KW. turbo-generators for the Greenwich generating station were submitted subject to the model conditions of contract for electrical works adopted by the Institution of Electrical Engineers, which differ in many respects from the Council's standard conditions of contract, some of which are based on standing orders. The Commitee has been in communication with the British Westinghouse Electric and Manufacturing Co., Ltd., whose tender for £62,003 was accepted with a view to the modification of the Institution's model conditions of contract to bring them as far as possible into line with the Council's standard conditions. A modified form of contract has now been agreed as a special case, and without prejudice to the future consideration of the whole question, and, as the payment clause differs somewhat from the terms of that provided for in Standing Order No. 295 (*d*) (1) it will be necessary for the Council to suspend its operation. The Committee therefore recommends :—

> That the operation of Standing Order No. 295 (*d*) (i) be suspended, in order that the contract to be entered into with the British Westinghouse Co. may provide for the undermentioned payments to be made to the company in respect of the work—(i) monthly payments of 50 per cent. of the contract value of the plant delivered or work executed on the site ; and (ii) further payments in respect of each distinct section of the works of 30 per cent. of the contract value of the work executed on the site upon completion of the erection of the plant, 10 per cent. at the expiration of one month after the plant shall have been taken over by the Council, and the remaining 10 per cent. at the expiration of the period of maintenance.

The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., has been accepted for carbon-filament lamps for the ensuing 12 months.

Bermondsey.—Messrs. Chamberlain & Hookham's tender for meters and time switches has been accepted by the Council for the coming 12 months.

Fulham.—The prices quoted for the supply of electrical and engineering stores for the ensuing year show a general advance of from 10 to 20 per cent., and the Electricity Committee therefore recommends that for the ensuing year no annual contracts be entered into for the above-mentioned stores, but that the borough electrical engineer be instructed to purchase in the open market at the lowest price obtainable as and when required.

St. Pancras.—The Electricity Committee has further considered the question of the acceptance of the tender for the supply of carbons for the ensuing year, and as there is in hand a sufficient stock of carbons for four months the General Electric Co. were asked whether the price named would hold good for a four months' instead of a year's supply. The company are prepared to give a four months' supply of open-type carbons at the prices quoted, provided the full 12 months' supply of flame carbons is taken. This would represent £475 for flame carbons and £511 for open-type carbons. The Committee recommends the acceptance of the offer.

Manchester.—The Corporation Electricity Department has placed a repeat order with Messrs. Ed. Bennis & Co., Ltd., for the relinking of two pairs of chain grates of another make, at the Bloom Street power station, with "Bennis" patent chain-grate links.

Newport (Mon.)—The B. of G. has accepted the tender of Messrs. R. Alger & Sons, for E.L. fittings.

Rawtenstall.—The T.C. has contracted with Messrs. J. Morris & Co., for a supply of 1,500 to 2,000 tons of coal to the electricity works, Hareholme.

Sunderland.—The *Times* states that Messrs. Vickers, Ltd., are supplying two turbo-alternators of 5,000-KW. capacity each for the Philadelphia power station, near Sunderland, the contract for which was originally given to the A.E.G.

Walthamstow.—The electrical engineer has reported with reference to the supply of arc lamp carbons, and has been instructed to at once accept the quotation of the General Electric Co., Ltd., for the supply of 25,000 pairs of 10-ampere size carbons, at £8 1s. 6d. per 1,000 pairs, and 50,000 pairs 5-ampere size carbons, at £4 16s. per 1,000 pairs ; 200 tons of Griff peas coal and 100 tons of High Park nutty slack coal have been purchased from Messrs. Myers, Rose & Co., Ltd., and Messrs. G. Hinchliffe & Co., respectively. The District Council is recommended to authorise the surveyor to hire an electrically-propelled dust van from the Edison Accumulators Co., Ltd., for one week on trial, at a cost of £6, the Council to provide the current.

West Ham.—The tender of the Fuller Electrical and Manufacturing Co., Ltd., has been accepted for the supply of motors for the sales department during the ensuing 12 months. The existing contract for the supply of cables terminates on March 31st. The electrical engineer has been in negotiation with the present contractors, the British Insulated and Helsby Cables, Ltd., who are prepared to grant a concession in regard to low-tension service cables if the contract be extended for a further period of three years. In view of the fact that the cables under this contract are supplied on a sliding scale in regard to the price of copper and lead, the Committee has decided to accept the offer.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Friday, March 26th. At 9 p.m. At Albemarle Street, W. Paper on "Experiments in Slow Cathode Rays," by Prof. Sir J. J. Thomson, F.R.S.

Saturday, March 27th. At 3 p.m. Lecture VI on "Recent Researches on Atoms and Ions," by Prof. Sir J. J. Thomson, F.R.S.

Physical Society of London.—Friday, March 26th. At 5 p.m. At University College, Gower Street, W.C. Paper on "The Change of Thermal Conductivity with Fusion," by Prof. A. W. Porter, F.R.S., and Mr. F. Simeon.

Birmingham Association of Mechanical Engineers.—Saturday, March 27th. At 7.45. At Technical School, Suffolk Street. Paper on "Electric Furnaces," by Mr. J. H. Stansbie. To this meeting members of the Birmingham Local Section of the I.E.E. are invited.

Association of Supervising Electricians. Tuesday, March 30th. At 8 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Intercommunication Telephones," by Mr. H. C. Lee.

Institution of Electrical Engineers (Students' Section).—Wednesday, March 31st. At 7.30 p.m. At Victoria Embankment, W.C. Discussion on "The Application of Electrical Engineering to Warfare—Searchlights and Projectors," opened by Mr. E. L. Emtage.

(Birmingham Local Section).—Wednesday, March 31st. At 7 30 p.m. At University, Edmund Street. Paper on "Development of Main-Line Signalling on Railways," by Mr. W. C. Acfield. To this meeting members of the Institution of Signal Engineers and the Institution of Mechanical Engineers are invited.

Greenock Electrical Society.—Friday, April 2nd. At 7 45 p.m. At 21, West Stewart Street, Greenock. Social meeting.

Salford Technical and Engineering Association.—Saturday, April 3rd. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "Lifting Machinery," by Mr. D. Riley.

NOTES.

Our Next Issue. — Next Friday being Good Friday, the ELECTRICAL REVIEW will appear on Wednesday morning. All matter for our Editorial and advertisement pages should be in our hands at the earliest possible moment.

The Electrical Trades Benevolent Institution.—The Committee has resolved to call the annual general meeting of this Institution for Monday, April 19th, at 6.30 p.m., at the Institution of Electrical Engineers. Mr. E. Garcke will be in the chair. The time mentioned has been selected in order to afford a better opportunity of being present to those interested in the Fund. It is thought that it will be convenient to many subscribers and friends to "drop in" at the Institution on their way home from their offices. We hope that the attendance will justify the change; also that it will show that in these trying days the electrical world has time and thought to spare for so deserving an organisation and Fund, the claims upon which must inevitably be larger in the near future.

Copper. — Some difficulty arises in endeavouring to appreciate the copper position at the present time, as comparisons with pre-war conditions, though of some interest, cannot give an indication of the general tendency. The statistics for mid-month, now to hand, as tabulated by Messrs. H. R. Merton & Co., require, as is pointed out, to be considered in relationship to the fact that the quantity of stocks at Havre can now be ascertained, whereas for the past seven months it has been given, as an estimate, at pre-war figures. This makes an apparent falling-off in European supplies of 5,973 tons, since the end of last month. English supplies, however, have only decreased by 447 tons.

In detailed supplies we find that European arrivals from North America during the fortnight ending March 15th were 16,184 tons, which approaches very closely to the pre-war average of 17,200 tons. Spain and Portugal, even after the heavy consignments of last month, supplied this country and France with a quantity slightly in excess of the pre-war average.

The quantity from countries not specifically mentioned, which has been very strong recently, is again high at 3,576 tons. Chile shipments were low, and Australian, after two heavy months, show only 1,250 tons against a pre-war average of 1,655. The extraordinary thing about the figures is, of course, that it is possible to compare them with pre-war figures at all. The supplies for the first half of March are less than 4 per cent. lower than the average pre-war half-monthly supply. The impression given by the figures is that a very little stimulus in the way of extra price would raise supplies again to the normal quantities.

Patents and Alien Enemies.—Mr. G. H. Wilson, electrical engineer, of the Manchester Armature Repair Co., Pendleton, Manchester, applied on Tuesday in the Patent Court set up to deal during the war with the patents of alien enemies, for a licence to manufacture self-insulating aluminium field coils for electrical motors, under five German patents—namely, Nos. 10,457 of 1906, 2,711 of 1910, 20,634 of 1910, 9,941 of 1911 and 27,661 of 1912, held by the Spezialfabrik für Aluminium Spulen und Leitungen, of Frankfurster Str., Berlin.

Mr. J. G. Johnson represented the applicant; Mr. Courtney Terrell appeared for the patentee.

Mr. Johnson said the patent applied to field coils for electrical motors. These coils could be used in electric motor-cars and tramcars, as well as industrial dynamos and motors. All the patents related to the manufacture of coils from aluminium instead of copper.

Mr. Terrell said the film of oxide on the surface of aluminium formed a natural insulation; that, however, was not entirely relied upon here. Sheets of insulating material were used, instead of insulation wrapped round the wire. The advantages of the aluminium coil were its lightness, durability and cheapness.

Mr. Wilson said the first patent related to the natural oxide; the rest were concerned with strengthening the oxide film. He employed 30 men at his works and had supplied 20 tramways. He had made about 300 aluminium coils. He had regular customers who otherwise would be forced to use copper coils. He could supply them with aluminium on more favourable terms. His firm made armature coils for tramways and field coils generally. If he had a monopoly of the supply of aluminium coils, he thought he could sell 10 or 20 thousand pounds' worth per annum, say, 5,000 coils. The Manchester tramways bought about a thousand coils per annum, at a cost of between £2 and £3 each. The price to sell of the average tramway coil was 10s. a coil cheaper for aluminium than for copper, roughly, ignoring the fluctuations in the price of copper which had coincided with the war. On the average number used by the Manchester Corporation the saving would be £700; he would offer them copper coils at £2 10s., aluminium at £2. He had a year's experimental agreement with the German firm dated August 1st, 1912, which entitled him to the grant of an exclusive licence from them to manufacture, sell or use electrical aluminium coils in the United Kingdom or the British Colonies, and negotiations for such exclusive licence were in progress when the war broke out. He paid the owners £100 on signing the first agreement, and was to have paid a further £100 on signing the second.

Mr. Wilson offered a royalty of 5 per cent. on the selling price, and asked that the licence should date from the commencement of the war.

The Controller said the Board of Trade would duly communicate with him as to his licence.

Electro-Harmonic Society.—The smoking concert on Friday last—the last of the season—was particularly successful, the audience enthusiastically encoring almost all the items. Sir John Snell presided, and just before the interval he took the opportunity to explain to the members that when, last autumn, the question was raised whether the concerts should be held, the Committee decided, in his opinion very wisely, to continue them during the war. He understood that the previous concerts this season had been attended by large and enthusiastic gatherings, and he could quite understand it, if they were as good as this one; he entirely dissented from the view that such concerts should be abandoned, believing that our gallant comrades at the front would desire that they should be continued. He was present in the dual capacity of President of the Institution of Electrical Engineers and hon. treasurer to the Society; the latter was not a very onerous position, as the bulk of the work was done by Mr. Lane. The Society had gained 55 new members and lost only 58, in spite of the war, and the membership now stood at 661, a very good result; he hoped those members who had not yet contributed to the funds would do so at their early convenience. In a third capacity, as a member of the Society, Sir John pointed out how much they were indebted to their hon. musical director, Mr. T. E. Gatehouse, for drawing together the talented artistes and organising these splendid entertainments; he also referred to the enormous amount of work done for the Society by Mr. W. E. Lane, their hon. secretary, to whom, with Mr. Gatehouse and some other members, the thanks of the Society were due, and to whom they were obliged for that harmonious gathering.

An unusual feature of the evening was the presence of an orchestra from the London Symphony Players, whose rendering of the Allies' National Anthems and various patriotic and other selections was heartily appreciated.

Preferential Rates.—It appears that the question of charges for electricity used for photo-printing has cropped up at Ilkeston, but this time on the point of preference as between two men in the same line of business. An Ilkeston photographer named W. E. Attenborough, writing to the *Ilkeston Pioneer*, stated that he had threatened to commence proceedings against the Town Council for "undue preference" unless within 48 hours the Corporation agreed to charge him at the same rate for electricity for his photographic lamp as another photographer was charged. The Town Clerk called a meeting of the Electricity Committee, and the latter decided to accede to Mr. Attenborough's demand, besides refunding to him the amount overpaid, which came to £2 9s. 8d. An earlier issue of the same paper states that Councillor W. Smith resigned the chairmanship of the Tramways and Electricity Committee, because he believed that an injustice had been done to Mr. Attenborough in charging him for energy at the lighting rate, and as he intended to assist that gentleman to obtain his rights, he felt he could not retain the position of chairman.

Councillor Smith is to be congratulated on his firm stand for justice and common-sense: the conversion of the Committee to his view completely justifies his action, which, however, should not have been rendered necessary. The Committee ought now in fairness to re-elect him chairman.

Scottish Radium Factory.—The *Times* states that Dalvait, on Loch Lomondside, is to be the home of a new radium industry in Scotland. An old sawmill has been adapted for use as a factory for the extraction of radium and other rare metals from their ores, and within the next few weeks a start will be made.

The promoter of the scheme is Mr. John S. MacArthur, a Scottish metallurgical chemist, who, about two years ago, began to make industrial experiments, working with ores from which the uranium and vanadium had already been extracted, and has already placed upon the market about 1,500 milligrammes of radium. In the new establishment he expects to be able to extract about 5 or 6 grammes a year.

London Electrical Workers' Demands.—With reference to the last paragraph appearing in the communication appearing under this heading in our last issue, the *Daily Telegraph* says that the strike of electrical wiremen and armature winders working in the tramway department of the London County Council threatens to affect seriously the running of the tramcars. "The men are employed in repair work. About a year ago the electrical masters of London granted an increase to their wiremen of 1d. per hour, making the wages 10½d. The Tramway Conciliation Board advanced the men's wages ½d. per hour, to 10d., and the County Council took up the attitude that their wiremen are not covered by the agreement between the London electrical masters and the Union. Nearly 1,500 cars are owned by the Council, and of these over 40 are in the depôt for repairs at one time. With the exception of a few armature winders, who are still at work, all electrical workers are on strike to the extent of nearly 100 men. The remainder of the winders are expected to join the strikers. The men are receiving strike pay from the Electricians' Federation, which was represented at the Government conference at the Treasury, where it was agreed that no strikes should take place."

Electrical Expansion in Germany.—The statistical report published yearly by the German Union of Electrical Central Stations has again appeared, and covers the year 1912-13. The new volume contains complete particulars of the working of 364 installations, 70 of which, serving about 15,000,000 people, are located beyond the borders of the German Empire, and 294 serving about 30,000,000 people, are situated in Germany. The statistics show that the undertakings have a tendency to enlarge their network, especially in the rural districts, and to become "overland" systems, corresponding to our large power supply companies. This is confirmed by the yearly increasing number of stations serving more than two localities, there being 99 such in 1910; 132 in 1911, and 153 in 1912. The number of communities served was 4,153 in 1910, 4,722 in 1911, and 6,434 in 1912, which gives an average for 1912 of 40 communities per station. One of the stations serves a locality situated at a distance, as the crow flies, of 102 km., while 13 serve localities situated over 50 km. distant. The figures show that 29 per cent. have a capacity of 5,000 KW. and upwards, and they represent 81 per cent. of the total power installed, which is a proof of the constantly increasing centralisation of the production of energy. The energy sold increased from 313,000,000 KW.-hours in 1911 to 385,000,000 KW.-hours in 1912. Per 1,000 inhabitants, the establishments supplied represent a power of 35·7 KW. for lighting, 50 KW. for motors, and 31·8 KW. for light and motors, with a common tariff, that is to say, about 100 KW. in all. The power used by the motors grows more rapidly than that for lighting, the proportion being in 1912 53·5 per cent.

The energy sold per head of population yearly has grown from 34·6 KW.-hours in 1910 to 43 KW.-hours in 1911, and 48·9 in 1912 per 1,000 inhabitants. The average sale price of the KW.-hour in 1912 was 45·1 centimes for lighting, and 18·5 for power.

The average total cost of production per KW.-hour sold was 10·65 centimes in 1912.—*L'Industrie Electrique.*

The Ilford Railway Accident. — Lieutenant-Colonel von Donop, the Board of Trade Inspector, in his report on the Ilford railway accident, which took place on New Year's Day, when a passenger train from Gidea Park to Liverpool Street was run into by an express from Clacton, states that it is certain that the signals were in the danger position when the express passed them, and it was to a mistake on the part of the driver of the express that the collision was due. The Inspector says: "This collision points to the desirability of the provision of some arrangement for giving a driver an unmistakable warning as to the position of his distant signal when he passes it. Several railway companies have already made trials of devices designed for this purpose, and on some lines such devices are already in use to a limited extent."

Institution and Lecture Notes.—Physical Society of London.—At the meeting held on March 12th a paper on "The Estimation of High Temperatures by the Method of Colour Identity," by C. C. Paterson and B. P. Dudding, was read by the former. Preliminary experiments were described in which the temperature of incandescent substances was estimated with a very fair accuracy by matching their colour with that of incandescent filament lamps working at appropriate efficiencies. These had previously been calibrated by comparison with a "black body" over a large temperature range. The comparisons were made in the field of a Lummer Brodhun photometer, and the method was shown to give the correct result for the melting point of platinum.

A paper on "The Unit of Candle-power in White Light," by C. C. Paterson and B. P. Dudding, was read by the latter. The paper described the methods adopted at the National Physical Laboratory for minimising the difficulty of photometric comparison of white lights of different hue. A series of six sets of electric sub-standards were described varying in the tint of the light radiated from that of the pentane lamp to that of a tungsten vacuum lamp operating at 1·5 watts per candle. The absolute value of the unit of candle-power had been re-determined, as had also the corrections for humidity and barometric changes, and the probable existence of a temperature correction was discussed.

A paper, entitled "The Relative Losses in Dielectrics in Equivalent Electric Fields, Steady and Alternating (R.M.S.)," by Mr. G. L. Addenbrooke, was taken as read. After references to former work, especially on surface leakage, tables were given showing an intimate connection between the losses in steady and alternating fields, and that the one could be predicted from the other to a first approximation. Curves of the losses in from 1 to 4 seconds up to 40 cycles were given for specimen dielectrics. Above 8 to 12 cycles, both for "good" and "poor" dielectrics, these became rising straight lines. The salient features lay below about 16 cycles.

The formula $a + b\,n$ applied to all dielectrics for frequencies above about 8 cycles, but not below. Liquid dielectrics behave similarly to solid with certain differences, particularly that for a given resistance the ratio of the steady to the alternating loss was less than with solids. For the dielectrics tabulated these losses varied in a steady field from 1 to 1,300,000, but the corresponding alternating losses varied only from 1 to 1,100. The difference was principally in the "good" dielectrics, the alternating losses in which at 40 cycles were vastly larger than those in a steady field, though they still appeared to be connected with them.

Institution of Electrical Engineers.—At the meeting of the MANCHESTER LOCAL SECTION on Tuesday last, Mr. W. R. Cooper's paper on "Electric Cooking, Mainly from the Consumer's Point of View," was read and discussed.

Bristol Association of Engineers.—The concluding meeting of the Session 1914-15 was held on March 13th, when a paper on "Impulse Electric Clocks" was read by Prof. D. Robertson.

Northampton Polytechnic Institute. — The course of Advanced Lectures on "Electrical Instruments and Switchgear," by Mr. A. C. Heap. M.I.E.E., which last autumn was announced to be given at the Northampton Polytechnic Institute during this spring, had to be cancelled, as urgent engagements caused by the continuance of hostilities make it impossible for Mr. Heap to undertake it at the present time.

Electrical Association of Australia.—The annual meeting of the VICTORIAN SECTION was held at Melbourne in December. The report of the Council referred to the amalgamation of the Victorian and New South Wales Associations, to the licensing of wiremen, and other matters. The financial position is sound, and the number of members of all classes is 226. The election of officers for the ensuing year resulted as follows:—President, Mr. W. H. Alabaster; vice-presidents, Messrs. F. A. McCarty and A. W. Kendall; hon. secretary, Mr. E. H. W. Westwood. At the conclusion of the ordinary business a smoking concert was held.—*Com. Engineer.*

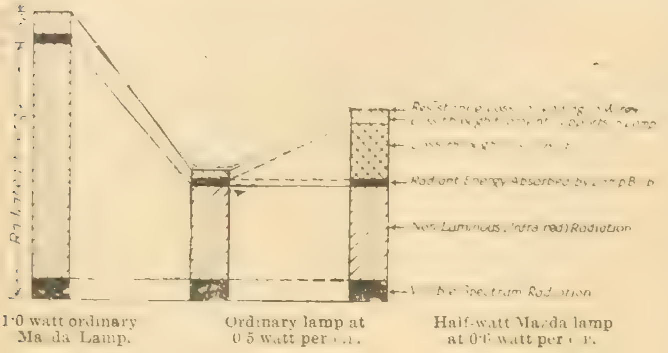
Mr. O. W. Brain, M.I.E.E., Chief Electrical Engineer for Railways and Tramways, N.S.W. Government, has accepted the position of president of the Electrical Association of Australia. Other officers are:—Vice-presidents, W. H. Alabaster, chief assistant electrical engineer, Melbourne City Council; W. H. Myers, assistant engineer, Electrical Branch, N.S.W. Government Railways and Tramways (president of the New South Wales Section); members of Council, Prof. Henry Payne (Melbourne University, Engineering Department), Mr. W. J. Newbigin (director, Adams & Co., Melbourne), Mr. H. R. Forbes-Mackay (city electrical engineer, Sydney), Mr. A. C. F. Webb, M.I.E.E. (consulting electrical engineer, Sydney).—*Sydney Morning Herald.*

Appointments Vacant.—Meter tester (£2) for Barrow-in-Furness Electricity Department; assistant electrical engineer (£125) for Aylesbury U.D.C.; jointer for Stretford U.D.C.; works fitter (50s.) for Rhondda Electricity and Destructor Works; junior assistant electrical engineers (15s.), for Newcastle-upon-Tyne Electric Supply Co. Particulars are given in our advertisement pages.

The Swedish Iron Ore Railway.—As previously announced, electrical working was commenced on January 19th on that particular section of the Swedish State Railways which proceeds from Kiruna to Riksgransen, and which has a length of 80 miles, the trains representing for the first time in Europe, it is claimed, loads of over 2,000 tons, inclusive of locomotives, trucks and iron ore. The working of the service takes place under specially difficult conditions, as the line is the most northerly railway in the world, although it was formerly operated with steam locomotives, naturally with a considerably lower transport capacity and speed. The starting point of the railway lies nearly 87 miles to the north of the Polar Circle; a complete Polar climate prevails, and violent snowstorms occur, with degree of cold of 35° C. Nevertheless it is stated that down to the first week in March the working of the railway was fully maintained without any interruption. The railway is used for the transport of iron ore, which is mined at Kirunavaara, near Kiruna, to the Norwegian frontier, whence it is conveyed to Narvik, on the Atlantic Ocean, and each train of 40 ore trucks, each weighing 46 tons loaded, is hauled by two electric locomotives, of a combined length of 120 ft. The greatest tractive effect on the draw-bar is said to amount to about 10 tons. In addition to ore and passenger trains, one fast train runs in each direction daily, and forms one portion of the Northern Express between Stockholm and Narvik. The power station, which is 155 miles distant from the terminus of the railway, is situated at the Porjus Falls, where 40,000 H.P. have been brought into requisition for the operation of the line. Single-phase current, at 80.000 volts, is transmitted by overhead conductors to substations arranged along the route, where it is converted to a suitable pressure for the engines. As Sweden possesses but little native coal and is compelled to procure most of her supplies from abroad, the substitution of electric traction by the use of water-power yields certain economic advantages to the State from this point of view, as well as from others. Thus it is asserted that in the present case, and as compared with the former steam locomotion, it has been possible to increase the train capacity by 40 per cent. and the speed by 50 per cent., which are claimed to represent an augmentation of 70 per cent. in the transport of iron ore. The work has been carried out by the Allmanna Svenska E.A.B. in association with a German firm.

Energy Losses in Electric Lamps.—The accompanying diagram shows very clearly how the new half-watt (gas-filled) lamps obtain their superior efficiency over the ordinary metal lamps. The columns in the diagram show the losses occurring in the ordinary vacuum lamp when operated at an efficiency of 1 watt per candle and at 0·5 watt per candle, as compared to the losses in the gas-filled or half-watt lamp when operated at an efficiency of 0·6 watt per candle. This diagram was recently presented in a paper before the Chicago Engineering Society by Mr. S. E. Doane.

The upright columns show how the energy is dissipated in the lamps. The vacuum lamp when operated at an efficiency of 0·5 watt per candle shows smaller losses than the gas-filled lamp at similar watts per candle consumption, due to the energy loss in the gas employed in the gas-filled lamp. As is well known, however, the ordinary metal (vacuum) lamp operated at such an efficiency as 0·5 watt per candle has a life of only a few hours.



On the other hand, the gas-filled (half-watt) lamp is able to operate at this high efficiency with satisfactory life, because of the neutral gas with which the bulb is filled. This gas, by preventing the evaporation of the filament when the lamp is operated at a high efficiency, enables the half-watt lamp to be produced with a commercial length of life.

Energy losses due to the inert gas in the gas-filled lamp are, of course, unavoidable; but in spite of these losses, the diagram shows that the gas-filled or half-watt lamp makes a marked advance in efficiency over the ordinary vacuum lamp as used commercially. The actual energy losses in each type of lamp are shown in full detail, so that one can readily see how the remarkable gain in efficiency is obtained in the new lamps.

Russian Hydro-Electric Power.—The Inland Waters Department has prepared an explanatory report on the projected legal regulations for using Russian waterfalls, one of the leading motives in respect to which is the long-distance transmission of electrical power, having in view the exploitation of mines, electrochemistry and metallurgy, as well as the production of various materials of importance to agriculture. But above all the governing idea is the supply of hydro-electric power for traction purposes, it being considered that the application of electric traction on railways becomes more and more imminent. In European Russia it is calculated that 24 rivers can yield 1,000,000 H.P. without counting the rivers of the Caucasus; whilst the water power of Siberia has not yet been investigated. Some writers estimate the water-power of all Russia at 12,000,000 H.P.

The Russian Government has been moved to take this step by the large number of applications made to it for water power concessions, which began to be received in the nineties of last century. The first consideration is to be the requirements of the Government, which points to the need for a general Governmental control; whilst it is recognised that almost every private concession involves some Government or public interest. The *projet de loi* is governed by the following essential conditions:—All water power must primarily be at the disposition of the Government, which may use it directly for the public good or lease it in the interests of industries requiring Government countenance. Any right conceded to private individuals may not be for an indefinite time as a private right; but must have a term to allow for reconsideration of the conditions and objects of the concession. Water power used for Government or public purposes must be considered as alien to anything in the form of private exploitation. It should always be under Government inspection, the Government being free to supress abuses, and to remove injurious consequences of a monopolistic character; and in the case of need the sources of supply of energy may be appropriated by the Government, which will make suitable compensation to concessionaires up to the final dates of their respective contracts.

Electrical Developments in Italy.—Treating the theme of "The Present and the Future of Electric Installations in Italy," the *Rivistà Tecnica d'Elettricità* comes to the following conclusions:—Premising that the war will occasion a long period of dear coal, as French, Belgian, German and Bohemian supplies will be interrupted, and only England and America will be able to furnish supplies, at enhanced prices, it concludes that a great opportunity will be afforded to substitute electricity generated from water-power for thermal sources of energy, and generally to enlarge and improve existing electric plants. According to the last official statistics (of 1911), there were in all Italy 46,194 motor power installations of a total horse-power of 1,620,404, of which 977,906 were operated with electrical energy. The statistics show that there are 32,357 water-driven installations of a capacity of 951,836 H.P., of which 685,834 H.P. are converted into electric power; 7,264 installations driven by steam power, with a capacity of 471,045 H.P., of which 224,506 H.P. are converted; 4,743 gas-driven installations of a total capacity of 167,501 H.P., of which 52,894 H.P. are converted; and 1,830 installations driven by either benzine, petrol or other substance, the total capacity being 30,024 H.P., of which 14,672 H.P. are converted into electric power.

Fatalities.—Irlam.—An inquest was held at Irlam on March 17th, on Thos. John Roberts (33), who was jammed against a girder by an electric crane at the works of the Partington Steel and Iron Works. Peter McGowan, electric crane driver, said he was employed at the works, and was 15 years of age.—The Coroner: You are rather young to have charge of an electric crane.—Mr. Dobson (secretary): Not for this class of crane.—Mr. Ireland, H.M. Inspector of Factories, said the Board of Trade regulations stipulated 18 years of age.—Witness, continuing, said he was working the crane, and, from where he stood, could not see anyone near the girder. It appeared from further evidence that deceased was fastening a ladder to a girder, and no warning had been given, either to the crane-driver or to the men at the bottom of the ladder.—A verdict of "Accidental death" was returned, and Mr. Loxley, assistant engineer, said that in future he would have cranes stopped while repairs were in progress on the gantry.

Manchester.—A verdict of "Accidental death," due to electric shock, was given by a Manchester Coroner's jury, on Friday last, after investigating the circumstances of the death (which took place the previous day) of Edward Sidney Wigglesworth (19), an apprenticed electrician to the British Westinghouse Co., Ltd., at Trafford Park. Deceased had been employed in the works for four years, and in the testing-room for about six months. Another electrician, who was with him, said that on looking round he saw Wigglesworth in a state of collapse. He was apparently holding a live wire attached to the transformer; the voltage would be about 440.

Mr. Fraser, assistant superintendent of the electrical department, said that the cables were so insulated that they could be safely handled, provided a man kept clear of the obviously bare metal. The floor was also an insulator. On behalf of the company, Dr. Eastham, barrister, expressed regret at the accident, and sympathy with the relatives of the deceased.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On relinquishing the post of station superintendent at the Battersea electricity works, to take up the position of generating engineer at the Reading Electricity Supply Co.'s works, MR. ALEXANDER WHITIE was presented by the staff with a silver-mounted crystal salad bowl and servers. In the absence of the chief engineer, Mr. H. F. J. Thompson, the chief assistant engineer, made the presentation. Mr. Whitie was also presented with an easy-chair from the workmen, and several other small presents from individual members of the staff.

The Rochdale Corporation Electricity Committee last week decided to give further extension of leave to MR. C. CLAREMONT ATCHISON, the electricity works manager, who recently underwent an operation, and whose recovery, so far, has not been quite as satisfactory as was originally hoped.

The Hackney Borough Council has been recommended to place MR. F. C. GRIMWOOD, sales department foreman, on the staff of the Council, at a fixed salary of £130 per annum.

MR. W. H. TUNNICLIFFE has resigned the position of engineer-in-charge under the Morley Corporation and is taking up a post in the Rotherham Corporation Tramways Department.

Tramway Officials.—MR. H. PILLING, manager and engineer of the Accrington Corporation tramways, is one of the four selected candidates for the position of manager of the Southampton tramways. The salary is £400 per annum. Mr. Pilling has been with the Accrington Corporation eight years.

General.—Congratulations to MR. DUNCAN WATSON upon his election last week to be an Alderman of the Borough of Marylebone. Alderman Duncan Watson, who is chairman of the Electricity Committee, first took his seat in the Council between four and five years ago.

MR. JOHN MCMILLAR, who has for 24 years been with the Electric Construction Co., at Bushbury, Wolverhampton, and has for 10 years had entire control of the switchgear department, is leaving. The staff and employés have presented him with a collection of plate.

MR. F. YOUNG, electrician to the municipal tramways at Dover, has resigned.

The Highways Committee of the L.C.C. recommends that MR. G. H. HUME be appointed chairman, and MR. J. PRESTIGE vice-chairman of that Committee.

MR. W. M. FURNISS has been appointed by the board of directors as manager of the Electric Construction Co.'s Works, Wolverhampton, in succession to the late Mr. William Bulloch. Mr. Furniss took up his duties as manager as from 17th inst.

Obituary.—Lieut.-Col. Geo. Hollingworth, who was well known in Lancashire engineering circles, and the head of the firm of Booth & Hollingworth, civil and consulting engineers, of Manchester, and also consulting engineer and part proprietor of the Bredbury Colliery Co., died at his residence, Brinnington Lodge, Stockport, on Tuesday, after a fortnight's illness. He was for some years connected with the Lancashire Territorials, from which he retired recently with the rank of lieutenant-colonel. Lieut.-Col. Hollingworth was about 60 years of age.

NEW COMPANIES REGISTERED.

Manley & Sandy (1915), Ltd. (139,678).—This company was registered on March 17th, with a capital of £1,000 in £1 shares, to take over the assets of Manley & Sandy, Ltd., in liquidation, to carry on the business of electrical and mechanical engineers and contractors, suppliers of electricity, manufacturers of and dealers in machinery, electric, magnetic, galvanic and other apparatus, etc. The subscribers (with one share each) are: G. B. Dobb, 16-18, Knightrider Street, E.C., manufacturer; J. W. Manley, Woodbury, New Barnet, Herts., engineer; R. B. Dobb, 2, Stone Buildings, Lincoln's Inn, W.C., solicitor. Private company. The number of directors is not to be less than two or more than five; the first are G. B. Dobb, J. W. Manley and R. B. Dobb. Qualification £5. Remuneration (except J. W. Manley) £52 each per annum. Solicitors: White & Dobb, 2, Stone Buildings, Lincoln's Inn, W.C.

Mid-Somerset Electric Supply Co., Ltd. (139,699).—This company was registered on March 19th, with a capital of £7,000 in £1 shares, to adopt agreements (1) with Christy Bros. & Co., Ltd., for construction of plant, and (2) with C. & J. Clark, Ltd., for supply of electricity in bulk, to take a transfer at cost price of a Provisional Order acquired in the name of Christy Bros. & Co., Ltd., and to carry on the business indicated by the title. The subscribers (with one share each) are: F. Christy, 53, Broomfield Road, Chelmsford, electrical engineer; H. B. Clark, Netherleigh, Street, Somerset, shoe manufacturer; J. B. Clark, Overleigh House, Street, Somerset, shoe manufacturer; J. C. Morland, The Orchard, Street, Somerset, skin rug manufacturer; J. Pursey, 172, High Street, Street, Somerset, auctioneer; F. W. Vooke, 98, High Street, Street, Somerset, butcher; J. L. Ward, Bowling Green, Street, Somerset, mill manager. Minimum cash subscription, 2,000 shares. The number of directors is not to be less than three or more than seven; the first are F. Christy, H. B. Clark, J. B. Clark, J. C. Morland, J. Pursey, F. W. Vook and J. L. Ward. Qualification, 50 shares. Remuneration as fixed by the company. Solicitors: Duffield & Son, Chelmsford.

Tungsten, Ltd. (139,665). This company was registered on March 16th, with a capital of £30,000 in £1 shares, to carry on the business of extractors, producers, refiners and manufacturers of tungsten, dealers in wolfram and tungsten and their products, metal workers, electrical engineers, electric lamp makers, etc., and to adopt an agreement with the National Industrial Syndicate, Ltd., F. W. Warburton, W. W. Crawford, P. Richardson and S. Clarke. The purchase consideration is £20,000 in shares, to be allotted as to 10,000 to the National Industrial Syndicate, Ltd. (vendors), as to 5,000 to P. Richardson, and as to 5,000 to S. Clarke. The shares are to be allotted to P. Richardson and S. Clarke by request of the vendors as consideration for services rendered and for underwriting. The subscribers (with one share each) are: A. W. Bellman, 336, Liverpool Road, Highbury, N., law clerk; R. W. Eades, 91, Shelley Avenue, Manor Park, Essex, clerk. Private company. The number of directors is not to be less than two or more than five; the first are P. Richardson, S. Clarke and F. W. Warburton. Qualification, 250 shares. Remuneration, £200 each per annum and £100 extra for the chairman, with any further remuneration voted by the company. Solicitors: Kenneth Brown, Baker, Baker & Co., Lennox House, Norfolk Street, W.C.

Seear, Scott & Co., Ltd. (139,663). This company was registered on March 16th, with a capital of £1,000 in £1 shares (500 7 per cent. pref.), to carry on the business of railway, motor, cycle, mechanical, electrical, experimental and general engineers and manufacturers, model-makers, etc. The subscribers (with one share each) are: E. C. Seear, 16-17, Devonshire Square, E.C., electrical engineer; J. Scott, 51a, St. Peter's Street, Croydon, engineer. Private company. The number of directors is to be two, the first are E. C. Seear and J. Scott (provisional directors). Solicitor: W. Drake, 45, Chancery Lane, W.C.

Newton Brothers (Derby), Ltd. (139,711).—This company was registered on March 20th, with a capital of £31,000 in £1 shares (1,000 employés'), to take over the business carried on at Alfreton Road, [illegible], and at Derby, as "Newton Brothers," to carry on the business of electrical and mechanical engineers, manufacturers and workers of and dealers in electricity, motive power and light, manufacturers of and dealers in electric lighting and power plants, dynamos, motors, cranes, pumps, motor vehicles, telegraphs, telephones, phonographs, accumulators, lamps and other apparatus, founders, metal workers, tool makers, dealers in hardware, etc., and to accept a proposal in writing made by C. A. Newton, R. Newton and H. Newton. The subscribers (with one share each) are: C. A. Newton, [illegible] Hotel, Derby, electrical engineer; R. Newton, 31, Hartington Street, Derby, electrical engineer. Private company. The number of directors is not to be less than two or more than six; the first are C. A. Newton, R. Newton and H. Newton (all permanent). Qualification £50. Remuneration as fixed by the company. Secretary: E. A. Swindell. Registered office: 21, Market Place, Derby.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Reduction Co., Ltd.—A memorandum of satisfaction in full on February 9th, 1915, of [illegible] 1903, securing £2,000, has been filed.

Brilliant Arc Lamp & Engineering Co., Ltd.—Issue on February 27th, 1915, of £50 debentures, part of [illegible] have already been filed.

Flexible Wheels, Ltd.—Mortgage on book debts dated March 12th, 1915, to secure £280. Holders: [illegible] Walk, Golders Park, and S. W. Woorner, [illegible]

Carville Site & Power Co., Ltd.—Particulars of £140,000 debentures, created December 21st, 1914, [illegible] February 26th, 1915, filed pursuant to Section 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £10,000. Property charged: The company's undertaking and property, present and future, including uncalled capital and freehold land at Carville, Northumberland. Trustees: Phœnix Assurance Co., Ltd., 19, Lombard Street, E.C.

County of Dorset Electric Supply Co., Ltd.—Particulars of £16,000 debentures, created by resolutions of February 24th and December 28th, 1914, filed pursuant to Section 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £3,000. Property charged: The company's undertaking and property, present and future, including capital [illegible].

Cambridge Electric Supply Co., Ltd. (36,457).—Capital, £100,000 in £10 shares. [illegible] £31,000 [illegible] £30,000 [illegible] £11,000 [illegible]

St. James' and Pall Mall Electric Light Co., Ltd. (26,015). Capital £300,000 in 20,000 [illegible] 40,000 [illegible] Return dated March 2nd, 1915. [illegible] 20,000 pref. and 39,650 [illegible] £298,250 [illegible] £1,750 [illegible] Mortgages [illegible] £140,000 [illegible] £236,729 4 per cent. [illegible] Supply Co., Ltd., being [illegible] capital.

India Rubber, Gutta Percha & Telegraph Works Co., Ltd. (1,122C).—Capital £812,000 in 50,000 ord., 25,000 pref., and 6,200 unissued shares of £10 each. Return dated January 5th, 1915. 50,000 ord and 25,000 pref. shares taken up. £750,000 [illegible]

Auckland Electric Tramways Co., Ltd. (61,199).—Capital £600,000 in £1 shares. 150,000 [illegible] Return [illegible] 1914. All shares taken up. £1 [illegible] £14,900 [illegible] as paid. Mortgages [illegible] £408,527.

Westminster Electric Supply Corporation, Ltd. (27,061). Capital £2,000,000 in £5 shares, 200,000 ord. and 200,000 4½ per cent. cum. pref. Return dated March 10th, 1915. 110,000 ord. and 110,000 pref. shares taken up. £5 per share [illegible] £1,100,000 [illegible] Mortgages and charges, £250,000.

CITY NOTES.

London United Tramways, Ltd.

The directors report that the operation of the undertaking during 1914 resulted in gross receipts amounting to £527,871. After adding the balance brought forward from 1913, and deducting all expenses chargeable to revenue, including an appropriation of £12,500 to reserve for reconstruction and renewals, there remains £8,142. The dividend on the preference shares at the rate of one-half per cent. per annum (paid in July last) absorbed £6,250, leaving £1,892 to be carried forward. The traffic receipts amounted to £316,808, a decrease of £11,768 due to war conditions. Owing to the number of employés who, as Reservists, were recalled to the colours, it was found necessary to reduce the services, and further reduction had subsequently to be made owing to the enlistment of employés in the new armies. 581 men are serving with the Forces, equivalent to about 24 per cent. of the entire staff. During the year a considerable length of track has been reconstructed, and £29,139 has been charged to the reserve for reconstruction and renewals.

Traffic Summary.

1913		1914
53.5	Mileage open	53.5
62,645,125	Passengers carried	61,4[illegible]
9,407,226	Car miles run	8,996,891
8.[illegible]d.	Average receipts per car mile	8.47d.
1.265d.	Average receipts per passenger	1.17d.
338	Cars in stock	338

Annual meeting: March 26th.

Wemyss and District Tramways Co., Ltd.—Presiding at the annual meeting in Edinburgh, Mr. George Balfour said that the receipts for 1914 showed a decrease of about £1,000, due entirely to the effect of the war on the districts through which the company's lines run. Notwithstanding the reduction in gross receipts, the net balance carried to the net profit and loss account was £6,819, only £745 less than a year ago, owing to economies in operating and general reduction in expenses. Taking all the circumstances into consideration, he thought the shareholders were to be congratulated on the result. During the year the doubling of the track, with a view to expediting the service from Leven to Kirkcaldy, was completed on a considerable portion of the system, and there was no doubt that this had materially improved the value of the property.

South Metropolitan Electric Tramways and Lighting Co., Ltd.—The revenue for 1914 amounted to £65,324. The available balance is £16,721, and the directors propose to place £4,500 to reserve, against £5,000, to pay a dividend at the rate of 6 per cent. per annum on the preference shares for the year, 1913, and to pay on account of preference dividend for 1914 at the rate of 1 per cent., carrying forward £351.

Stock Exchange Notice.—The Committee has appointed Wednesday, April 14th, a special settling day in—

General Electric Co., Ltd. Further issue of 10,000 ordinary shares of £10 each, fully paid, Nos. 40,001 to 50,000 and 30,000 6 per cent. cumulative preference shares of £10 each, fully paid, Nos. 40,001 to 70,000.

The preference shares mentioned are to be officially quoted.

Reduction of Capital.—Turners & Manville, Ltd., and Reduced.—A petition for confirming the reduction of the capital from £50,000 to £39,994 is to be heard on March 30th.

Robey & Co., Ltd.—Dividends of 4 per cent., free of income-tax, on the ordinary and preference shares for the year are recommended.

Winnipeg Electric Railway Co.—A dividend of 2½ per cent. for the quarter ending the 31st inst. is announced.

Metropolitan Electric Tramways, Ltd.

The revenue for 1914 amounted to £5[illegible]1,587. After adding the [illegible] brought forward from 1913, and deducting all expenses chargeable to revenue, there remains an available balance of £47,605. There is to be placed to reserve account £12,000; dividend on the preference shares absorbs £25,000, dividend on the ordinary shares at the rate of 2 per cent. £[illegible], and there is to be carried forward £1,118. £7,880 4½ per cent. [illegible] stock and £3,950 5 per cent. debenture stock [illegible] bought [illegible] cancelled during the year. The traffic receipts amounted to £467,415, a decrease of £8,511 due to war conditions. Owing to the number of employés who, as Reservists, were recalled to the Colours, it was found necessary to reduce the services in August last. Further reductions had subsequently to be made owing to the enlistment of employés in the new armies. 181 employés, equivalent to about 25 per cent. of the total staff, are serving in the Army or Navy.

[illegible] annual payment of £2,500 made by the company to the L.C.C. in respect of [illegible]

[illegible]

The business of the North Metropolitan Electric Power Supply Co., in spite of the decrease in the number of units supplied for traction purposes during the last five months of the year, has been satisfactorily maintained; the total number of units sold during 1914 amounted to 36,869,118, an increase of approximately 7 per cent. over the figures for the preceding year. Mr. George Richardson has resigned his seat on the board on account of ill-health. Mr. E. Garcke offers himself for re-election.

Traffic Statistics.

1913		1914
[illegible]	[illegible]	56,250
91,426,011	[illegible]	93,32[illegible],170
12,2[illegible]	[illegible]	11,179,[illegible]92
[illegible]	[illegible]	9,771
1,20[illegible]	[illegible]	1,20[illegible]
[illegible]42	[illegible]	312

Annual meeting: March 2[illegible]th.

London and Suburban Traction Co., Ltd.

The revenue for 1914, consisting almost entirely of dividends and interest upon investments in and loans to the subsidiary companies, amounted to £118,580, as compared with £105,371. After deducting all expenses chargeable to revenue, including interest upon debenture stocks and loans and making provision for the sinking fund charges upon the 5 per cent. debenture stock, there remains £83,627, making, with £8,597 brought forward, £92,224 available for dividends. Out of this there has already been paid the full dividend on the 5 per cent. cum. pref. shares and an interim dividend at the rate of 1 per cent. per annum on the ordinary shares for the half-year ended June 30th last, leaving £2,886 to carry forward. In July last the directors felt justified, in view of the improving results then shown by the subsidiary companies, in declaring an interim dividend at the rate of 1 per cent. per annum upon the ordinary shares for the half-year ended June 30th last, and they had at that time no reason to believe that this rate of dividend could not be maintained for the whole year. The war has had an adverse effect upon the tramway receipts, with the result that the revenue received by the company for the year as a whole does not admit of the payment of any further dividend on the ordinary shares. In March last £[illegible],000 5 per cent. "A" debenture stock, secured (*inter alia*) upon a like amount of unissued 4½ per cent. first mortgage debenture stock was created and sold. Additional shares in the Metropolitan Electric Tramways, Ltd., and the London United Tramways, Ltd., have been acquired in pursuance of the scheme of consolidation referred to in the last report, and the following capital of the company has been issued as fully paid:—£3,250 in 4½ per cent. first mort. deb. stock, £10,833 in 5 per cent. cum. pref. shares, £5,237 in ordinary shares.

Windsor Electrical Installation Co., Ltd.

The capital expenditure during 1914 amounted to £933, bringing the total up to £94,166. The profit (including £408 brought forward) was £6,451, from which the following sums are deducted:—Debenture and other interest £701, dividend on 5 per cent. preference shares £1,086, depreciation, renewal and reserve fund £2,000, directors' fees £350, leaving £2,314. Out of this a dividend of 4 per cent., less income tax, is recommended on the ordinary shares, and £468 is to be carried forward. The absence of the Court from Windsor, and the precautionary measures taken by the Home Office in restricting the lighting in the area, have adversely affected the revenue. During the year [illegible] lamps were connected, equivalent to 3,877 of 8-c.p., making the total 56,603 lamps. The board regret the death of their colleague, Mr. Edward Riley, but they do not propose to fill the vacancy.

Slough and Datchet Electric Supply Co., Ltd.

The capital expenditure during 1914 was £2,727, bringing the total up to £67,073. The new expenditure chiefly represents the provision of a new feeder cable from the works to Slough, to meet the growing demand for electricity. The equivalent of 1,227 additional lamps of 8-c.p. have been connected.

Year	Lamps and motors connected.	Units sold	Revenue.
1912	25,914	819,733	£8,546
1913	27,630	842,389	£8,900
1914	28,857	831,803	£8,956

The revenue would have shown a considerable increase but for the war regulations put into force by the Government restricting the lighting over the whole area. The total net profit available for distribution is £4,830. £1,350 is to be allocated to depreciation and reserve, bringing it up to £8,620, and a dividend of 5 per cent. per annum, less income tax, is recommended, £427 being carried forward.

Altrincham Electric Supply, Ltd.—Mr. C. J. Ford, presiding at the annual meeting, held on 9th inst., said that they had spent £981 on new transformers, and that expenditure had had the effect of largely reducing the quantity of current unaccounted for, which was now 18 per cent. of the total generated, against 47 per cent. in 1910. When the remainder of the old transformers were renewed, there would be a still larger saving. A satisfactory increase in the demand for power might be expected in the near future; but for the insufficiency of labour preventing night work, the demand from such of the factories would have been larger. Lighting loads were affected by householders' economies. Last year they spent £5,300 on capital account, and this year they would have to spend £7,000, mainly for new generating plant. The sole reason for their applying for a new prov. order was to enable them to remodel the capital of the company, as that could not be achieved by any other means. The report was adopted.

Minehead Electric Supply Co., Ltd.—The directors report that in spite of the fact that the season in Minehead was very adversely affected by the war, a further expansion of business occurred during 1914, the total units sold amounting to 224,626, as compared with 212,969 for the previous year. Certain economies in working have been effected—the works costs now standing at the low figure of ·79d. per unit sold—an exceptionally low cost for a station of this size. During the year the plant has been well maintained and a number of new consumers have been connected. The profit on trading, after payment of interest on debentures, &c., amounts to £1,967, plus £21 brought forward, less income-tax £63 and a year's dividend on the preference shares £450, leaving £1,475. A dividend of 8¾ per cent. per annum on the ordinary shares (less tax) requires £216; bonuses to managing director and manager and secretary £115; there is to be put to depreciation and reserve fund (making same into £4,000) £1,000; leaving to carry forward £145. The directors record the death of Mr. E. Culverwell, a director.

Carmarthen Electric Supply Co., Ltd.—Mr. W. A. Schultz presided at the annual meeting held recently. The report submitted showed a profit of £1,293, after providing for all working charges. A dividend of 5 per cent. for the year on the ordinary shares was recommended. The consumers numbered 444, as compared with 374 in 1913, and they were still increasing. The chairman said that the company was in a thoroughly satisfactory position, and though they would be justified in raising the price of electricity, they would not do so unless they were compelled. Mr. Blagdon Richards, who seconded, complimented the manager (Mr. H. H. Arthur), and said that if perchance they lost the public lighting, they would still be able to pay the same dividends as in the past. Sixteen new consumers had been secured since the beginning of the year. They had come to the end of necessary capital expenditure.

Barton Electric Light Supply Co., Ltd.—The annual meeting was held recently, and Mr. F. Hopper, the chairman, referred to the satisfactory profit of the year. The number of consumers had increased by over 60 per cent., and there was every prospect of a continuance of such increase. There was an unabated demand for light and power, and with the attention to detail which the directors were giving, there was an excellent prospect that given ordinary conditions the accounts would show better and better each year in the future. Mr. L. Collison, in seconding, pointed out that the capital of the company compared most favourably with that of other companies in similar places. He felt sure that the shareholders would very soon look upon their holdings as a safe, remunerative and appreciating investment.

Liverpool District Lighting Co., Ltd.—During 1914 there was satisfactory progress, 5,733 lamps having been connected. 535,526 units were sold, compared with 504,247 for 1913. The new steam engine and dynamo, in use since May last, have materially assisted in producing the extra profits. The directors do not anticipate any serious expenditure on capital account this year. After paying 4 per cent. for the year, £728 is to be carried forward.

Arbroath Electric Light and Power Co., Ltd.—The annual report shows a profit for the year amounting to £1,499. The balance in hand amounts to £1,037, which is to be carried forward to next year. The number of consumers is steadily increasing

Urban Electric Supply Co., Ltd.

The gross profits for 1914 amount to £68,962, as compared with £64,895 a year ago, and after deducting the expenses shown in the profit and loss account, a balance of £65,666 is carried down to net profit and loss account. In the latter account the amounts required for interest and debenture stock redemption absorb £43,283, leaving an available balance, including £1,021 brought forward, of £23,404, which the directors recommend should be applied as follows:—To dividend of 5 per cent. for the year on the preference shares £12,500, to reserve for depreciation £10,904. The following table shows profits and the equivalent in 33 watt lamps connected at 31st December of each year:—

	Lamps.			Profits.		
	1912.	1913.	1914.	1912.	1913.	1914.
Hawick	70,251	76,964	82,665	£4,788	£4,952	£5,503
Stamford	34,515	40,261	44,985	1,529	2,004	2,351
Weybridge and Walton	71,862	78,725	86,545	5,963	5,881	6,281
Godalming	35,518	37,759	40,268	3,416	3,443	3,040
Twickenham and district ..	129,466	146,462	167,492	11,012	12,129	12,128
Dartmouth	25,274	26,539	27,393	2,410	2,171	1,821
Camborne and Redruth ("A") and Cornwall ("B")	146,954	179,038	199,877	"A" 7,584 "B" 6,286	"A" 7,882 "B" 11,775	"A" 7,477 "B" 17,325
Newton Abbot	22,761	24,950	28,647	2,003	2,252	2,549
Grantham	40,586	42,902	46,235	3,132	3,182	5,636
Glossop	33,125	35,422	36,390	2,898	2,651	3,018
Berwick	23,831	24,958	26,721	1,615	1,728	1,548
Caterham	18,426	19,916	21,079	1,927	2,074	1,925
Newbury	24,926	26,423	28,224	2,873	2,746	3,505
Totals	677,495	760,319	836,519	£57,436	£64,871	£74,107

For the previous year the available balance was £23,021, out of which £12,000 was put to reserve for depreciation, 4 per cent. on the preference shares absorbed £10,000, and £1,021 was carried forward. The balance of the 5 per cent. dividend was then satisfied by funded dividend certificates.

Annual meeting: March 31st.

W. T. Henley's Telegraph Works, Ltd.

Mr. Sydney Gedge presided on Friday at the annual meeting held at the offices, 13 and 14, Blomfield Street, E.C. He first referred to the death of Mr. F. Newton, at the age of 80, who up till last year had been a director of the company since its commencement. The directors had made their annual visit to the works at Greenwich and Gravesend, and every visit only showed what great improvements were being made. By extensions and rearrangement their Greenwich works were becoming as convenient as the area of the site would allow. At Gravesend they had a fine area and were gradually using up that area by erecting works for the carrying on of the growing business of the company. They had to a certain extent suffered a loss of business by the war in two ways. First, many of those who supported golf and bought the company's balls were fighting at the front, with the result that the orders for golf balls had almost entirely ceased. They had, however, been able to employ the women engaged on their manufacture on other things in the works. Otherwise it might be said that the effect of the war on their trade had not been very great. No doubt they had lost some orders, but, on the whole, the orders they obtained from the Government on account of the war perhaps rather more than compensated them for other losses. Of course, these orders caused great anxiety, but he hoped it would never be said that Henley's works turned out anything which was not as perfectly made as it was possible to make it. When they came to manufacture that was a different thing. Manufacture had become more difficult and expensive. They had had higher prices and increased wages, and also what, perhaps, ought to be mentioned first, the loss of men going to the Army. They regretted this and rejoiced at it. They rejoiced that out of their staff 333 men had gone to the front and they had only heard of three deaths so far. They had suffered in respect of these men going, but it had not prevented them going on with certain necessary extensions, although owing to the high prices they were following the old motto and making haste by going slowly. While they were endeavouring to keep pace with their actual wants, they were not doing more than was really necessary at the present time whilst the high prices remained. As to the accounts, there was an increase in every important item. The trade profits were £6,000 or £7,000, which was a few thousand more than the year before. The other day he took out the figures for the last ten years and divided them in three-year periods, and found that in each succeeding three years there had been a steady increase. In each year they had been able to pay the same or greater dividends and put an increasing sum to reserve, with the result that they had a reserve account of no less than £215,000, whilst to that they were adding £20,000 this year, making a reserve account of £235,000, which on an ordinary capital of £200,000 might be considered to be most satisfactory. With regard to their investments in consols and other trustee securities, last year they reserved £15,603 against that sum, and thus these investments, which cost them £97,097, stood at £81,493. They did not think it necessary to reserve anything more this year against these securities. With regard to the profit and loss account, they had put by for depreciation of machinery £16,700, which was rather more than last year, and they were able to carry to the general account £90,125, which was about £400 or £500 less than last year, and they were able to pay a dividend of 15 per cent. and a bonus of 5 per cent. Some of them would regret that they were not declaring the dividend free of income tax, but they thought it better to make the change now than wait until the tax was increased, as it was bound to be. The Chairman next referred to the provision made for the dependents of the men who had joined the colours. At present it was costing them £3,000 a year, but it might be heavier, and they had set aside a special reserve of £10,000. When the war was over if it was not used it could then be dealt with. He was assured by the managers of the works that during the year the work had been done well, quietly and contentedly. They had been going into the question of the rise in the cost of living, and had made an arrangement with which he believed the workmen would be satisfied. They had also been considering the establishment of a pension scheme, but that had been postponed in consequence of the war. In conclusion, the Chairman dealt at length with the war and gave his reasons for believing that it would last at least another year.

Mr. G. Sutton (Managing Director), in seconding the motion, said that 1913 was the best trading year in the company's history, and at the last meeting he told them that they went forward with the promise that in 1914 the results would exceed the year 1913. They had reason for thinking so, for they had several large contracts on their books at that time, the market prices for raw materials were steady, and the trade of the country generally was good. They had made a reputation for golf balls which had resulted in a considerable industry outside electric cables. When it came to the war all these things were upset. The large contracts were partially closed down; they had to go slowly at the request of their customers; market prices were anyhow; and it became a difficulty to get materials at all. The golf ball trade collapsed, although they made a good profit on their spring trade. But, notwithstanding all this, the profits of the company were greater than in the previous year and, what was perhaps even more satisfactory, the turnover of the company had been larger in 1914 than it had ever been before. But neither the turnover nor the profits had been increased by war material. They supplied large quantities of goods for the Admiralty and the War Department, and orders had been more numerous during the five months ending December than was usual, but the ordinary work which had been displaced was greater than the amount of work they had done for the Government. He wanted to make it quite clear that they were not making large profits out of war materials and that the incidence of the war had put back their profit. What 1915 was going to be he could not say. They were busy with war material, but the work done for the War Department necessitated new machinery. The War Department had bought practically nothing from them since the Boer war, and now to supply the department they had to install new machinery. At the end of the war that machinery could only be partially employed, and the cost of it would go to swell the depreciation they would have to write off. So far as the Admiralty was concerned that did not apply, for they had always done work for them; but there again it had to be remembered that by the extraordinary pressure being put on them to turn out work quickly, the future, to a certain extent, was being mortgaged. The shareholders might ask why they did not charge prices which would cover the eventuality of scrapping the machinery. Rightly or wrongly, that was not the view the management took of their responsibility with regard to supplying the Government. They took the risk of how much use the machinery was going to be put to. The war might last six months or six years, and if it lasted for six years the machinery would be employed during the period and written off by depreciation. Therefore, the loss on depreciation would be greater according to the shortness of the war. He might tell them that at the outbreak of the war they wrote to the Admiralty and placed at their disposal the works of the company. They placed the works at their disposal for anything they might require, and said that with regard to payment they were prepared to leave the percentage of profit entirely to the Government Department. They, therefore, could not be put amongst those contractors who were said to be making a large sum of money from the country. With regard to the £10,000 special reserve which the Chairman had referred to, he could see that the cost to the company would be more than £10,000, for the bonus which had been given to the workpeople in consequence of the rise in the cost of food would cost them £8,000 or £9,000 a year. Their ordinary foreign business had grown owing to the war, and they were doing a great deal of work which used to be done in Germany. Although they were doing this work, the Government would not allow them to transport the work to its destination so freely as he thought they ought to. They had no difficulty in regard to some countries, but in the case of Holland they had great difficulty. They had shipments for Holland which had been waiting for two months, and unless by next week they got permission to send them, they would have to stop doing trade with Holland, because it was not policy to manufacture special lines of goods and keep them in stock. He was not complaining of the action of the Government, for perhaps they knew better than he did, but he did know that none of their goods were going to an enemy country. They had spent a large sum of money in the exten-

[illegible] of their works, and the shareholders were getting it back in the way of increased profits. They had now double the number of buildings that they had originally at Gravesend. They were now spending £5,000 in building a large dining-hall for their workpeople there, and it would show no return except that return, which they could not estimate, from the comfort to their workpeople. They were making a large extension of the tyre factory. That branch was only started commercially in October, 1913, and within six months they decided to extend the buildings, which increased the output 200 per cent. Certainly their tyre business had been very successful. The good fortune which had followed the company in electrical work was following it in this department of motor tyre construction. They had now passed plans for a further extension of the tyre factory which would enable them to make solid tyres for commercial vehicles. So far as they could judge from the two or three months which had elapsed, the current year ought to be a good one. They had on hand several of the large contracts he had spoken of, and with good progress with the war they hoped they would be allowed to proceed at a normal rate with those contracts, and they would help to swell the profits for 1915. The actual business which was being carried from 1914 to 1915 was larger than he had ever known it. If they were to execute the orders on the books and did not take another order this year they could pay the shareholders a dividend at the end of the year. He did not think they could have anything more satisfactory than that as regarded the state of the business.

The resolution was passed without discussion.

Mr. Drysdale proposed a vote of thanks to the board and the staff, and remarked that Mr. Sutton always modestly refrained from using the personal pronoun "I." It was always a case of "we" with him, and he (the speaker) did not think he took enough credit to himself.

Major Monsell seconded the motion and it was carried.

British Electric Transformer Co., Ltd.

Mr. A. F. Berry took the chair at Salisbury House, E.C., on Friday at the annual meeting. Before commencing the ordinary business, the Chairman alluded feelingly to the loss sustained by the company by the death of Mr. J. F. Albright, the late chairman, and the shareholders signified their concurrence in a vote of condolence with the family by standing in silence. In moving the adoption of the report the Chairman said sundry creditors were increased by £2,900, but in view of the stock they had this was not a large figure. They had followed their usual practice of paying up promptly and obtaining all the cash discounts possible, but in order to do this they had had to borrow £6,000 from the bank. Depreciation reserve had been increased by £1,500, and they were suggesting the transference of a further £1,500 this year, which would bring up the total to £10,800. They also recommended adding another £5,000 to the reserve, bringing the total up to £31,823. They would probably remember that this reserve was intended in the first instance as a reserve against their investments, some of which had considerably depreciated in value. During the year one of the companies in which they held an interest went into liquidation, and they had written the asset out of the books and deducted it from the reserve account. With regard to the credit side of the balance sheet, they had allowed certain Continental patents to lapse. Their useful purpose had been served, and owing to the war they felt it was the right thing to do. The difference between the cost of these patents and the cost of new patents taken out had been deducted from the figure at which patents and goodwill stood, and left that item at £64,579 as against £65,054 last year. The investments stood at £2,655 and were now practically of that value, so that the whole of their reserve account of £31,831 could if necessary be set against this item of patents and goodwill. The addition of £1,018 to freehold land, plant, etc., was principally due to the plant and machinery purchased for the equipment of the last bay erected at Hayes, and had been necessary to cope with the additional business they had been doing. Stock and materials showed an increase of £23,000 and stood at £63,553. The increase was nearly all due to the railway and other contracts held up by reason of the outbreak of war, and since the end of the year the figure had been much reduced. Sundry debtors were about £9,000 more than last year and were all considered good. Up to that morning £23,000 had been received of the £45,638 standing in the accounts. The payment of the ordinary dividend was very carefully considered by the board, and, having regard to all the circumstances, they recommended a dividend of 7½ per cent. It was with regret that they departed from the 10 per cent. they had paid for the last three years, but in view of the dislocation of trade and the fact that they thought it prudent to carry forward £3,477, he thought shareholders would agree that 7½ per cent. was a good dividend. The Chairman explained at considerable length the reasons for the decrease of profit. In the first place the business felt the shock that civilisation as a whole felt at the outbreak of war. Then although the suppliers of material had done their best to assist them, yet the congestion of work which had occurred had affected the economical working of the factory. Then 50 per cent. of their men between 18 and 38 had joined the forces, and this made it extremely hard for those left to carry on the work. It was imperative that the works at Hayes should be kept going, for their machines were being largely used in the execution of Government contracts. They had trained and were training men to take the places of those who had left them, but, of course, it meant loss which could not be avoided. He had no doubt that the cost of educating these new men would come back to them in future years, but during 1914 it meant a reduction in output, and the profit was quite seriously affected. They had also had to set other work aside for Government work, and this was not conducive to economical manufacture. In August, September and October the works were badly upset by these and other causes, but in the last two months of the years things became more normal, although they were not now normal. Although there was a considerable difference this year, he was of opinion that the bulk of the difference in profit between last year and the previous year's working would be made up in the present and future years. As to the future, in the first place it might be assumed that immediately after the war the engineering section would be the busiest in the world. There would be repairs to the damaged districts and also the shifting of the centres of industry due to changes of the map. They would find that greatly increased activity prevailed in England after the war of 1870, and he thought it would take more than five years to repair the damage which was now being done. In this connection they had particularly to remember that electrical energy was superseding all other forms in domestic and industrial life. There was a natural tendency for factories to put in more and more electrical machinery; and, then, the trade which should be taken from German hands, not only in this country, but in the Colonies and abroad, ought to put a bigger strain on the producing people of this island. All these things seemed to indicate that they would find their productive powers taxed very heavily for many years to come in spite of the fact that dear money at the end of the war would possibly curtail the spending powers of certain countries with whom they did a good deal of trade. As to the situation at present, they had more unexecuted orders on hand than ever before. During January and February, and up to date in March, the orders they had received exceeded those for the corresponding period of last year by something over 50 per cent. The new men were rapidly gaining somewhat of the efficiency of the men they had lost, and they might reasonably look forward next year to a resumption of results more akin to those of the previous year than the last. They hoped one result of the war would be to increase the number of orders they received from the Colonies; already that was the case, although this was a business which, for financial reasons, one had to proceed with cautiously. In spite of the war their Tricity cooker business for 1914 compared favourably with 1913, and some 30 equipments had been ordered from them for warships. Electricity House also, in which they had an interest, was doing more business this year than last.

Mr. T. Rowe seconded the motion and the report was adopted.

Brush Electrical Engineering Co., Ltd.

The directors in their report for the year ended 31st December, 1914, state that effect has been given in the balance sheet to the reduction of capital. The conversion of the preference and ordinary shares forming the issued share capital of the company into ordinary stock has also been carried out. Notwithstanding the abnormal conditions prevailing during the second half of the year, the improvement in the company's position has been well maintained. A temporary effect of the outbreak of war was to cause a diminution in the volume of business, but the position in this respect has gradually improved, and the orders secured since the beginning of this year are above the average. The profit and loss account shows that after providing for general charges, maintenance of plant and buildings, and interest on the company's debenture stocks, there remains a balance of £19,110. The directors recommend that £10,000 be placed to a reserve account for depreciation, that £2,044 be applied in payment of the further 4 per cent. to which the holders of the company's 6 per cent. prior lien participating second debenture stock are entitled out of the first net profits available for dividend in any year; and that £7,065 be carried forward. Continued experience with the Ljungstrom steam turbine has fully confirmed the merits of this invention, and has proved its reliability under service conditions. The directors are of opinion that the present and prospective demand for this type of turbine justifies the capital expenditure necessary for its more economical production on a larger scale, and machine tools of modern and improved designs are on order for this purpose. The company is engaged on important contracts for the Admiralty and War Office Departments of H.M. Government, including the manufacture of aeroplanes. To meet the outlay necessary for these various developments, and also to improve the company's manufacturing equipment in other departments, the directors propose (subject to the consent of the Treasury) to issue, when required, the balance of the 6 per cent. prior lien participating second debenture stock. On the outbreak of the war Mr. G. F. M. Cornwallis-West was recalled to the colours and he has since retired from the board.

Annual meeting: March 29th.

Windermere and District Electric Supply Co., Ltd.

In their report for 1914, after expressing regret at the death of Mr. W. Long, a director, the board say that the gross revenue shows some expansion. This would have been distinctly greater but for the effect of the war, which seriously lessened the consumption, especially during August and September.

The cable to Grasmere was completed in the spring of last year and a fair number of new consumers has been secured in that district. During the year 59 new consumers have been connected to the mains, constituting a record, and in addition numerous extensions have been made to other installations, including supplies for heating, cooking and power purposes. The sales of current show an increase of £165, and the total increase in gross revenue is £255.

It is very unfortunate that the Diesel oil plant was not completed in contract time and is still not in service owing to defects which would in all probability have been remedied months ago but for the impossibility of the contractors obtaining the necessary material, the makers of which are fully engaged on Government orders. This delay is the more regrettable as it has entailed a very large increase in the cost of fuel for the year.

A payment of 5 per cent. on account of arrears of interest has been received on the Keswick Electric Light Co.'s debentures and the net revenue account has been credited with £441 accordingly.

£3,200 of 5 per cent. debenture stock has been issued, being the balance of £20,000 authorised. The amount spent on capital account for new mains, transformers and meters has been £2,086.

The expenditure on revenue account for the year was £2,561, an increase of £361. The balance of revenue account is £1,613, plus £441 interest on Keswick debentures, and £3 brought forward. Out of this have been paid debenture interest, bankers' charges, etc., £955, interim dividend of 1 per cent. on preference shares £250, written off free wiring installations £75, transferred to depreciation reserve account £400, leaving £377. The directors recommend a further dividend of 1 per cent. (making 2 per cent. for the year) on the preference shares, leaving £127 to be carried forward.

Newcastle-on-Tyne Electric Supply Co., Ltd.

The annual meeting was held in Newcastle on 16th inst. Mr. J. H. Armstrong (vice-chairman), who presided, expressed regret that Dr. J. T. Merz, the chairman of the company, who since the beginning of February had been seriously ill, was unable to be present. Dr. Merz was still confined to his room, but was better. The h.p. connections to the system at the end of the year amounted to 231,425, an increase of 27,755, as compared with an increase of 29,341 h.p. in the previous year. The profits amounted to £184,969, a sum considerably more than in the preceding year, but these profits included the dividend on practically the whole of the shares in the Durham Co., which now belonged to the Newcastle Co. The interest charged on debenture stocks, loans, etc., amounted to £52,563, as against £42,632 in the previous year, but in the former figure there was the full interest charged on the recent issue of second debentures, which were created in October, 1913. The dividends were naturally larger than in the previous year, because the amount included the shares that had been given to the shareholders in the Durham Co. under the fusion scheme, by which the Newcastle Co. acquired their rights. The transfer to depreciation account had been increased by £5,000, and the reserve fund had been increased from £10,000 to £17,000; £7,000 of the latter was a provision against possible losses on investments. During the past year they had spent £74,500 out of revenue upon the upkeep of plant, which included the cost of laying new services and mains, which many companies charged to capital account. They had kept the plant in thorough-going order, and this was illustrated by the fact that during the last six months a load had been thrown upon it at a moment's notice, which he felt sure it would never have carried had not the plant been in the highest state of efficiency. The total expenditure for the year had been £129,590, the greater part of which sum had been spent on the Dunston and Carville Stations, and £51,000 had been spent on the laying of mains. The increase of £6,000 in management expenses was brought about by two main items. The first was the expenses in connection with the acquisition of the Durham shares and the sub-division of the Newcastle Company's shares to £1 shares, which amounted to £3,300, and the second item was the replacing of thirteen motor cars. These were not in a way management expenses, but their difficulty was that they had not a heading under which to place these items. Generally, the results of the revenue account were satisfactory, especially when they bore in mind that for five months of the year they had been working under what might be called the influences of war, and under most abnormal conditions. At the same time the profits had not come up to the expectations of the directors, purely because of the effects of the war. Fortunately the Northumberland area of the company did not suffer so much as the Durham area, as they had had certain counteracting influences in the shape of large demands made upon them by local companies who were manufacturing for the Government war and other materials. The collieries had been working short time, but there was an unusual demand for current in other directions. Last year the company's programme of increased output included a 16,000 h.p. turbo-generator, due for delivery before the end of the year, but in consequence of the war there was delay in delivery. When the Government made an order for plant, it meant an order, and it had the first claim on the whole of their output. As the shareholders knew, the company had a very extensive system, and had various sources of supply in different parts of their area, and by spending considerable sums on the rearrangement of their plant they had been able to successfully deal with all the demands made upon them. Their difficulties had been increased by 11 per cent. of their employés, all skilled, having joined the services. They had to remember that their business was a continuous one, running the twenty-four hours, and they had to take a load so great as they had done when short of skilled men. They would appreciate the demands that had been made upon their staff, and, he thought, the thanks of the directors and the shareholders were due to the officials and the employés for the hearty manner in which they had faced and overcome difficulties. The positions of the employés who had enlisted had been safeguarded, and allowances to the wives and dependents made up their wages to what they were at the time of enlistment. The cost to the company in this respect was about £200 a month. The company might congratulate itself upon having got over a very difficult time, and upon solving difficult problems. The new plant was running in January, and during the last five months the company had been of enormous benefit to the country. Had that company not been in existence the effect on the war would have been very serious. If the companies who were manufacturing for the Government had been dependent on their own private supplies, and if they had had to order plant to meet the requirements, they could not have got it for at least a year or more. As it was, the Newcastle Company was able to come and keep things going. He thought that the prospects for the coming year were satisfactory. In regard to the interim dividend he had a word to say. It might be that their works might be bombarded—they never could tell—and they might be stopped working altogether. He pointed out that when the directors paid an interim dividend on the ordinary shares they did so on their own responsibility. That was a risk that many directors in the country might decline to take. If the directors found it necessary not to pay an interim dividend this year it would not mean that the profits were not able to pay it, or that necessarily there would be a reduction in the dividend for the whole year, but it would be only for the self-protection of the directors, and the profits would be divided among the shareholders as soon as the accounts were made up at the end of the year.

Sir Lindsay Wood seconded the report, which was adopted. The dividends of 5 per cent. on the preference and 5½ per cent. on the ordinary shares were declared. The directors were authorised to expend £1,000 (of which £200 had already been spent) for various relief funds.

City of London Electric Lighting Co., Ltd.

Mr. J. B. Braithwaite presided on March 16th over the annual meeting, held at Salisbury House, E.C. He said that there was no alteration in the capital account, nor, indeed, had there been for many years. He pointed out last year that they had provided £766,000 out of revenue for capital purposes, and this year that amount had been raised to £816,862. Assuming that they had had to raise that capital at 5 per cent., it would have involved them in an extra charge for interest of £41,000, which they had been saved by the liberal allocations of £50,000 a year which they had made for the last ten years to depreciation. The capital expenditure for the year was rather heavier than for the last two or three years—£61,938 as against £49,436 for 1913, and £45,508 in 1912. The increase last year was due to the final payments for the most up-to-date turbine plant which they had recently installed in their power-house at Bankside. That installation had given them improved economy in their generating expenses. The expenditure on mains in the case of their company was not a heavy annual item. They had only one square mile to serve, and when they laid down the mains originally they allowed for a considerable increase of business, and therefore they were relieved of what to most electric lighting companies was one of the heaviest expenses. With regard to the revenue, they had had a great disappointment, for owing to the war, for the first time since 1910 the net revenue showed a shrinkage. At the end of June they had an increase in revenue of £2,300, but they finished the year £8,229 to the bad, so that the war had cost them £10,500 in reduced revenue. That was not to be wondered at because, before the war actually broke out, the Stock Exchange was closed, and the whole of the members, some thousands in number, carried on business within the company's area. Therefore the entire closing of the Exchange for five months in itself had led to a considerable reduction in the demand for lighting. The general stagnation of business in the city had also helped to reduce their revenue, so that on the whole, when they considered what the amount of their total revenue was, they might consider themselves fortunate to have escaped with an actual decrease of £10,500 gross. The decreased revenue had been accentuated to some extent, because they had had an increase of [illegible] in the working expenses, so that altogether, as compared with the previous year, they were £10,126 to the bad on the balance. The result was that they had had to go back one per cent. in the dividend, which accounted for £7,000, and the balance they had taken from the addition which they made last year to carry forward, leaving that figure at £23,400. As they knew, he regarded £20,000 as their proper carry forward, and anything above that was equal to a dividend equalisation account. Therefore they still had a margin of £3,400 available for any further reduction in profits that might occur this year. Their great difficulty at the present time was the dislocation which the war had caused in the coal traffic. The Government had commandeered a great many of the vessels previously employed in conveying coal to London, and they had also taken over many of the railway wagons, with the result that coal had gone up very much in price. They were living from "hand to mouth," as it were, in regard to their coal supply at the present time, and they did not quite know what the effect would be during the current year. They proposed to invite their customers to share with them the burden which the difficulty of obtaining coal and its enhanced cost were throwing upon the company. Those who had been using electric power had hitherto got off scot free whenever there had been coal difficulties or anything of that kind, and the shareholders had borne the whole of the burden. They felt, however, that the time had now come when they must ask their consumers to share part of the burden, and he did not believe that their customers would object for the time being to take their part. With regard to the heating output, that was steadily increasing, and now exceeded two million units, or an increase of 20 per cent. over 1913, so that it looked as if the advantages of electric heating were gradually being more and more appreciated. They had 5,403 KW. at the end of 1914 connected for heating purposes, an increase of 533 KW., being the largest increase they had ever had in any one year. The net increase in connections for all purposes during 1914 amounted to 1,829 KW., which he thought was as much as they could reasonably expect in view of the five months of the war period which the accounts covered. They would be glad to know that 87 of their permanent staff and workmen had joined the naval or military forces, and they were making suitable allowances to all such or their dependents, and keeping their places open as far as was possible. The Marquis of Winchester, one of their directors, was also away on active service. The absence of so many workers at the front had necessarily thrown a large amount of extra work upon those who had remained behind, and they could congratulate themselves on having a staff that was thoroughly loyal and willing to help its country wherever its help was most needed. They had thought it right to carry to a suspense account the special expenses incurred in connection with the war, and this year they had carried £1,318 to such account. He told them last year that they had come to an arrangement with the City Corporation as regarded public lighting, and had commenced the installation. Had it not been for the war, by this time they would have had the gratification of seeing those parts of the city which they had undertaken to light, the best lit thoroughfares of any great capital in Europe. Owing to the restrictions put upon the public lighting, the benefit of what they had done had not yet become apparent, but it would be seen when the war was over and normal lighting was resumed in the streets. He might say that February 18th last was the last day on which the Corporation could exercise their power of purchase. They had, however, allowed that unique opportunity to slip by, and had not given the necessary notice; therefore the shareholders might take it that the company would remain theirs for the rest of the term. Having referred at some length to the abortive attempts to introduce legislation for the unification of London's electric supply, Mr. Braithwaite concluded his remarks by saying that the directors would continue to do their best for the company during the current year, and he hoped that when he met the shareholders next year he might have a relatively good report to present.

Mr. F. W. Reynolds seconded the motion.

Mr. Deputy Millar Wilkinson, C.C., congratulated the directors upon the report, and said he was glad to think that the Corporation had not exercised their powers of purchase. It was quite possible that the Corporation was so imbued with the excellent management of the company that they felt that they could not possibly do any better for the citizens, and therefore they had left the company alone. With regard to legislation, he was very glad that the L.C.C. had dropped its Bill.

The Chairman remarked that he, too, was glad that the L.C.C. Bill had been dropped, and although there was nothing to prevent them bringing forward a similar measure in the future, he rather fancied that the Council would be very chary of taking up the question again.

The report was adopted.

Direct Spanish Telegraph Co., Ltd.

Sir John Denison-Pender, K.C.M.G., presided on March 18th at the annual meeting, held at Electra House, E.C. He said that the traffic receipts showed an increase of £18,000. The ordinary working expenses had increased by £3,119—to £19,832. Salaries in London had increased by £439, which was chiefly accounted for by an improvement in the position of their head office staff granted by the board, and which therefore became more or less a permanent charge. A small portion of the increase was due to overtime necessitated by the absence of some of the staff in the army, and extra work at the head office owing to the increase of traffic over the whole system. Salaries at stations showed an increase of £2,258, due to several causes, the principal cause being a revision of the salary schemes at the stations. The increased work caused by the pressure of traffic had of course also contributed to that increased expenditure. They had contributed £439 to War funds, they having joined with the associated companies in sending donations to the Red Cross and other leading funds. The Bilbao cable broke down on September 23rd last three knots from the landing place in Cornwall, connection being restored on September 27th. They were most fortunate in getting the services of the cable steamer *Electra* without any delay, and in having fine weather, with the result that the interruption only lasted five days. The cost of repairs was only £327, which had been charged against revenue. That was the only break they had had during 1914, and he thought perhaps it was the smartest repair and the cheapest that the company had ever had in the course of its existence. The £30,000 4½ per cent first mortgage debentures of the company matured and were paid off on June 30 last. Instead of realising securities from the reserve fund, which would have caused a considerable loss on their purchase value, the directors arranged with the Eastern Telegraph Co. to find the balance required to pay the debentures, they being given the opportunity of paying off any part of the advance as the money came in. That was a considerable advantage, and the sum of £10,000 outstanding at 31st December had since that date been further reduced, and now stood at only £2,000. With regard to the increased profit, as they knew, there were three direct routes to Spain—the British and French land lines *via* the Channel and Bordeaux; the Eastern Cables *via* Vigo; and the direct Spanish route *via* Bilbao. When the war broke out naturally the British and French lines became fully occupied by Government traffic, and that pressure was augmented during the short period the French Government removed from Paris to Bordeaux. The result was that a very large proportion of the land line traffic to and from Spain was transferred to the Direct Spanish and the Eastern Cables. Also the Direct Spanish Co. benefited materially by having a good route, though naturally at a higher price, to the South of France *via* the Bilbao cable land line across Spain, and the Bilbao-Marseilles cable to Marseilles, and the public took advantage of that route when the English and the French land line routes were congested. He could not, therefore, say whether the total volume of traffic with Spain had increased since the war started, or whether the increase was due to the pressure of Government traffic on lines which in times past carried their full share of work, and which were keen competitors for Spanish traffic. The result of the year was that, after providing for interest to the 30th June, 1914, on the debentures, and the amount required to complete their redemption, providing for the depreciation on their securities as at the present date, and placing £5,000 to reserve, the directors recommended payment of a dividend at the rate of 10 per cent. on the preference shares, and the usual dividend at the rate of 4 per cent. on the ordinary shares. In addition, they considered they were justified in recommending a bonus of 2s. per cent. on the ordinary shares, without weakening the financial position of the company, which it was their first duty to maintain.

Sir Albert J. Leppoc Cappel seconded the motion, which was carried.

British L. M. Ericsson Manufacturing Co., Ltd.

The annual meeting was held on March 17th at the Memorial Hall, Farringdon Street, E.C. Mr. W. M. Crowe, who presided, said that the net profits amounted to £20,614, as against £23,808 in 1913, and £18,562 in 1912. It would be seen, therefore, that although the profits were somewhat smaller than in 1913 they were somewhat larger than in 1912. They might congratulate themselves on being able to show such a good result in face of the exceptional circumstances of last year and the difficulties of the latter part of the period. Those difficulties included, amongst other things, the supply of raw material, which was a very serious difficulty to a company such as theirs. That was brought about by the enormous demands by the Government for materials for war purposes, and the fact that suppliers gave preference to Government orders before theirs were considered, although they were working on Government contracts. Labour became scarce in consequence of the large number of men who left the factory to join the army, and they had great difficulty in replacing those men who were, for all practical purposes, specialists in their particular line of work. In the end they had to apply to the Government for protection against the recruiting officer, otherwise they could not possibly have kept anything like delivery time. Towards the end of January they received letters both from the War Office and the Post Office giving them the required protection, and pointing out to the men that they were serving the country in the factory as well as if they had been in the field, since they were helping with Government contracts in a time of emergency. Those letters helped them somewhat, but still the men continued to go, and they could not but admire their enthusiasm, even although they suffered from it. Wages went up as a natural consequence of the labour demand being more than the supply, and that, along with the increased price of materials, helped to reduce the profits, particularly on orders taken before the commencement of the war and before labour troubles began. Taking everything into consideration, he thought they might congratulate themselves upon such good results. He was glad to say that the factory was now full of work, and they could have secured orders for possibly double the amount if only they had had the capacity to deal with them. At the present time they were increasing the capacity of the works by putting in new plant and machinery. They were not providing specially for "passing" work brought about by the present state of affairs in the country, although the Government might come and tell them that they would have to use the plant for those purposes. They were providing for work which they trusted would remain in the country after the war had ceased and peace had been signed. That prospect of retaining in the country industries, which in the past had been in the hands of what were now enemy countries, depended very largely on what action the Government might take in order to protect home industries. He thought the Government was beginning to see the necessity for this, and that they might have legislation on the point before very long—in any case, let them hope so. They at the present time were entering upon a new field of manufacture, which would require that protection if the particular article in question was to remain in this country as an industry—he meant the making of magnetos for motor-cars and motor-cycles, also for motor accessories. In the past those things had been almost altogether made in Germany, and doubtless the Germans would, at the end of the war, do all that was possible to recover the trade, and they might be able to do it if the Government did not come to the support and protection of such companies as theirs, and many others throughout the country which had spent, and were spending, large sums of money in promoting new home industries. The business was an enormous one, as was shown by the immense factories in Germany, employing thousands of hands, engaged altogether in that class of work. The time was opportune for them to enter into the business, and their factory was well suited to the purpose, and he hoped that by this time next year good results would be shown. The magneto on which they had pinned their faith was named the "B.E.C."—the initials of the company, and was the invention of Mr. W. C. Burling, the manager of the Ericsson Manufacturing Co., of Buffalo, U.S.A., which company was closely allied to theirs. Already they had orders for some thousands of them. With regard to the new Act just passed and Lord Kitchener's message to the manufacturers he could only say that their factory was already fully engaged on Government work; and, therefore, they would probably be undisturbed. But if it should happen that they were required to put their full forces on the output of war material, then the Government would not find them wanting. He thought, however, they were doing their full share, seeing that there was very little else going through the factory than Government work. With regard to the financial strength of the company, it was sounder than even last year. They had written off liberally for depreciation—close on £11,000 last year, and during the past seven years they had written off £80,000. They had also gone very carefully into the stocks of material to see that no article was priced above its actual value, or where any article had become obsolete it was either written off altogether or greatly written down. There was nothing in the books for goodwill, patents, or anything of that kind—there was not a penny piece of doubtful assets in the company. Out of the net profits they recommended that £6,000 be placed to reserve, as against £5,000 last year, and that £7,023 be carried forward, as compared with £6,405 a year ago. He might remind them that the carry forward was £1,000 more than enough to pay the preference dividend this year if no profits were made. The prospects, however, were that 1915 would be an excellent year if they were to judge by the amount of orders already in the factory. £25,000 was received from the Aktiebolaget Stockholms Handelsbank, which was the balance of £45,000 placed there on deposit. When the war broke out they were not at all sure what countries in Europe would be involved, and the directors therefore thought it wise to recall that deposit, and the balance of £25,000 was received on January 1st, and was used to purchase a corresponding amount of War Loan stock.

Mr. A. Rogers Jenkins seconded the motion, and the report was adopted.

Bath Electric Tramways, Ltd.

The annual meeting was held on March 18th at Winchester House, E.C. Sir James Sivewright, K.C.M.G., who presided, said there was nothing to be ashamed of in the report or in the result of the operations of the company during what Mr. Hamilton described as "an extraordinary year for tramways." Mr. Hamilton, of the Leeds tramways, was the expert whom they called in to advise upon their system of management, and he was credited with being one of the best authorities in Great Britain upon tramways. He had made out the report which the shareholders had already seen, and which the board thought it right to get in view of the criticisms which had been passed on their management by a certain section of the shareholders. The board called Mr. Hamilton in as a Balaam to curse them, but instead of doing so he blessed them in his report, and so satisfied was he with the management and the future prospects of the company that he was now a fairly large shareholder. He would have been at the meeting, but had had to go to Edinburgh in connection with a tramway inquiry. He had written them a letter, in which he said: "I think there cannot be the faintest shadow of real criticism about any of the accounts of the company during the past extraordinary year." They would see from the report that the traffic and other receipts showed a decrease of £1,019 for the 52 weeks of 1914, compared with the 53 weeks of the previous year. On the other hand, however, the expenses had only amounted to £16,132, as against £17,0[illegible], therefore, although the gross receipts were over £1,000 less, the net result was nothing nearly so bad. That was why he thought it was misleading for tramway companies to publish their weekly or monthly traffic receipts, as shareholders were apt to get unduly alarmed. Take their own case for the first two months of the present year. The total traffic receipts were only £5,025, as against £5,594 for the corresponding period of 1914, but looking to the net revenue they had made a profit this year of £1,113, against £1,266 during the corresponding period last year. Up to the outbreak of the war they were doing extremely well, and were far ahead in the revenue as compared with the same period in 1913, and if they had gone on at that rate, instead of being £1,000 behind, they would have shown quite that increase over 1913, which was a record year. He was glad to say that they had been able to be of service to the country by disposing of several of their motors to the Government. They lost nothing by the transaction, as the price they obtained for the vehicles was almost within a shilling of the price at which they stood in their books. They had also been able to do a good deal of work for the military on Salisbury Plain. That was not particularly profitable, but they were glad to render what service they could to the Government in this time of emergency. They had been put to considerable expense to dispose of the adverse criticisms of those who wished to get the management of the company into their own hands. Those gentlemen had ulterior motives which the board did not agree with, and they had been proved to be right. The savings which had been effected as a result of the recommendations of Mr. Hamilton had not been seen this year owing to the military work which the company had undertaken at practically no profit. The auditors drew attention to the fact that nothing had been written off for depreciation. He would, however, remind them that they had spent £25,000 on capital account, and they had intended floating more debentures to meet that charge, but the terms were so onerous that they could not bring them before the shareholders. They had carried that loan at the bank and had made provision this year for £2,000 out of revenue to reduce the loan; and they were carrying forward £5,234 to the next account, and they intended to use that amount in replacing their motors. With regard to the future, he was by no means despondent. As he had said, for the first two months of this year they were only £123 down as compared with last year, and he believed that if they had a fine spring and summer, although the war might still be raging, they had got a very fair future before them for the current year. Their foundry, which was very much criticised, was doing splendid work. It was said by some that they had made a bad bargain when they bought the foundry, but it was doing all their own work and other work as well, and was showing a very handsome return.

Mr. A. A. Campbell Swinton seconded the motion, which was adopted without discussion.

Brompton and Kensington Electricity Supply Co., Ltd.

The annual meeting was held at the offices of the company, 251, Earl's Court Road, S.W., on March 18th. Mr. H. R. Beeton, who presided, said that the development of the business during the past year showed a remarkable similarity to that of the year before, although the conditions under which they had worked had been very different. Again they had to complain of a decrease of profit, notwithstanding a satisfactory growth in their connections, and again the benefit of more efficient plant had been offset by a further heavy increase in rates and taxes. The effects of the war on their revenue during the second half of the year was to cause them to lose much of the gain which they had secured during the first half of the year—due, of course, to a general disposition to economise in the national emergency, and to the police restrictions on lighting, which he trusted might soon be relaxed. Although they connected fewer customers, and although their customers consumed less current per lamp installed than during the previous year, the growth of electric cooking in the area resulted in their securing a larger number of lamp connections, so that they actually sold, in spite of the war, 112,000 more units in 1914 than in 1913. As, however, a larger proportion of the units sold were for purposes other than lighting, the average price received per unit was less, and the revenue barely equalled that of 1913. The more efficient plant which they substituted in 1913, and which they were extending this year, enabled them to produce a larger output with a smaller coal consumption, so that although the cost of coal was slightly higher they were enabled to further reduce their works cost, which, he was pleased to say, was now the lowest in their history. The most noteworthy feature of the accounts was that the decrease in net profit of £1,229, as compared with the preceding year, was more than accounted for by the increase of £1,[illegible] in rates and taxes, attributable in part to an enhanced valuation for rating purposes. He ventured to think it was a somewhat striking commentary upon their system of local taxation that an enterprise like theirs, which contributed so largely to the public advantage and enhanced so greatly the value of property, should be burdened to the extent of [illegible] per cent. of its expenditure for the purposes of local government. The directors had been unable to [illegible] the view taken by the assessment committee that their undertaking, which carried

£1,[illegible] less in 1913 than in 1912, and £1,200 less in 1914 than in 1913, possessed a greater rateable value in those years, and they were appealing with confidence to Quarter Sessions for relief from the provisional assessment which the local authority has seen fit to make. In the circumstances in which they found themselves to-day there was little doubt that the result of the working of the year on which they had now entered was likely to be even less satisfactory than that now under review, because although they were again substituting more efficient plant at a capital sacrifice, which would result in further economy in working, they would not derive the benefit from such expenditure until the close of the year, and they would have to face considerably increased expenditure on coal and wages, due, in the latter case, to the payment of half wages to the dependents of their employés who had enlisted, and to a war grant which they had made payable monthly to those employés who remained, in order to assist them in meeting the temporarily increased cost of living. In regard to the appropriation of the balance of net revenue, they were recommending that the company's investments be written down to their value at the close of the year, instead of at the close of the Stock Exchange, which involved a provision of £1,100, instead of £200, against possible loss on realisation, although the latter date had been more generally adopted by banks and other joint stock companies holding similar securities. They were also recommending the same provision to reserve fund as last year, and the writing off of £1,000 more on shares in and advances to the Accessories Company. They hoped that this provision against loss on capital sunk in the course of founding this branch of the business might prove excessive, but the war had not only interfered with their manufacture and sales, but it had also disorganised their accountancy, and in face of delay in completing the final accounts it was well to give themselves the benefit of any doubt as to results. In view of the heavy increase in income tax they thought it was prudent to discontinue the payment of the dividend on the ordinary shares free, which for the ensuing year would represent a covert bonus of 12½ per cent. or a virtual dividend of 11¼ per cent. Such a distribution of profits would enable them to pay their customary dividend of 10 per cent., which they had now paid regularly for the past thirteen years, and would enable them to carry forward a balance of £5,625 as against £7,152 last year, the total of their reserves and undivided profits amounting to £130,000, as against £125,000 twelve months ago. He was pleased to say that 35 out of a total of 165 men in the employment of the Supply and Accessories Companies had joined the colours. These would be reinstated at the close of the war, and in the meantime they were paying at the rate of £840 per annum to their dependents. This large drain on their establishment, which they deemed it right to encourage, had imposed a considerable burden on the staff which remained, a number of whom had been enrolled as special constables and were doing voluntary guard duty during the night at the company's generating and sub-stations. Thus both those who had gone and those who had stayed behind were discharging their public duty under trying circumstances, and the recognition of the shareholders was due to them accordingly. Whilst the disorganisation which the war had entailed upon them prevented him from entering as definitely into the results of the working of the Accessories business as he would like, he might say that the restaurant continued to make satisfactory progress in spite of the times, and that although the manufacturing department was practically depleted of men by enlistment and had difficulty in obtaining materials, it also had made considerable progress, and had completed designs for a great variety of apparatus suitable for public institutions, hotels, restaurants, clubs and private houses. They were installing large equipments in several of the most important cities in the country, and as they were confident that these would give the same satisfaction in use as the domestic cookers installed in their own area, they might reasonably look forward, with a return to normal conditions, to the profitable development of this branch of the business, apart altogether from the advantage which inured incidentally to the company. The continually recurring endeavours at such vast, and so far, unavailing, expenditure of public and private money, to remedy the disadvantages and remove the difficulties which had been the outcome of the conditions imposed by Parliament, in its zeal to protect the public from the rapacity of private enterprise, at the inception of their industry, were renewed with exemplary bravery in the past year, but only to meet with failure as usual. Both the County Council and the companies, with one or two regrettable exceptions, promoted bills for the better co-ordination and development of the supply of the Metropolis, and negotiations were entered upon between the parties to harmonise, if possible, their separate endeavours. But the innocents were both massacred, the one at the hands of the L.C.C. itself and the other at the hands of Parliament, and a solution was therefore still to seek. It was unnecessary to enter into the details which distinguished those well-meant schemes from each other further than to say that the companies, who had certainly had more experience of the problem in hand, did not share the sanguine expectations of results likely to accrue from extreme concentration which were held out to the County Council by its professional expert advisers. It was, however, the intention of the companies to persevere in an endeavour to effect an amalgamation on fair terms which would safeguard the interests of the shareholders as well as the public by removing the necessity under which the companies would come to labour, of restricting development so as to avoid loss by the operation of the existing purchase clause. In their endeavour to do that their directors would keep them advised of any definite steps which might be taken.

Col. W. F. Leeti seconded the motion.

The report and accounts were adopted.

Bournemouth and Poole Electricity Supply Co., Ltd.

Mr. J. A. Hosker (Vice-Chairman) presided on March 18th, at Moorgate Court, E.C., over the annual meeting. After expressing regret at the absence of Mr. Sanderson, the Chairman said that at last year's meeting an optimistic view was taken of their prospects in the present and succeeding years. Since then the war had affected their business. It was, however, a source of keen satisfaction that they were able to submit the result of their working in the past year, which, although not quite equal to former anticipations, was eminently satisfactory. Their issue of the balance of the unissued second preference shares, viz., 2,500 of £10 each at par, though not underwritten, was considerably over-subscribed. These were by no means favourable times for floating an issue, and it afforded great satisfaction to the directors to know that the undertaking was held in such high esteem by the shareholders. The loan account of £48,000 was as against £41,000 last year. The total capital expenditure amounted to £487,949, and of this the net sum of £14,552 had been expended in the past year. The gross expenditure was £28,773, the difference being accounted for by machinery written off during the year. By far the larger portion of that expenditure was represented by additions to machinery and plant at their Bourne Valley station, viz., £16,189. The main extensions were £8,285. They had an extensive and excellent area of supply and one that was developing daily in all directions. They had advanced a further £2,250 to the Richmond Co. on loan and taken up 2,570 ordinary shares of £1 in the Dorset Electric Supply Co., Ltd. In the revenue account the results were quite satisfactory. There was an increase of £3,839 in receipts for the sale of current and meter rentals, and of £281 in the interest and dividends, mainly due to the increased return from the company's holding in the Richmond Co. A decrease of £126 was shown in the profits of their trading account which, to some extent, was explained by the fact that a larger sum had been charged for standing charges, etc. This department, however, was most useful in developing the company's business, and they did not desire to cut prices or compete rigorously with local engineers and contractors. The only item he would refer to on the debit side of the revenue account was that for coal and other fuel, which had increased by £758. They had sold 242,504 more units, or nearly 7 per cent. increase, and in common with other companies who were large users of coal they had suffered from the rise of price since the beginning of the war. They had had difficulty in maintaining their usual large stock, but so far had succeeded in doing so; but as the result of these difficulties they were paying on the average 8s. per ton more for coal. They had written off £7,000 for depreciation, as against £6,000 in the previous year. To summarise the results, an increase of £3,602 was shown in gross revenue; the total sum written off out of revenue in respect of reserve was £739 up for the year, being £40,039 against £38,284 brought into the account; the dividend of 7 per cent. was the same as last year; the carry forward was increased by £1,684, which was equal to a further 1 per cent. on the ordinary share capital; the applications for a supply of current received during the year amounted to the equivalent of 874 kw., as compared with 504 kw. for 1913; and the units sold were 3,910,511 against 3,668,007 for 1913. With regard to the Richmond Co., they held shares and debentures and loans representing an investment of £122,750. They were greatly indebted to their Managing Director, Mr. Renwick, for the skilful manner in which he had carried through most difficult negotiations with the Richmond Corporation whereby the company had secured an extension of the period of purchase for a further 30 years, which made the unexpired term 36 years. This was a most remarkable achievement when they realised that the terms were regarded as most advantageous to the Corporation, whilst, so far as the company was concerned, their investment was immensely strengthened. The concession was secured without any cash payment. The company was now taking a bulk supply from an outside source, the economy of which had already resulted in a small increased profit, and would result in bigger dividends at no distant date. Returning to the Bournemouth and Poole Co., last year he told them the Board had decided on the policy of installing new plant at the Bourne Valley generating station, from which vast economy in running might be secured. A turbo-alternator of 1,000 kw. capacity was installed and brought into use at the end of September, whilst a second unit of the same size was brought into use at the end of October. This plant had been in use a sufficient time for the board to satisfy themselves that the large outlay of £16,000 would effect economies quite equal to their anticipations. Comparing January and February of 1915 with the corresponding months of 1914, whilst a considerably greater output had been obtained the consumption of coal was 800 tons less. The saving thus effected meant a saving of 44 per cent. of the quantity of coal previously used, and there were other economies in lubricants, etc. Doubtless they could secure further economies and better distribution of their electric current if additional new plant was installed, and he felt confident it would be found desirable and financially sound to extend their up-to-date plant to deal with Christchurch at no distant date. The Chairman proceeded to refer to the board's indebtedness to Mr. Sparks (the consulting engineer), Mr. E. L. Ingram (the engineer), and Mr. W. D. Brightman (the secretary). With regard to the prospect for the current year, they had no reason to be downhearted, for the business was maintaining satisfactory progress. Sixty-two new consumers had been connected since January 1st with a demand of 46 KW. for lighting and 98 KW. for power and heating, and the weekly estimated consumption during the present year showed a satisfactory increase over the previous year. They had now 7,616 consumers connected. Seventy-six of their staff had been called up or enlisted, and the board were making adequate provision for their dependents, which would cost them £600 a year.

Mr. F. W. Reynolds seconded the motion and it was agreed to without discussion.

Listowel (Co. Kerry) Electric Lighting Co., Ltd.

The second annual meeting was held recently. Mr. J. Macauley, who presided, said that the year had been most satisfactory. The gross profits amounted to £296. Although they were in a position to pay 7½ per cent. on the capital, the directors considered that at present it was not advisable to do so, and they proposed that £150 should be set aside for depreciation reserve, and that a dividend of 7 per cent. be declared, carrying forward the balance. The number of consumers had increased from 175 to 197, but there was a falling off in receipts from individual consumers, due to greater economy in lighting. They had secured a very large portion of the private lighting of the town, and they were considering how to still further extend the business. The contract for pumping water to the reservoir for the town supply had been secured during the year, and a special plant had been laid down to deal with it. It had now been working about seven months and had given satisfaction. They had shown a considerably increased output of current at a reduced cost per unit. The average price obtained for current was considerably lower than that for the previous twelve months. Both the cost of generating the current and the price charged compared favourably with other towns in the South of Ireland. He believed that Listowel was the only town in Munster of its own size where current was available at 5d. per unit. Owing to the heavy demand they were installing additional reserve plant.

British Westinghouse Electric and Manufacturing Co., Ltd.

The directors report that, notwithstanding abnormal conditions arising out of the state of war, the accounts for 1914 show a continued improvement. The net profit amounts to £151,627, plus £6,494 brought forward, making £158,121. This is to be appropriated as follows:—To general reserve £50,000, to patents, goodwill, etc., amount written off, £25,000, dividend on preference shares at the rate of 7½ per cent. £75,000, to be carried forward £8,121. The net profit is considerably in excess of that in 1913, when it amounted to £106,494. Substantial sums have again been charged against revenue for the maintenance of the works and plant, and in addition £50,846 has been applied to depreciation. Since the end of the year under review the company has acquired from the American Westinghouse companies their interests in the French, and through it the Italian, Westinghouse companies. The board believe that this extension of the company's business will be profitable.

The profit and loss account shows that the gross profit for the year, including estimated profit accrued to date on completed work on contracts, interest received, transfer fees, etc., after providing for expenses of management, directors' fees, bad and doubtful debts, maintenance of buildings, machinery, etc., and all other working charges, was £267,819. This has been dealt with as follows:—To interest on 6 per cent. prior lien debentures to 31st December, 1914, £12,870; to prior lien debenture redemption account, £7,130; to interest on 4 per cent. mortgage debenture stock, £49,654; to expenses on surplus land and buildings, £2,822; to depreciation written off works, machinery, plant, etc., £43,716; to balance, being net profit for year, £151,627.

British Aluminium Co., Ltd.

The trading profit for 1914, together with interest and dividends on investments and deposits, and the revenue derived from Kinlochleven and Foyers Estates, and transfer fees, was £272,256, plus £16,690 brought forward. Provision for income tax, legal expenses, bad and doubtful debts, depreciation of investments and furniture, and proportion of profits payable to directors, absorbs £21,966, prior lien debenture service fund £18,000, debenture stock service fund £43,221, reserve for depreciation £50,000, carried to reserve account £50,000, leaving £72,756. The dividend at 6 per cent. per annum on the preference shares requires £17,974, and the directors recommend a dividend of 5 per cent. per annum, less tax, on the ordinary shares, payable 1st April, 1915, requiring £30,031, leaving to be carried forward £24,751. The reserve account, including £50,000 added out of profits for the year, amounts to £180,000. Owing to the necessity of making provision for capital expenditure, the allocations to this account for the last two years have not been invested outside of the company's business. The depreciation reserve account, including £50,000 set aside out of the year's profits, now stands at £200,000. The various works of the company have been operated satisfactorily during the year. The power plant for the rolling mills at Warrington has been completed, and the preliminary work for the erection of the new Alumina Works at Burntisland is in progress, and contracts have been placed for a large part of the buildings and plant required. The erection of further plant for the extension of the manufacture of carbon-electrodes at Kinlochleven is proceeding, and will be completed in the course of the year. The output and sales show an increase over the previous year. Prices are approximately on the same level as last year, but the cost of production has been affected towards the end of the year by the increased prices of certain materials, freight, and insurance. The war has necessitated the cancellation of considerable orders and contracts on the company's books with certain Continental users, but this has been off-set by the increased demand of the British Government and its Allies, and contractors working for them. The demand for the metal continues to increase, but, owing to the abnormal situation created by the war, difficulties are now being experienced in connection with supplies of raw material and coal required by the various works, and the costs of production are being adversely affected by the increase in labour charges, coal prices, freights, insurances and other expenses. In view of the difficulties above mentioned, the board feel that, notwithstanding the improvement in profits for the year, it is prudent that the dividend on the ordinary shares of the company should not be increased.

Annual meeting: March 26th.

STOCKS AND SHARES.

Tuesday Evening.

The present situation at the front and in the Dardanelles contains nothing of what might be called sensational interest, sufficient to quicken Stock Exchange markets. Even in these days, when there is no speculation and business is confined to the humdrum lines of investment, the character of the news from the front does make a considerable difference. Lord Kitchener's grave warning on the necessity for workmen at home to back up in the shops the efforts of their comrades in the Services, added to the serious rumours circulating in the City this week, have provided food for reflection to those who gaily declared that the war was going quite all right and that its conduct could be left to those already engaged in it.

Armament shares have given way in consequence of the growing impression that the Government will take over the companies, pay shareholders a fixed rate of dividend, and run the concerns in the same way as they are doing the railways and the wireless systems. The report of the British Westinghouse Co. shows fine progress, and that issued by the Brush Electrical is fairly satisfactory.

Electricity supply shares have shown a drooping disposition, notwithstanding the expansion in the matter of public interest. St. James' fell abruptly to 8¼, and London Electric preference at 4 15/16 are 1/16 down. County preference came in for fresh attention, by reason of the good yield still obtainable on the shares at the present price of 11¼. There are buyers about for South London and for South Metropolitan ordinary—the latter in the neighbourhood of 10s., while for the former would-be purchasers at 2 15/16 ex-dividend have found they could not be supplied.

Rumour toys with the idea that there may be something brewing in the shape of amalgamation or working agreement between certain of the London companies. The South London and the South Metropolitan are already mentioned in connection with this, and their names are linked with that of one of their bigger brethren, though the gossip is still too nebulous for it to be referred to in a way other than the [illegible]

The Stock Exchange, by the way, was a little [illegible] a week or two ago, because its supply of coal [illegible] threatened by the all-round scarcity. The House makes its own electricity, and its fuel consumption is something like twenty tons a week in the winter months. Its bunkers contain reserves of about a month's supply, which have not yet been touched, although the managers contemplated the possibility of having to raid their eighty tons while the acute scarcity of coal prevailed.

With the gas companies [illegible] it would be at least [illegible] had to follow suit, so that the reports as to the possibility of this taking place might have [illegible] than mere intelligent anticipation.

Metropolitan Consolidated stock has gone back to 29½, and Districts to 17, but Underground Electric incomes keep hard about 81. The tendency of the railway market as a whole showed a change for the better a few days ago, but since then, prices relapsed into dullness again on the cessation of the few buying orders which imparted temporary strength to the market.

The Treasury have consented to a lowering of the minimum prices fixed by the Stock Exchange Committee, and below which brokers were not allowed to sell stock. The following are the principal changes affecting electrical issues:—

Reduced Stocks.	Minimum Previous.	Minimum Present.	Reduction.
Central London 4 p.c. debenture	95	93	2
London Electric debenture	87	85	2
Metropolitan 3½ p.c. debenture	85	83¾	1¼
Met. District 4 p.c. P.L. debenture	94	92	2
Metropolitan 3½ p.c. preference	79	77¾	1¼
Metropolitan "A" preference	76	74¾	1¼
Metropolitan Conv. preference	76	74¾	1¼

The reduction in the minima, which was preceded by such heated controversy from those who favoured it and those who did not, has had some little effect in improving business. At first, the result was directly opposite from this; but as the markets concerned have become accustomed to the new prices, so orders have increased. It is, of course, only in the gilt-edged markets that this system has been applied. Consols, for instance, were lowered from 68½ to 66½; and many trustee stocks came down from two to four points. The Treasury have intimated that they will not permit any further variations to be made during a period of at least three months.

The following is our list of representative stocks and shares:

HOME ELECTRICITY COMPANIES.

	Mean price. July 27, 1914.	Mar. 23, 1915.	Rise or fall this week.
Brompton Ordinary	9⅛	8¾	—
do. 7 per cent. Pref.	8⅝	8⅝	—
Charing Cross Ordinary	5¼	4½ xd	—
do. do. do. 4½ Pref.	4¾	4⅛	—
do. do. City Pref.	4⅝	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅛	4¾	—
do. 4½ Deb.	96½	92	—
City of London	16	14¾	—
do. do. 6 per cent. Pref.	13½	12½	—
do. do. 5 Deb.	116½	112	—
do. do. 4½ Deb.	100½	98	—
County of London	12	11⅜	—
do. do. 6 per cent. Pref.	12	11½	+ ⅛
do. do. 1st Deb.	102½	99	—
do. do. 2nd Deb.	100½	97	—
Kensington Ordinary	7½	7 xd	—
London Electric	1 7/16	1½ xd	—
do. do. 6 per cent. Pref.	5 1/16	4 1/16	— 1/16
do. do. 4 Deb.	92½	87	—
Metropolitan	3½	3⅛	—
do. 4½ per cent. Pref.	4 7/16	4	—
do. 4½ Deb.	97½	96	—
do. 3½ Deb.	83	80	—
St. James' and Pall Mall	9⅝	8½	— ¾
do. do. do. 7 per cent. Pref.	7	6⅜	—
do. do. do. 3½ Deb.	84½	80	—
South London	8 1/16	8	—
South Metropolitan Pref.	1¼	1⅛	—
Westminster Ordinary	8⅝	7½	—
do. 4½ Pref.	5⅛	4½	—

TELEGRAPHS AND TELEPHONES.

	Mean price. July 27, 1914.	Mar. 23, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108½	103¾ xd	—
do. Def.	23	21¾	+ ½
Chile Telephone	7⅜	6⅝	—
Cuba Sub. Ord.	8½	8½	—
do. Pf.	16½	15	— ½
Eastern Extension	12¾	12¾	—
do. 4 Deb.	97½	92 xd	—
Eastern Tel. Ord.	130½	128½	—
do. 3½ Pf.	77½	74	—
do. 4 Deb.	96½	94	—
Globe Tel. and T. Ord.	11½	11	—
do. Pf.	12⅞	12	+ ⅛
Gt. Northern Tel.	32½	29	—
Indo-European	59	51	—
Marconi	1 15/16	1¾	— 1/16
New York Tel. 4½	101	97½	+ ½
Oriental Telephone Ord.	2 5/32	2	—
do. Pf.	1 [illegible]/32	1 3/16	—
Tel. Egypt Deb.	98	88½	—
United R. Plate Tel.	6⅜	6	—
do. Pf.	5¼	5	—
West India and Pan.	1½	1 5/16	—
Western Telegraph	13⅝	13	— ¼
do. 4 Deb.	96½	94	—

FOREIGN TRAMS, &C.

	Mean price. July 27, 1914.	Mar. 23, 1915.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅞	4½	—
do. 2nd Pf.	4¼	3⅝	—
do. 4 Deb.	91	84	—
do. 4½ Deb.	98½	91	—1
do. 5 Deb.	96	88	—
Brazil Tractions	66	62¼	— ½
Bombay Electric Pf.	11⅝	10⅝	—
do. 4½ Deb.	96	91	—
Mexico Trams	70	35	—
do. 5 per cent. Bonds	84	45	—5
do. 6 per cent. Bonds	76	30	—
Adelaide Sup. 6 per cent. Pf.	5½	5⅛ xd	—
do. 5 Deb.	104	103	—

HOME RAILS.

	Mean price. July 27, 1914.	Mar. 23, 1915.	Rise or fall this week.
Central London, Ord. Assented	83	76½	+ ¼
Metropolitan	37½	29½	— ½
do. District	21¾	17	— ¼
Underground Electric Ordinary	2½	1 11/16	— 1/16
do. "A"	7/6	5/6	— 6d.
Income	88	81 xd	—

MANUFACTURING COMPANIES.

	Mean price. July 27, 1914.	Mar. 23, 1915.	Rise or fall this week.
British Westinghouse Pref.	1¾	2	+ ⅛
do. 4 Deb.	74½	72	—
do. 6 p. lien	102½	99	—
Callenders	11⅞	11¾	—
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2½	3 3/16	—
Edison & Swan, £3 pd.	3/32	14/6	—
do. do. fully paid	1¼	2¼	—
do. do. 4 Deb.	59	63	—2
do. do. 5 % Deb.	63½	60	—
Electric Construction	17/32	13/6	—
do. do. Pf.	1/16	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	14½	—
do. 4½ Pref.	5	5	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	8¾	—
Telegraph Con.	38½	37½	—

In the Telegraph market, activity centres for the moment principally in Anglo-American Telegraph deferred stock, which has risen to 21¾ on a fair amount of investment buying. The Eastern group is tolerably steady, but Westerns lost their 5s. rise of last week. Globe preference continue to harden, and are now up to 12. Marconis eased off 1/16, which took the price back to 35s., while the subsidiaries are practically unchanged. The company's preference shares keep about a florin a share below that for the ordinary.

Brazil Tractions show a dullish disposition, which possibly may be connected with the approach of the time when the next dividend declaration is due. The market is becoming calloused to these quarterly apprehensions; and if the directors should happen to decide to cut the dividend, advance familiarity with such an idea may have the effect of preventing any particular fall occurring as a result. Mexico Trams 5 per cent. bonds receded another 5 points to 45, so that the price is almost exactly half what it was when war broke out. Affairs in Mexico are no better, though a gleam of satisfaction may be felt by holders of Mexican securities that New York should be buying shares in certain of the Mexican railway concerns controlled from the United States.

British Westinghouse preference rose to 40s., and there has been a good deal of business at prices from 6d. to 1s. above that level, owing to the excellent report just issued by the company. It was expected that the British Westinghouse would be seen to have done well, but the actual figures exceeded anticipation; and a good deal of fresh support has come into the market. Brush issues are not much affected by the company's report, also out a few days ago. Edison & Swan 4 per cent. debenture stock went back 2 points to 63; the company's shares remain steady at 14s. 6d. The rubber market exhibits quiet strength. Those who try to buy good-class shares find it extremely difficult to do so; and with two or three companies publishing reports this week in which they show that their costs are reduced to 9d. or 10d. per lb., it is not surprising that there should be enquiry for bargains in this department. The trouble is, however, to pick up the shares. The armament group, as mentioned above, is dull, and the fall of the Austrian fortress with the unpronounceable name had little quotable influence upon markets as a whole.

MARKET QUOTATIONS.

In last week's issue, through a figure failing to print up, the price of aluminium sheet in ton lots appears as £20 per ton. It should, of course, have read £120.

Folkestone Electricity Supply Co., Ltd.—At the annual meeting held on March 19th, the Chairman (Ald. Spurgeon, J.P.) congratulated the shareholders on the very successful year's business. £11,696 had been spent during the year, principally upon a new 500-KW. Parsons exhaust turbine, condensers, and pipework. The revenue for the year showed an increase of £1,212; the working expenses were reduced by £322, and the gross profits were £1,534 in excess of 1913. They had used less coal in the year by 806 tons (resulting in the saving of £813) although there had been an increase of 88,000 units. This saving he attributed to the advent of Kent coal and increased efficiency of plant. The future coal supply was not entirely satisfactory, although the contracts for the present year were favourable. The amount available for dividend was £13,099, as compared with £11,348 in 1913—an increase of £1,750. Only on one occasion in 1912-13 has this increase been exceeded, and then it was £1,921. During the year 233 additional consumers were added, being equivalent to 6,843 8-C.P. lamps, the total being 145,943 lamps; 2,333,415 units were generated, and 1,753,330 sold. The chairman added that the directors were continuing the system of bonuses which had been in force for two years, and they also were paying those employés who had joined the Colours the difference between the pay they received and their earnings at the works. The company had arranged to supply the adjoining town of Cheriton with electric light.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING FEBRUARY, 1915.

The February returns of electrical export and import business make a poor showing beside those of the previous month, which even the shortage of days will scarcely account for.

The electrical exports for the month reached a total value of £256,519 as compared with £364,562 in January, which, however, was a good month under the circumstances. The imports of electrical material were valued at £217,500 as against £239,127 in the previous month, while the re-exports had a total value of £22,216, showing an improvement over the January total of £12,455.

Practically every section of our electrical export business fell off in value, the only exception being glow lamp exports, which were £2,000 to the good. Of our various customers, India was the most prominent, while France probably owing to prevailing conditions occupied second place; Australian business also reached good proportions.

The only sections of the imports showing any increase over the January figures were goods, batteries, and particularly glow lamps, due to the inclusion of nearly £15,000 worth from Holland.

The United States was the principal contributor to the imports total, and business in that direction decreased from £198,596 in January to £171,696 in the month under review.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark	1,818	838	13	1,127	...	1,275	953	268	733	192	2	1,010	8,369
Germany	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies	482	2,474	431	22	38	27	257	317	332	19	161	6	4,566
Belgian Congo	...	...	39	...	...	...	...	...	...	...	...	...	39
France	2,473	...	1 915	40	150	...	3,243	364	558	80	6,434	8,783	24,040
Portugal	92	74	38	20	...	175	862	...	...	...	318	...	1,579
Spain, Canary Isles and Spanish N. Africa	106	87	91	...	...	33	1,152	33	43	27	142	403	2,117
Switzerland, Italy and Austria-Hungary	420	...	191	...	...	...	467	...	639	...	105	4,398	6,223
Greece, Roumania, Turkey and Bulgaria	...	...	...	19	...	...	...	...	...	...	...	...	19
Channel Isles, Gibraltar, Malta and Cyprus	121	24	...	83	...	...	320	...	330	...	15	16,225	17,118
U.S.A., Philippines and Cuba	555	11	35	...	...	...	256	20	...	...	10	372	1,259
Canada and Newfoundland	126	76	7	464	46	820	5,710	...	2,167	28	...	1,605	11,049
British West Indies and British Guiana	133	...	30	124	...	15	587	...	...	...	40	353	1,552
Mexico and Central America	15	...	57	...	...	38	247	...	...	...	...	211	568
Peru and Uruguay	...	141	...	315	...	...	52	...	...	...	435	...	943
Chile	27	...	...	740	...	...	270	...	...	...	9	22	1,068
Brazil	216	2,314	175	44	...	193	1,567	...	42	1	...	87	4,639
Argentina	1,170	1,020	1,365	569	...	235	3,785	1,874	103	...	6	164	10,345
Colombia, Venezuela, Ecuador and Bolivia	3	541	78	10	...	...	443	97	...	...	...	297	1,469
Egypt, Tunis and Morocco	82	...	98	...	...	...	397	...	115	...	80	6,901	7,673
British West Africa	40	...	23	...	...	46	105	...	...	...	56	9	279
Rhodesia, O.R.C. and Transvaal	462	584	273	361	...	385	865	194	...	144	...	...	3,268
Cape of Good Hope	324	845	274	371	13	146	1,518	8	96	...	32	809	4,436
Natal	208	2,308	402	105	56	295	502	...	111	...	212	...	4,199
Zanzibar, Brit. E. Africa, Mauritius & Aden	59	28	8	148	...	11	481	23	83	...	13	604	1,458
Azores, Madeira and Portuguese Africa	5	42	85	62	...	20	1,094	...	...	13	40	...	1,361
French African Colonies and Madagascar	...	...	...	...	...	...	...	...	...	...	...	...	...
China and Siam	550	1,326	1,561	81	50	1,347	2,555	465	133	2	19	782	8,871
Japan and Korea	209	...	53	...	...	487	2,519	4,420	91	25	...	133	7,937
India	2,598	13.944	2,085	1,631	...	1,867	8,987	2,219	1,292	21	2,241	4,526	41,411
Ceylon	114	182	87	49	...	...	1,276	...	144	...	72	260	2,184
Straits Settlements, Fed. Malay States and Sarawak	166	1,617	326	202	26	243	10,663	165	19	153	56	1,024	14,660
Hong Kong	203	598	78	21	...	...	1,422	...	112	...	...	818	3,252
West Australia	145	33	435	448	...	10	30	384	400	...	30	...	1,915
South Australia	18	480	519	134	...	375	289	...	13	34	142	...	2,004
Victoria	675	2,750	829	946	17	317	3,258	80	1,066	...	6,003	183	16,124
New South Wales	1,239	1,937	1,050	986	188	42	8,770	2,532	677	369	1,313	71	19,174
Queensland	32	1,868	291	403	...	34	902	26	722	15	158	824	5,276
Tasmania	...	...	66	...	...	...	668	...	...	...	213	...	947
New Zealand and Fiji Islands	532	4,793	1,106	1,255	27	469	3,065	154	1,183	111	79	365	13,139
Total, £	15,418	10,935	14,509	10,780	611	8,905	69,527	13,643	11,204	1,234	18,508	51,245	256,519

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark	302	...	57	129	849	...	2,218	41	1,130	...	2,206		6,932
Germany	...	...	...	...	...	...	...	...	...	...	...		...
Holland	284	201	...	14,879	1,400	...	227	217	929	...	...		18,137
Belgium	...	...	...	...	...	...	...	...	...	...	...		...
France	357	1,380	197	46	22	126	177	...	2,896	1,575	74		6 850
Switzerland	267	474	273	151	...	1,419	3,150	...	...	560	185		6 479
Italy	...	1,845	28	...	320	...	14	128	...	148	...		2,483
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...		...
United States	8,508	814	2,105	250	4,744	263	19,960	123,984	8,655	1,412	1,001		171,696
Total, £	9,718	4,714	2,660	15,455	7,335	1,808	25,746	124,370	13,610	3,695	3,466		212.567

Additional imports.—Spain, arc lamp parts, £6; carbons, £4,345. Canada, electric goods, £10; fittings, £20; machinery, £537. carbons, £15.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above	748	337	39	749	871	770	11,005	...	136	543	7,018		22,216

TOTAL EXPORTS: £256,519 TOTAL RE-EXPORTS: £22,216 TOTAL IMPORTS: £217,500

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

RUSSIAN TRADE AND ELECTRICAL PROSPECTS.

(Communicated.)

(*Concluded from page* 416.)

In the matter of credits, German firms have ever been most obliging, backed as they have been by their banks. In Russia, as an agricultural country wherein money flows chiefly in the seasons of sowing and harvest, six months credit is usual and twelve months often demanded. The numerous co-operative societies (mentioned again later) are doing a good deal to provide agriculturists with ready money at other seasons, but the broad fact remains that any firms exporting to Russia must be content to wait six months or so for payment; there is rarely any objection raised to reasonable payment for this accommodation. For a good many years to come, Germany will not be able to give such preposterously long credit as she has often employed in the past to win business in undeveloped countries.

Russian import duties are framed on a weight basis*, and whereas many British manufacturers send in heavy machinery complete and therefore subject to heavy tax, German firms have evolved special types for export, and have arranged to make and fit heavy castings, etc., within the Russian frontier. Ironically enough many of the "factories" built by Germans to comply with the letter of Russian law, are simply private foundries and assembly shops serving to evade by one means or another a considerable portion of the customs dues paid by less astute or less efficiently organised undertakings. Under the existing tariff it is obviously foolish to pay freight and customs charges on heavy frame castings, etc., which can be as well made in a branch factory on the spot. The establishment of such a factory gives prestige and affords a good centre for a local representative or a more ambitious staff of travellers.

It is practically certain that there will be substantial mutual tariff concessions between the Allies after the war, and our gain in this respect would obviously be greater if we had a tariff of our own on which to offer concessions. Apart from this consideration, anyone who has made more than the most casual study of measures taken since last autumn to "capture German trade" must realise of what immense assistance would be a protective tariff to our newly-founded industries. Without it, some industries cannot possibly compete with established and protected German trade.

We shall not secure the Russian electrical or any other market unopposed. During the war we have a temporary respite from German commercial activity abroad, and *now* is undoubtedly the time to prepare a commercial campaign in Russia. Almost every firm here is choked with war orders. Necessary and urgent as these are, they represent national expenditure and not national production, and while we are engaged upon them we must see that the rivers of our peaceful commerce become neither silted nor diverted. America realises the importance of the Russian market, and an American firm with a factory in Russia has a good share of the electrical business in the Baku oil fields.

Just at present we have easier access to Russia than most neutrals, but even so it is not wise to start circularising Russia at the moment, for postal delays are considerable (a registered letter dispatched from Petrograd early in February taking nearly a month to reach England). With the opening of the Dardanelles a revival in Russian trade will occur, and as there is already a great shortage of electrical material in Russia, it is not a moment too early to plan the measures which are to be taken directly an easy trade route is opened. There has been much talk of a new Scandinavian trade route to Russia to replace permanently the old Berlin route. Whether the suggestion will mature is open to doubt, but it has at any rate caused considerable annoyance in Berlin!

The Scandinavian route leads to an important industrial area, but is long and without particular merit. Given neutralisation of the Kiel Canal and some more Baltic seaboard for Russia—both quite probable contingencies—the all-sea route would seem well worth while for all but the lightest traffic, and would not be so much longer than that for the Scandinavian route, while avoiding the long rail journey and a large fraction of transhipment costs.

It is difficult to foresee precisely what will be the labour position in Germany after the war, but no doubt it will be characterised by long hours and low wages, and no doubt it will constitute a serious factor in the competition we shall have to meet. However, there is no cause for despondency—only need for improved organisation in manufacture and selling to set the balance right. America competes effectively in every market despite her very dear labour. It is surely time, however, that the British working man saw clearly that strikes are literally "bad business." The heavy union levy is dissipated in a few weeks of strike pay, trade is disorganised, and national production is inevitably given an irrevocable set-back. Usually some advance in wages is obtained, but the strike is not a success for the resulting increase in market price reacts sooner or later to the disadvantage of workers, and better organisation and better machinery are introduced to decrease the wages cost for given production despite the higher wage rate. The final upshot is that the net profit to the striker is very small but he has to work under strenuous conditions. The fact is that capital *will* have a certain minimum return or it will go elsewhere. Compulsory arbitration in labour disputes is long overdue, would only be in conformity with ordinary civil law, and would greatly strengthen our position in the years of keen competition that are to come.

In turning from consideration of the general electrical trade field in Russia, and the means whereby it is to be secured, to a specific review of the exact nature and extent of Russian electrical developments and demands, we are faced by the difficulties that imperfect statistics are available; that during the last year or two innumerable fresh schemes have been mooted, some abandoned, and some far developed (mostly under the cloak of German organisation); and that the past development will be as nothing compared with that yet to come. So far the Russian electrical industry has centred round Riga, Petrograd and Moscow, but recently there have been very extensive developments, actual and mooted, in the Baku district, in the Urals, and in Siberia, so that with rapid improvements in ways and means of communications electrical development will proceed rapidly all over the Empire.

Some 60 per cent. of the 150 most important central stations are managed municipally; the remainder are operated by concessionaires, chiefly in industrial districts, and supply about 10 million population (twice that served by the municipal concerns). There is, however, an enormous field for municipal enterprise in water and electricity works and tramways, and for State enterprise in electric railways and hydro-electric schemes. Municipalities and State departments seem thoroughly alive to these possibilities and display preference for electrical operation wherever practicable. By its agricultural and mineral wealth the country is able to afford large public undertakings which will have as their first effect rapid industrial development.

The present unsatisfactory position under electrical companies in Petrograd will be much improved by municipal purchase, schemes for which are already far advanced, though, due to the war, they will probably be suspended till the right of purchase falls due in 1917. The central station in Moscow, controlling the great Bogorod industrial district, has been repeatedly extended since its inauguration nearly thirty years ago. The maximum load has roughly doubled in every five years' period since 1901, and now exceeds 30,000 KW. The present station is a two-story building with efficient equipment, totalling 55,000 KW. capacity and supplying two-thirds of its output to factories and workshops. The usual supply system in Russia is generation and main distribution at 2,000—2,200 volts, 3-phase, with 100—220 v. transformers supplying groups of consumers. No better system could be employed under the conditions to be met, indeed, the relatively low lighting pressure would be very acceptable in this country since the introduction of metal and half-watt lamps. Seven years ago the generating and main feeder pressure in Moscow was raised from 2,100 to 6,500 v. to suit extended and increased supply, and it is an advantage of A.C. distribution that by adding fresh main feeders and transformers such increases in primary pressure can be continued indefinitely.

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* £2 15s 10d. per cwt. on dynamos, motors and transformers; £3 18s. 10d. per cwt. on measuring instruments; £9 17s. 0d. per cwt. on incandescent lamps mounted, and £19 14s. 0d. per cwt. unmounted.

Plenty of water power is available on the Urals for hydro-electric development; conditions will permit economical and strictly utilitarian construction, and a base load is already to hand in the mining districts. Concessions have been granted for the supply of traction, lighting and power to the whole Petrograd and Viborg district from the Imatra-Raisala falls, one of the largest undeveloped waterfalls in Europe, capable of yielding somewhere about 500,000 horse-power. The £125,000 loan sanctioned for a lighting and power station in Nijni-Novgorod is another little matter deserving the attention of British firms.

The municipality of Kieff (where there is already a 12,000 KW. plant on the usual Russian system, supplying 10,000 consumers) has in hand a loan of £2,500,000 to purchase and extend tramways, and a half-million loan is approved from tramways in Vilna. The Vladivostok tramways, at present working successfully despite the limited facilities which they provide at exorbitant fares (4d. to 5d. a mile), are to be extended and reorganised, and a large number of traction schemes are more or less advanced in Siberian towns. Belgian enterprise has been very active in Russian tramways (especially in Siberia and Central Asia) but no one would begrudge our Allies their share in this business, there is room for all—except Germany. The State Commission for New Railways is an active body, and has a number of important schemes in hand for electric railways radiating from Warsaw, as well as an electric railway from Vladikavkaz to Tiflis, and a 1,200-mile line from Irkutsk to Bodaibo. Electric power is much used in the State railway shops and electricity is to be used for lighting on the railways.

Very extensive telephone and telegraph additions are required. This business has been mostly shared by Swedish and German firms, and there is no reason why British firms should not compete very effectively in future.

RUSSIAN ELECTROLYTIC MANUFACTURES, 1913.

	Tons.	Total value.	Average £/ton.
Electrolytic Copper	21,000	£1,040,000	£92 10s.
Nitric Acid	56,500	640,000	£11 6s.
Accumulators	3,400	180,000	£53
Aluminium	1,300	170,000	£131
Potassium Chlorate	2,400	130,000	£54
Electro-steel	4,000	66,500	£16 12s.
Calcium Carbide ...	1,450	42,500	£29 6s.
	90,050	£3,169,000	

Electrochemical and metallurgical manufacturers in Russia represent a very extensive and remunerative industry, 100 per cent. net profit being realised on much of the capital invested. Unfortunately, much of that capital has been German in the past. Russian electrolytic manufactures in 1913 are reported in the table given in the previous column.

The steadily increasing demand for electrolytic copper for railways and electrical undertakings is met by Mm. Rosenkranz, of Petrograd, and the Kyshtim Corporation, new plant recently installed by the latter bringing their total capacity up to 8,000-9,000 tons per annum.

Among the most promising electrical fields in Russia are those of electricity in agriculture and power supply to peasant industries. The very active spirit of co-operation in Russian farming and dairy districts should do as much to help the extended use of electric motors in agriculture as co-operation has already done in Canada and the States. *There are more than 30,000 co-operative combinations of Russian farmers* already in operation, apart from important State co-operative schemes. A co-operative society can afford equipment beyond the reach of individual farmers, and can secure commensurate advantages to the whole community and equal benefit to electrical manufacturers and supply stations. Already these societies have done much in the way of purchasing tractor ploughs and thrashers, and the impending inauguration of new power transmission schemes, and extension of existing central stations, will produce opportunities which should not be neglected for the use of electricity in agriculture. British manufacturers could very profitably lay themselves out to exploit at the same time the use of electric power and lighting in our own and in Russian farming districts. Large numbers of oil engines are used and will be used in Russia, and since British agricultural machinery and oil engines are already well known in Russia, and since electrical equipment would be required to work with one or both of these (according as power was taken from central or independent supply), there would seem to be room for very effective combination between British manufacturers of agricultural machinery, electrical equipment and oil engines. Without such co-operation there must be much unnecessary competition and all-round inefficiency. For a time, the chief demand is likely to be for medium high tension (2,000-3,000 v.) equipment and low tension (120-240 v.) transformers and lighting and power apparatus. The more special field for E.H.T. equipment will be extensive but not of immediate interest to the general manufacturer.

With a view to enabling peasant industries to continue their independent existence, State and municipal departments are taking considerable interest in rural distribution schemes for electric power, and there is reasonably to be expected a deal of business in this direction.

The past dominance of German capital and influence, and the drastic measures adopted to thwart attempts to establish independent electrical concerns in Russia, have been felt very keenly in influential quarters, and there is a movement on foot (which might advantageously be copied in this country) to execute all public electric requirements in Russia by Russian material and labour where possible, and in any case free from German profit and control. The establishment of independent Russian concerns and the granting of industrial credit by the Russian Imperial Bank will be very effective in promoting free international trading and rapid industrial development in that country. Electrical development will be among the most important branches of this general industrial advance, and there is not the least doubt that Russian firms and authorities are very wishful to trade more extensively with British manufacturers. Such a ready-made market as never before existed lies open to us, but the special advantages we enjoy can only persist unaided for the immediate future, and the time for action is now.

ELECTRICITY APPLIED TO MINING.

By C. P. SPARKS, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *February 25th*, 1915.)

(*Concluded from page* 422.)

Distribution Underground.—In contrast with some other countries the working conditions in the British coal fields require all conductors to be insulated, and in order to prevent damage due to movement in the workings all conductors are usually suspended by leather thongs. To ensure continuity of supply for important pumping plant duplicate double-wire-armoured cables are used, either placed on opposite sides of the shaft or preferably run in separate shafts so as to prevent the supply being interrupted by mechanical injury.

Earthing Connections.—Whilst recognising the difficulty of specifying how an efficient earth connection should be made, the author is in agreement that the main "earth" must be placed at the surface of a colliery, owing to the difficulty of constructing and maintaining efficient earth-plates underground. The usual power-station practice should be followed in which several earth connections are made by a copper ring-main connected to steam condensers, circulating-water pipes, feed pipes, and other metal-work in direct connection with earth, or, in cases where it is not possible to make such an earth connection, the contact area of each coke bed should be materially greater than that specified in the General Regulations issued under the Coal Mines Act, 1911, the coke bed being carried down not less than 8 feet below ground-level. From tests on main station "earths" constructed on the lines indicated, the measured resistance to earth with alternating current at 50 periods varies in representative cases from 0.01 to 0.03 ohm.

Tests made on earth-plates constructed on the lines recommended by the General Regulations under favourable conditions as to moisture, vary from 1.8 to 2.2 ohms. If the conditions are not favourable a much higher resistance to earth will be found, as the resistance to earth is directly affected by the nature and temperature of the surrounding strata and by the amount of moisture, unless precautions are taken to supply earth-plates with moisture and periodically to impregnate the surrounding strata with salt. Tests show that this treatment is effective in lowering the resistance of poor earth connections.

Tests have been made on groups of earth-plates in different localities, constructed on the lines recommended by the General Regulations. The tests show that the size of the metal earth-plate is comparatively unimportant compared with the area of the coke bed. With a plate of 8 sq. ft. area surrounded by 12 inches of coke, the surface contact of the coke with the surrounding strata is about 40 sq. ft., which results in the resistance between the earth-plate and the outer surface of coke being approximately 0.5 per cent. of the total resistance to earth, with the coke bed surrounded by clay.

The tests show the desirability of burying the earth-plates at considerable depth so as to avoid too great a potential gradient on the surface.

Tests show that if a main "earth," consisting of two earth-plates constructed under favourable conditions on the lines recommended by the General Regulations issued under the Coal Mines Act, 1911, had been called upon to carry a current of 500 amperes for a short period, such as that necessary for a circuit-breaker to operate, the potential at the earth-plate would have been not less than 500 volts above earth. Any such pressure on the earth-plates, although of momentary duration, is dangerous, as it would result in the cable sheathings and any metal connected to the main "earth" being raised to a dangerous pressure. It is therefore essential that a different type of main "earth" should be used from that recommended by the Regulations, or else that the number of earth-plates be increased.

Earthing of System.—Safety has been much increased by the Regulations issued in 1913, which provided that all conductors where pressure exceeds low pressure (250 volts) must be protected by a metallic covering electrically continuous and efficiently earthed; but the author suggests that when the Regulations are next under revision Regulation (124) should be amended so as to make it compulsory to earth the neutral point of all polyphase systems. The main advantage of working with one point definitely earthed is the impossibility of continuing working with a definite fault on the system.

Switchgear.—At Middle Duffryn power station the switchgear, which is erected in a separate building, is operated electrically by remote control from a 110-volt battery. The busbars are arranged as a ring, which can be split by two 2,000-ampere oil-break motor-operated switches. For repairs, each half of the busbar ring can be subdivided by unbolting links.

The generators are protected by balanced protective transformers, connected between the neutral and each phase, and by time-limit, overload and reverse-current devices. The feeders are protected on the Merz-Price system and by time-limit overload apparatus.

The switchgear at Penallta station is mechanically operated by levers, the switchgear being in the basement (see fig. 10). The generators are protected by time-limit, overload and reverse-current relays, the feeders by time-limit overload, and the overhead transmission lines and transformers by time-limit overload and the Merz-Price system.

At Britannia Colliery the switchgear is erected in an annex to the winder house, the switches being mechanically operated and the control pillars being on the floor-level. The busbars are arranged as a ring, which can be separated into two halves by 400-ampere oil switches, each section of the ring being again divisible for repairs by unbolting links. When the ring busbar is divided, each section of the bar has direct connection with the Penallta and Bargoed stations, and a supply can be given from either section of the busbars to one main winder and to the 10,000/3,000-volt transformers which supply the remainder of the colliery plant. The 3,000-volt busbars are treated in a similar manner.

At Bargoed the busbars are in duplicate, the generators and feeders being connected to either of the busbars through interlocked isolating switches. The protective arrangements are as follows:—

Generators.—Time-limit overload and reverse-current relays.

Feeders.—Time-limit overload and Merz-Price protective system.

The pressure is controlled at the power station by Tirrill regulators. This has resulted in an improved power factor on very fluctuating loads. Having regard to the variation of 25 per cent. in load in either valley in a few seconds, it was found difficult to maintain a satisfactory pressure until the plant at the various power houses was controlled by these regulators.

The power factor varies between the following limits:—

Aberdare Valley	0.7 to 0.85
Rhymney Valley	0.7 to 0.8

The generators are constructed so as to give their full output with a power factor of 0.75. Owing to the moderate distance of transmission there has been no difficulty in maintaining the normal pressure at the individual collieries, but in order to deal with further extensions some of the larger motors will probably be fitted with power-factor correctors.

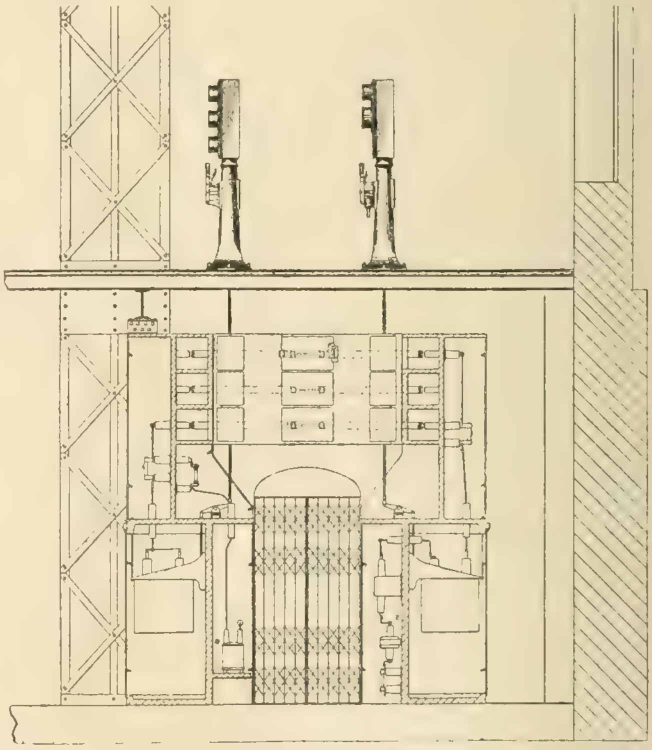


Fig. 10.—10,000-volt Switchgear, Penallta and Britannia Collieries.

Motors.—Originally all motors were controlled by screened panels, the high-pressure parts being protected by earthed metal screens, interlocked with the isolating switches. This type of switchgear is now displaced by pillars of rigid metal containing the isolating switch, oil switch, overload relays, series transformers, and ammeter, the isolating switch being interlocked with the cover which gives access to the switchgear.

All motors are controlled by overload relays actuating the oil switches. This gives definite protection and enables the supply to be renewed with a minimum of interruption; it also avoids the risk of fuses of the enclosed type being replaced with unprotected metal.

Lighting.—Underground this is confined to the immediate pit bottoms, and the haulage and pump rooms. The standard pressure is 110 volts, carbon-filament lamps being used.

The conductors are single rubber-insulated cables in stout, screwed, metal conduits, and are controlled by switches and fuses in cast-iron watertight boxes, all lamps being enclosed in watertight fittings.

The Powell Duffryn Co. have now between seven and eight thousand miners' electric lamps in use, or about two-thirds of the total. These lamps weigh about 5½ lb. each, compared with 3¾ lb. for the standard oil safety lamp, and they are welcomed by the miners, who prefer the additional illumination in spite of the additional weight.

The lamp batteries are charged in groups of 40 for lead and 26 for alkaline batteries by 110-volt continuous-current motor-generators, each charging stand having an ammeter and a variable resistance for adjusting the current.

At the larger collieries charging boards capable of holding 1,000 batteries are used, the lamps being stored in a standard rack in the lamp room when charged.

In the first instance the lead batteries were charged in seven hours; this is now extended to twelve hours. During charge the lead batteries are inspected to see that they are gassing, and on the completion of the charge the pressure of each is tested by a portable voltmeter.

With normal charging, the lamp will burn 12 to 14 hours. The candle-power is between 1 and 1½, depending upon the condition of the battery and of the type of bulb; whereas the ordinary oil safety lamp gives 0.5 to 0.6 candle-power.

The energy required for charging is of minor importance, and the cost of attendance for charging and cleaning the electric lamps is comparable with the cost of the daily attention necessary in the case of ordinary oil lamps. The important part of the cost is the maintenance of the battery and the lamp bulbs. In the case of the lead battery, the cost of lamp renewals equals the cost of battery maintenance.

Two types of battery are used. With the original lead type the positive plates lasted about nine months; new positive plates were then inserted to run a further nine months, before the negative plates required renewal. Improved positive plates are now on trial, and it is hoped that they will last eighteen months. The main point necessary for success with the lead type of battery is the non-spilling of acid. Cleanliness is everything.

The alkaline type of battery is now under trial. Although these are twice as expensive as the lead type, their life is very much longer. Sufficient time has not yet elapsed to allow the life to be definitely determined, but the makers give it as 15 years.

When it is possible to use lamps of the half-watt type, the useful field for miners' lamps will be much extended, as the batteries will then have to be charged only half as often as at present, with consequent decreased wear and tear, or, alternatively, increased light will be obtainable without adding to the weight.

In addition to the miners' lamp a second type is being tried for officials and hauliers. In this case the battery is strapped to the man's back and the lamp is fixed in his cap so as to leave both hands free.

In all positions where there is danger of gas the present type of electric lamps have to be supplemented by oil safety lamps, so that there may be a clear indication of danger.

Electric Signalling.—The increasing size of colliery undertakings and the use of haulages renders electric-bell signalling important. This system has been in use for about 25 years, and while its reliability in signalling over comparatively long distances has led to a decrease in the number of accidents, its safety has been questioned during the last two years.

Following an explosion of fire damp in the South Wales district in 1912, a notice was issued by the Home Office stating that "The explosion was proved beyond reasonable doubt to have been caused by the sparking of an electrical signalling bell, which ignited an accumulation of gas, resulting from a derangement of the ventilation due to the breakage of air pipes. It was afterwards proved experimentally that sparks from the bell in question, worked by a battery of 11½ volts, would ignite an explosive mixture of lighting gas and air; and the mixture was also ignited by sparks from signalling wires produced by a current of only four volts pressure. . . ."

It will be noted that these tests were made with an explosive mixture of lighting gas and air, which is ignited with much lower currents than pit gas. The second test at 4-volts pressure was made with an accumulator, which, owing to its low internal resistance, gave a current (not measured) quite disproportionate to that used for signalling purposes.

Following the explosion at the Senghenydd Colliery in October, 1913, a series of tests were made by the Home Office officials in January, 1914, at the New Tredegar Rescue Station, South Wales, at which the author was present representing the colliery owners. The signalling system in use at Senghenydd had been erected prior to June, 1911 (when the maximum pressure allowed in signalling circuits was 15 volts). The number of dry cells in use on the signalling circuits at the time of the explosion in no material case exceeded nine.

As H.M. Chief Inspector of Mines was not satisfied that these tests were sufficiently exhaustive to settle the safe limit, further tests were made at his request by Dr. Wheeler, at which the colliery owners were not represented. From these tests Dr. Wheeler deduced "That if the current flowing round the signalling circuit could be reduced below 0.30 of an ampere by introducing suitable non-inductive resistances there would be little risk of ignition by break flash below 25 volts pressure. The use of Leclanché cells, therefore, owing to their high internal resistance, should afford greater comparative safety than the use of dry batteries."

All these tests show that the principal danger point is the signalling wires, which are usually bare galvanised iron wire, the lead and return wires being run on insulators, signals being given from any desired point by pressing the wires together or by connecting them by metal bar, file, or knife.

Fig. 11 shows oscillograph records recently obtained at Faraday House across the contacts of bells connected to six "Dania" dry cells in series with a resistance of 10 ohms to show the maximum pressure across bell contacts at the moment of breaking and making the circuit.

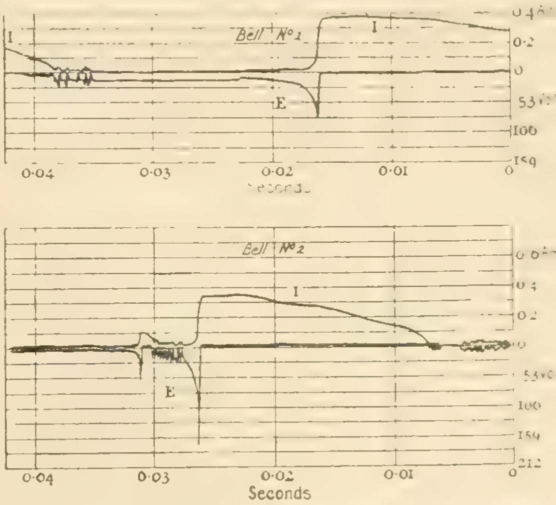


Fig. 11.—Oscillograph Records across Bell Terminals.

With a cell pressure of 9 volts on open circuit, a momentary pressure of 80 volts was reached with bell No. (1), while bell No. (2), which has the higher inductance, gave a momentary pressure of about 180 volts.

These records show the necessity of considering the inductance of any circuit before specifying the safety limit in terms of volts and amperes.

There are several alternative systems for securing safety. Where the distance of signalling is moderate the following system ensures safety:—

(1) Bare galvanised wires of No. 8 S.W.G. should be run high up on insulators on opposite sides of the roadway.

(2) Bells to have the contact-maker completely enclosed in a metal flame-tight cover, the contact being shunted by a resistance or a condenser, the shunt being inside the bell case.

(3) The number of dry cells to be limited to 10 (*i.e.*, 15 volts, as in the Regulations of 1905), the batteries being sub-divided into two groups, one half being placed at either end of the line.

(4) The batteries to be kept in locked boxes of only sufficient size to hold the standard number of cells, so that they must be replaced when run down instead of an indefinite number being added.

(5) Signals to be made by switches actuated by a "pull" wire, the switches being enclosed in rigid metal, the covers being flame-tight, and the switch contacts breaking contact through non-inductive resistances contained in the same metal case as the switch.

For long-distance signalling, a high-resistance relay with a shunted contact and enclosed in a flame-tight, rigid, metal case should be used, the shunt resistance being inside the relay case. Where this is done the line pressure can be kept down to 6 volts.

Alternatively the alternating-current system should be adopted. This system has the advantage of getting rid of battery maintenance. The transformer pressure should be 15 volts, and the bells should have their coils enclosed in rigid metal.

Schedule of Motors.

Powell Duffryn Steam Coal Company.

	No. of motors.	Horse-power.
Winding	9	7,550
Pumps—above 100 B.H.P.	36	14,490
below ,, ,,	60	2,120
Fans	11	2,720
Haulages—above ground	44	[illegible]
under ,,	55	6,370
Screens and elevators	61	1,285
Washery	20	[illegible]
Air compressors	[illegible]	[illegible]
Miscellaneous motors used for surface work	227	3,855
Total	[illegible]	[illegible]

Discussion in London.

Mr. C. H. Merz, in opening the discussion, said the paper gave an account of the largest electrified colliery system in the country; it was a complete and unified system standardised throughout. It should be noted that the work had been done without Parliamentary powers of any kind, and therefore it had made very great progress. He congratulated the author on the successful use of large gas engines, and considered that he could not have put the position more fairly as far as the power company's supply was concerned; in every case a connection to the power company's supply would pay if only for reserve purposes. There was also an economy in distribution, as it always paid to combine partially loaded circuits. As electrical engineers, they might confidently look forward to the proof that complete electrification of collieries was justified in all cases. The exhaust turbine was a temporary expedient, nothing more; the main steam winder was a remnant of the old form of engine, improved at the L.P. end by the turbine; but it could not be improved in that way at the H.P. end. He thought there was no doubt that the higher pressures and superheats in use would tend more and more to prime movers independent of the machines to be driven. It was unfortunate that the author's periodicity differed from that of the South Wales Power Co. If one were to go to the largest possible units the steam cycle would give an efficiency as good as the gas engine. He suggested that the Institution might put it to the author, whether he thought the regulations as to earth plates should be altered and how. With an electric winder on a power company's system it was not as a rule necessary to use the Ilgner set for equalising purposes, and he asked whether the set was really necessary for safety.

Mr. Sydney Evershed said the common system of two bare wires for bell signalling was too useful to be given up because suspicion had been cast on it. There was no real connection between the voltage of the battery and the danger point, and greater danger might arise from artificially blowing out the spark than letting it die out, owing to volatilised metal being blown off. He differentiated between a spark which, owing to cooling conditions present, would not produce an explosion, and a flash, which would do so. There was at his own works a piece of apparatus which had been running for months at a time breaking circuits, and a microscope gave no indication of sparking; it was quite possible to obtain sparkless operation. It would be safer to use copper, or copper-coated steel signal wires instead of iron wires, as there would be less sparking; zinc and iron were bad in this respect. Watertight bells were used in the navy successfully, with the hammer action outside.

Mr. W. J. Larke and the author had made a strong plea for the earthed neutral; it should be compulsory, as the perfection of the apparatus now used made such a system quite satisfactory. He thought the advantages of power factor correction were not really appreciated, as for 7s. or 8s. per K.V.A. connected, the correction would be applied over the whole system. He would have thought the squirrel cage motor preferable to the slip-ring type for small surface work.

Mr. Holliday, referring to the earth plate tests mentioned in the paper, said they had found that brown London clay had the least resistance of any earth. It would appear safe to allow a current density of 25 amp. per square foot of surface for 5 min. or 6 amp. for 3 hours. The earth resistance was much lowered by the presence of soluble salts. They had found it difficult to obtain an independent earth to measure from.

Mr. Rushton said published figures did not show that the electric winder had any great advantage over the steam winder, and to obtain the desired result it would be necessary to use the simplest system of winding and a cheap supply, which must be a bulk supply. Using induction motor winders, the peaks would not appreciably affect the power station; even if there were only two winders it would be possible to arrange for the acceleration of one to meet the retardation of the other. Equalising was expensive and should be avoided as far as possible. If numerous earth plates were used, the earth current would be distributed and there would be smaller potential differences.

Mr. Sparks, in replying, said the gas engines had been at work six or seven years and were very successful. The present mining regulations were ahead of anything in force in other countries, but there was still room for improvement. As regarded the Senghenydd disaster, while the electric bell signalling was suspected, there was a lamp chamber in the pit with naked flames in use.

DIESEL ENGINE BREAKDOWNS.

Mr. Percy Still, the acting Hon. Secretary of the Diesel Engine Users' Association, has sent us further particulars of the breakdown of a Carels Diesel engine at Oxford on September 26th last year. The engine was a three-cylinder 650-B.H.P. engine running at 240 R.P.M., but as it failed to give the guaranteed fuel consumption, it was reduced to 520 B.H.P. when running at 214 R.P.M. It was built by Messrs. Carels Frères for the Diesel Engine Co., Ltd. The breakdown occurred suddenly, without any intimation of anything being wrong. The big end of the connecting rod of the middle line was found in pieces, some parts being jammed between the crank webs and the bed plate. The connecting rod, complete with its small end and gudgeon pin, was kicked through the side of the frame supporting the cylinder and lay on the floor in a bent condition; the piston was badly smashed, and was fixed just below the cylinder; the cylinder liner and part of the base of the cylinder casing was smashed, and a portion of the bed plate at the middle line of the engine had been carried away by the blow of the connecting rod. The two outer lines of the engine were intact, and the crank shaft, although it had received several blows, was found to be still true. The fuel valve casing of the middle line was also cracked right through.

Mr. Philip H. Smith (of Messrs. Smith & Johnson) was called in as a Diesel engine expert to make an inspection and to report on the cause of the breakdown. He arrived at the conclusion that this was due to the failure of one of the bolts in the big end of the connecting rod, which he considered to be of insufficient strength for its purpose. The bolt failed at the neck just under the head, and the metal at the fracture had a crystalline appearance.

Mr. Philip Smith was invited to a meeting of the Diesel Engine Users' Association at which this breakdown was discussed, and there produced tables of figures relating to the stresses in the connecting-rod bolts of various Diesel engines. From these it appears that the Oxford bolts were stressed far too high; they were 2.35 in. in diameter, and bore a maximum stress of 7,000 lb. per sq. in.

Messrs. Willans & Robinson allow a stress of 3,750 lb. per sq. in., and on the assumption that the Willans bolt is "safe," the conclusion arrived at by Mr. Smith is that the Oxford bolt should be ¾ in. larger in diameter. The Willans bolt has been taken as standard, as it has been found in practice that it takes a violent seizure to make a Willans bolt fail, *i.e.*, stretch or actually fracture. On the basis of the Sulzer stress of 3,000 lb. per sq. in., it appears that the Oxford bolts should have been over 1⅛ in. larger in diameter, or about 3½ in.

The question of the metal forming the bolts was discussed. The Oxford bolt was of iron, the Willans and Carels bolts are of Siemens-Martin steel, and the Sulzer bolts are of crucible steel. Thus, not only were the Oxford bolts stressed higher than others, but they possessed the weakest material. Iron breaks at 24 tons per sq. in., Siemens-Martin steel at 28 to 32 tons, and crucible steel at 34 to 38 tons; hence the factors of safety are 7.7 in the case of Oxford, 18 for Willans, and 27 for Sulzer.

As regards the value of annealing, Mr. Smith expressed strong views against it, more particularly in reference to high tensile steels. He expressed his preference for crucible steel bolts, and recommended that big-end bolts be replaced after about 3,000 hours. The precise time would depend on the working stress of the bolts and upon the personal element; a man who permits the brasses to knock, indirectly causes more rapid deterioration of the bolts than a man who carefully adjusts the brasses immediately they require attention.

Mr. Philip Smith has used an empirical formula for a number of years by which the size of the big-end bolts can be gauged with a minimum of data and calculation. This runs as follows:—

Ascertain the diameter over the threads of a "safe" bolt. Then express this as a percentage of the bore. Take the same percentage of the bore of the engine, the bolts of which are to be compared with the "safe" bolt; multiply this figure by the ratio of the piston speeds, and the result gives the necessary diameter of the bolts of the engine under comparison. To instance a concrete example:—Compare the Oxford bolt with the W. & R. 75 B.H.P

The W. & R. bolt is 11 per cent. of bore; piston speed is 715 ft. per minute. The Oxford cylinder diameter is 23.6 in. and piston speed is 845 ft. per minute. Diameter of Oxford bolt should be $0.11 \times 23.6 \ (845/715) = 3.07$ in.

This rule is sufficiently near for all practical purposes, especially in consideration of the fact that after calculating the average stress mathematically one has to adopt a factor of safety in "good recognised practice" of 18 to 27 to ensure a "safe" bolt.

AUTOMATIC PROTECTIVE SWITCHGEAR FOR A.C. SYSTEMS.

The paper on this subject by Mr. E. B. Wedmore, which was first read before the Institution of Electrical Engineers on December 10th, 1914, and abstracted in our issue of January 8th, 1915, was discussed by the Scottish Local Section at Edinburgh on the 9th inst.

Mr. Page (Glasgow) argued that with the enormous increase in the output from generating plant which had taken place within the last two or three years the selective protection of feeders and distributors had not kept pace; in the majority of cases that was mainly due to engineers not having at their disposal reliable protective apparatus which they could buy at a reasonable price. Things were getting into better shape now. In Glasgow, until recently they had been satisfied to run with an unearthed neutral; in the majority of cases that enabled them to get through with faults on isolated feeders until the faulty section could be fed from another source. They found, however, that there seemed to be a critical stage in all systems; when, for instance, they in Glasgow reached 50,000 KW. of plant running, things happened which were perfectly sound with only 30,000 KW., and a new view of the situation had been forced upon them. They had now decided to earth the neutral, while they hoped by using to a considerable extent core-balancing protection that they would be able to get rid of what were really minor faults to earth without affecting the rest of the supply. They were fortunate in having three-pole relays, and they proposed to connect the series transformers which were at present supplying the instruments in such a way as to get core-balancing with three transformers. They could use their standard three-pole relays—two poles for overload protection, and the third would take care of faults to ground. The problem of the great majority of supply engineers was that they had to adopt some method of selective protection which would be suitable to a cable system already laid. If that was accepted, the low settings were not of very much value, because in parts of the system usually they would have two or three feeders in parallel from the main generating station to the first sub-station, and from thence ring-mains or other system to the bus-bars of the substation further on. If they were going to get through on relays upon such settings the system must obviously be designed to stand up to it and the fine settings were not of any great value. Where a supply was given to sub-stations beyond the first sub-station bus-bar or on a ring-main, balanced core protection was quite useless; if they had an earth, say, upon these ring-mains beyond the sub-station, it was not selective. They would bring out feeders at the power end, which was the very thing they did not want to do. So far as the use of fixed time relays was concerned, it seemed to him that no engineer in considering the protection problem would select either of the arrangements suggested, because if the fault should develop near the power station the protective device would not clear that fault until, say, three seconds had elapsed, and by that time the generating apparatus would probably have failed. The suggestion for balanced cores for generators would not, he thought, be ever considered nowadays, more especially when there were other and better systems, while it was shown in one of Mr. Wedmore's diagrams that the adoption of the system rather encouraged circulating currents in the neutral. The split conductor system, while they had not had any experience of it, gave promise of being very satisfactory, and Glasgow was adopting it on all new work. As to the suggestion that for the protection of all open-ended feeder circuits the core-balancing system should be recommended, he held that the only thing the core-balancing system could do was to clear the faults which were initially faults to ground. It seemed that Mr. Wedmore ought to have included something else to take care of shorts between phases.

Mr. D. Macfarlane Macleod said that in his opinion the failures which occurred on an extra-high-tension three-phase system, particularly those of higher voltage, took their origin in protective devices. Of course, there seemed to be a limit to the pressures, which he would conclude at 5,000 or 6,000 volts, at which one might expect a quite satisfactory performance, and when one went beyond that there seemed to be a distinct effect upon the protection transformer windings, and the result was that in the course of time instead of avoiding trouble they really caused it. If one were to take into account the failures of supply arising from series transformers one could prepare a formidable indictment against some protective devices, and make out a good case for others. The remedy seemed to be to concentrate the designers' attention on the improvement of these devices. With regard to the use of core-balancing devices, it seemed to him that these devices would remain inoperative in the event of a fault developing upon a sub-station bus-bar or upon any apparatus directly connected with the bus-bars. That was one of the limitations of the core-balancing system, and, indeed, of all protective systems, and they must resort to overload relays in instalments at the power station.

Mr. Newington suggested that though insulation had improved they were not much further advanced than they were in the days of shellacked tape. One felt that had all the brain-power now devoted to electrical devices been put into methods of improving or finding out some new form of insulation these protective devices might not have been necessary.

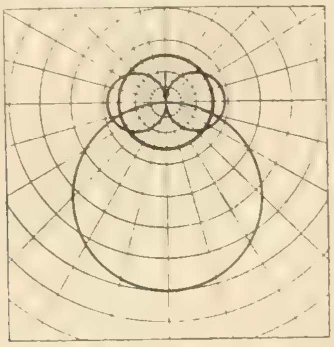
Mr. Seddon pointed out that while the circulating-current system shown in the paper was an advance as regarded certainty of action over older methods, it did not isolate the generator in case of failure of excitation as did the reverse-current relay. Perhaps some form of relay energised by the exciter could be used to hold in one of the current-transformer connections. The author had described some ingenious methods of protecting parallel feeders, but he would ask, in the case of biassed protection relays, what happened when one of the parallel feeders had to be switched out of service? It would seem that the remaining feeder would be cut out automatically as there would be no pressure on the restraining coil.

Mr. Wedmore, in his reply, explained that if the neutral point system was installed and one of the phases broke down to earth through the air they got an arc which had all the characteristics of the arc with capacity and shunt, and by its introduction in the circuit they got the well-known humming which Mr. Duddell had explained to them. That humming set up high-freqency and dangerous disturbances in the system which were liable to cause static troubles in unexpected quarters. They did not know enough yet of the metallic arc to know how to put resistance to earth. On the points raised by Mr. Page, when the auxiliary switch had been used, for example, to cut in in time with a phase in the shunt operating coil, thus making the relay automatically into a straightforward time limit overload relay, they could use the switch to get the relay out of circuit. That was to say, one relay operating, the other relay was cut off circuit and converted into a relay of a different type, and was again automatic and operated correctly, whether the cut-out feeder had no faults or was cut out by hand without disturbing balance protection. There was another way to do this on the auxiliary switch by introducing a setting above what each feeder was expected to carry, the feeder being left in circuit protected by the overload relay. If one of the feeders was cut out, they must make use of some of the existing well-known methods of protection. As to transformers, the protective systems advocated were for new work and could generally be carried out with transformers with a single-turn primary which admitted of better insulation than a transformer having a primary winding. He thought there was little reason to fear trouble with the sub-protective transformers as required for the split conductor system. At any rate, the results given so far with the apparatus had been successful, especially as the apparatus had to be regarded as in the development stage.

THE PRACTICAL RATING OF ELECTRIC INCANDESCENT LAMPS.

The question whether filament lamps should be rated by wattage or candle-power formed the subject of discussion by the Illuminating Engineering Society on March 16th last, when Mr. F. W. Willcox put forward claims in favour of rating by wattage and most of the subsequent speakers favoured candle-power rating.

In opening the discussion, Mr. Willcox said that candle-power as a practical lighting unit was being displaced largely as a result of its own deficiencies. Rating by candle-power was liable to abuse and had been abused, particularly in the case of lamps with very irregular polar distribution curves. Size rating of filament lamps by total watts had forced itself into practical use as being a simple definite rating which could not be manipulated as candle-power had been. The watt-rating had been used in the States and in Great Britain for four or five years past without any serious objection or any practical difficulty. There had been and would be no complete abandonment of the candle-power unit. Total wattage had simply been adopted as a practical size rating, the watts remaining fixed and candle-power values changing as lamp efficiencies improved. The general trend of practice was towards higher lighting values, and this was ensured by rating on a fixed watt basis. Candle-power values would still be used as needed, but they would be derived values obtained by dividing the watt rating by the efficiency. The majority of lamps were employed on public supply circuits where a definite value in lamp wattage was required by the station engineer and consumer for estimating and checking the cost of service. Practical illumination determinations and estimates were now calculated almost universally on a total watts basis, which simplified matters greatly. Having measured the floor area of a room, this figure multiplied by a constant, representing watts per square foot required to give the desired illumination, gave the total watts required; the actual requirements were determined without reference to candle-power. With candle-power as the fixed primary rating, the wattage of lamps would have to be varied as improved efficiency was attained, and this would introduce manufacturing complexities and confusion for the consumer and supply engineer. In the case of tungsten lamps, for instance, efficiencies had advanced from 1.25 to 1.0 watts per C.P. during the last two years, and if manufacturers had held to fixed C.P. and had lowered wattage as efficiency increased, we should now have the original watt scale over again, but with lamps increased 20 per cent. in candle-power for given wattage. In the meantime there would have been confusion and complexity, and the course which had been adopted, viz., keeping watts constant, was preferable to changing watts and periodically arriving back at the same watt values. With fixed C.P. rating it was necessary, owing to the lower efficiency of 200-250-volt lamps, to have two sets of watt values, one for 100-130 volts and another higher set for 200-260 volts. This would call attention to the lower efficiency of the high-voltage lamps and would lead to complaints from central-station engineers who had to use a 25 or 35-w. lamp whilst a neighbouring station was able to offer a 20 or 30-w. lamp. The Committee on Nomenclature and Standards of the American Illuminating Engineering Society had defined the luminous flux of a lamp as radiant power evaluated according to its capacity to produce the sensation of light. Radiant power was expressed in watts and the evaluating (efficiency) factor was a simple number. It was not necessary to measure candle-power to determine efficiency as this could be determined accurately by temperature by colour match. This method was particularly useful when dealing with lamps of great brilliancy and high temperature, such as half-watt lamps. As candle-power or some other unit would be retained to express the luminous value of a lamp where this was required, it was pertinent to consider the most desirable unit. The fundamental requirement was a definite unit which should always mean one definite thing. This the lumen was and the candle-power was not. Watts per lumen or lumens per watt was perfectly definite, but "watts per candle" at once raised the question as to whether maximum c.p., mean horizontal, mean spherical or mean hemispherical (upper or lower) candle-power were meant. The latitude allowed by the expression "candle-power" permitted and encouraged misrepresentation in lamps, but the lumen could not be manipulated and the lumens output of a lamp remained the same whatever the shape of filament and independent of the reflectors, etc., used, except as regards absorption losses in accessories. There could be desired no more striking illustration of the confusion possible, under a candle-power rating, than the accompanying geometrical diagram, which represented the same total flux of light (*i.e.*, the same lumens) emitted in different directions and giving very different ratings on any other basis than mean spherical candle-power. The output in lumens was simply 4 π × m.s.c.p., and a lumen was easier to think and speak about than a mean spherical candle-power. Flux of light expressed in lumens seemed to be the only unit suitable for expressing the luminous value of modern lamp and reflector or diffusor combinations, which differed so enormously in the distribution they provided from any given lamp. Finally, the lumen was a very convenient unit in practical illumination calculations.



Ideal Curves showing same Total Light Flux in various Forms of Light Distribution.

Mr. C. H. Wordingham said that his views as now expressed on this controversy, which appeared to have reached a deadlock, were from the commercial, scientific and general point of view, uninfluenced by the exigencies of a Government Department which often compelled a narrow view to be taken. The problem had to be considered from three points of view, those of the manufacturer, the central station engineer, and the public. Collectively manufacturers were in favour of watt rating, but individually they seemed to care little about the matter. Central-station engineers took the narrowest view possible and feared that they would be handicapped in their competition with other illuminants if they specified the candle-power of lamps; by working on a watt basis they mystified the consumer and hoped to keep bills constant as the efficiency of lamps improved. Actually, it was essential to compete with other illuminants in price and the lower the price could be brought, the more extensively would electric light be used. The public wanted a certain amount of light and to pay as little as possible for it. Distinction must be made between rating and marking. It was insufficient merely to mark lamps in candle-power. They must be made in a series of even candle-powers, not in a series of even wattages. In his opinion all Mr. Willcox's arguments in favour of watt rating told in the opposite direction, and the strongest argument against watt rating was the fact that lamps of given wattage were of different candle-powers according to their voltage. To rate a radiator by watts input was all right, because the whole input was converted to heat, but to rate a motor or a lamp by input was absurd, because the efficiency was variable. The American Nomenclature Committee's definition, which could be applied to measuring light in watts, referred to watts output, not input. Without photometry it was impossible to tell what a lamp was doing, and both watts input and candle-power output in every direction were necessary particulars.

Prof. S. P. Thompson (communicated): Lamps should be marked in volts, watts and, if desired, spherical candle-power. A standard of watts should be raised since wattage could be verified more easily than m.s.c.p. and wattage was more nearly constant than candle-power during the life of the lamp.

Mr. A. P. Trotter (communicated): Mean horizontal candle-power had no significance in such lighting units as the "Downlight" lamp. The lumen was not a commercial lighting unit and "lumens per watt" was a method of expression for experts, not for the public.

Mr. T. W. Goodenough (communicated): An actual, not a nominal, rating was required. A buyer with no photometer had to depend on the commercial honesty of the lamp seller, which was often very different from his personal honesty. Since the ratio of input to output was not constant, lamps should be rated and marked in power consumption and candle-power: neither item of information was sufficient without the other. If the meaning attached to candle-power were standardised there would be no need to use the lumen. Polar curves were necessary for use by illuminating engineers and foot-candles on the working plane was a good basis for illumination specifications, subject to a guarantee as to power consumption.

Mr. H. T. Harrison (communicated): To rate in anything but light units was illogical since the light obtained by given power consumption depended entirely on the lamp efficiency. A light-giving rating accurate within 5 or 7 per cent. was near enough for practical purposes. Candle-power had become fixed in people's minds as a measure of light-giving power, and was preferable to the term lumen, so long as the direction of measurement was indicated by symbols. Interior lighting should be specified by foot-candles; it was ridiculous to specify it by watts per sq. ft.

Mr. C. C. Paterson said that rating should certainly be by output since this was what mattered to the user. Further, watts applied only to electric lamps, and the Illuminating Engineering Society should seek a rating equally applicable to all lamps. Changes in efficiency and the variable distribution obtainable from different fittings introduced some difficulty in deciding between flux and candle-power bases, but rating should certainly be on the basis of light-giving power. m.s.c.p. or lumens had a definite reduction factor to candle-power in any particular direction, and could therefore be applied easily to illumination calculations. For the present, requirements would seem to be met by standardising existing c.p. bases. Ordinary glow lamps and upright gas mantles should be rated in mean horizontal candle-power and street lighing units in mean lower hemispherical candle-power. The vital point, however, was to rate in light-giving power and not on output.

Prof. J. T. Morris considered both watts and candle-power should be marked on every lamp since the user was interested in both factors. Rating should be on output and not on input. It would be worth manufacturers' while to supply polar curves for each type of lamp and for the lamp with the fitting they considered most suitable. They should also give the illumination on a horizontal surface at two distances below the lamp, the distances depending on the use to be made of the lamp.

Mr. McIntyre favoured rating by candle-power, and thought that if the light output of a lamp had not been difficult to measure the watt rating would never have been proposed. Manufacturing convenience might be increased by watt-rating, but the user needed a c.p.-rating and would call for it when the present simple equivalence between watts and c.p. no longer existed. Central station engineers should surely be credited with intelligence sufficient to handle their business equally well whether consumers' lamps were rated by watts or candle-power. The lumen-second was a useful unit representing a definite quantity of light. In addition to the polar curve of candle-power, he had found it useful in comparing various lamps, to prepare a curve showing illumination in a horizontal plane 5 or 10 ft. in diameter, 5 ft. below the lamp. In libraries or other rooms with obstructing furniture it was necessary to specify individual lamps in individual places.

Mr. Fletcher said that most of the previous speakers seemed to think that it was proposed to specify only the wattage of lamps. There was no such suggestion. Watts, watts per c.p., and candle-power were all given in standard lists, and generally polar curves were given as well. Makers were quite prepared to stamp candle-power values on lamps, and he, personally, was quite prepared to accept any standard system of having lamps tested on a uniform basis by the National Physical Laboratory as suggested by Mr. Gaster.

Mr. T. E. Ritchie said he would be very sorry to see any more extensive use of watt rating than at present. Watt rating led to absurd and misleading results in arc lamp practice. For all lamps, and particularly where the distribution curve was unusual, he favoured rating in candle-power (m.h.s. upper or lower with reduction factor for m.s.c.p.) and the provision of the polar curve. Using the lumen as unit eliminated any confusion as to the precise candle-power designation intended, and did not lend itself to inadvertent or other inaccuracies.

Mr. J. G. Clark showed a number of polar curves to demonstrate the difficulty of rating gas lamps by candle-power. The polar curve and consumption data were necessary and sufficient to express completely the power of the lamp. There being no equivalent to the watt in gas parlance, he suggested the term *cubour* (1 cu. ft. per hour), which might also be called a *murdoch* (after Murdoch, the originator of gas lighting). [Following this suggestion, a representative of the paraffin lamp industry proposed for the latter the unit *pint-day* to be called a *rockefeller*!] Mr. Clark considered it desirable that architects should specify interior lighting in foot candles.

Mr. M. Foulds could see no reason for the present controversy, both watts and candle-power being factors which it was necessary to specify.

Mr. le Marechal admitted that there were advantages in making lamps to a watt rating, but if desired makers were willing to mark both watts and candle-power on lamps.

Mr. Mullard maintained that as users were accustomed to candle-power rating, it would be confusing and undesirable to try to convert them to the use of watts and lumens.

Mr. Stroud said that whatever the rating it should be accurate. The hefner should at any rate be discarded. Since some sort of shade had to be used, which quite altered the distribution of light from the lamp, it seemed to him that consumption (*i.e.*, watts input) and efficiency in watts per M.S.C.P. were the particulars which should be specified and form the basis of rating.

Mr. F. S. Tilley urged the necessity for uniformity in the method of judging the performance of lamps, whatever that method might be. Standardised rules were needed and should be adopted universally. At present it was impossible to get uniform results from tests by different people.

Mr. J. S. Dow said that for a general scientific comparison between various lamps and reflectors it was essential to take account of the candle-power in all directions, whether measuring it as M.S.C.P. or lumens. This was imperative since almost any desired polar curve could now be obtained by use of suitable reflectors. The illuminating engineer must have the polar curve in every case, and it was interesting to note that practically every manufacturer now included polar curves in his lists, whereas five years ago they hardly knew the meaning of such curves. Given a calibrated polar curve for every lamp and reflector unit, it was an easy matter to predetermine and ensure obtaining desired illumination. To prevent the use of fittings which directed all the light on to the working plane, to the detriment of general lighting, interior illumination should be specified by illumination on the working plane and a certain M.S.C.P. or lumens for given cubical space.

Mr. L. Gaster said that any legislation in lighting matters and any accurate predetermination of results depended on reliable makers' data on a uniform basis. This could be obtained by standard tests by such a body as the National Physical Laboratory, and makers should be entitled to claim that some, at any rate, of the tests be carried out under conditions specified by them, so that indisputable evidence would be available as to the capabilities of lamps in the special applications for which they were intended.

In reply, Mr. F. W. Willcox said that the views put forward that evening had been advanced in America several years ago and had been refuted by practical experience. The crux of the matter was whether watts or candle-power should be fixed, and practical experience and evolution had shown watt rating to be convenient and acceptable.

HIRING POWERS FOR COOKING APPLIANCES.

In sending us the following extract from the Minutes of the Glasgow Electricity Committee, Mr. H. Faraday Proctor, Hon. Secretary of the I.M.E.A., points out that the terms accepted by the Scottish Contractors' Association are less favourable to them than those embodied in the I.M.E.A. Bill. The report of the special sub-committee on hiring of cooking appliances, etc., from which the extract is made, was dated March 4th, 1915, and states that as the result of a conference with a sub-committee of the Electrical Contractors' Association of Scotland (Glasgow Branch) as to the establishment of a central show-room in the city, with the following objects in view: (a) to provide facilities for present and prospective users of electrical energy; (b) to exhibit a selection of the latest electrical appliances in one place instead of having to visit numerous places scattered over the city; (c) to promote the use of electrical appliances for lighting, heating, cooking, etc.; and (d) to educate the public with regard to the possibilities of these appliances—the electrical contractors had now agreed that the proposed show-room should be equipped and managed entirely by the Corporation for five years from the date of opening the same, on the following lines:—

That the show-room shall exist primarily for the exhibition of electrical appliances;

That the contractors and their customers shall be afforded all possible facilities for inspecting the stock of appliances kept in the central show-room;

That any electrical contractor who shall request the Corporation to sell from the stock in the central show-room any fittings, accessories, lamps, or apparatus shall be entitled to receive out of the purchase price one-half of the discount which he would have received from the makers, had the contractor sold such apparatus to his customer direct;

That all fittings, accessories, lamps, and apparatus sold from the show-room shall be at list prices, such list prices to be the usual current list price of the firm supplying goods to the show-room;

That, as far as possible, sales initiated in the show-room shall be completed through the contractor who directed or sent the customer to the show-room;

That all wiring work resulting from inquiries at the show-room shall be done direct by a contractor, and no undue preference shall be shown to any one or more electrical contractors;

That the hiring of apparatus shall not be undertaken from the show-room, but the show-room management shall be free to lend apparatus for a short period to possible customers under exceptional circumstances, and make a charge, if they think fit, for the loan of such apparatus; and

That all charges made to consumers by the show-room management shall be separately stated on the relative demand notes sent to consumers, and all sums paid to and obtained by the Corporation as a result of business done in the show-room shall be separately shown in the annual accounts of the Corporation Electricity Department, which accounts are audited by an independent auditor.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

CANADA.—With reference to the notice published in a recent issue of the Electrical Review calling attention to a revision of the Canadian Tariff, the Board of Trade notify that they have now received the full text of the Resolution of the Canadian Parliament, having effect from February 12th. By this resolution it was provided that in addition to the customs duties formerly levied additional duties of 5 per cent. under the British Preferential Tariff, and 7½ per cent. under the Intermediate Tariff and General Tariff should be imposed. These duties will also be levied on goods formerly free of duty, with certain exceptions, which include advertising and printed matter imported by mail; locomotives and passenger and goods wagons; models and inventions; scientific apparatus, utensils and instruments.

The effect of this alteration in the Canadian Tariff will therefore be to increase by 2½ per cent. *ad valorem* the amount of the preference formerly granted to British goods.

The Board of Trade have received a communication from H.M. Trade Commissioner in Canada drawing attention to the regulations respecting the importation of samples *via* the United States into that Dominion. H.M. Trade Commissioner states that if samples have not been used in the United States for the purpose of securing trade, but are brought into the Dominion direct from the United Kingdom *via* the United States, duty will be collected thereon at the Canadian port of entry, and the amount collected will be refunded if the samples are exported again within a period of twelve months after the date of entry. If, however, the samples have been used in the United States for the purpose of securing trade, duty will be collected thereon and cannot be refunded when the samples are re-exported.

NORTHERN RHODESIA.—A proclamation recently issued by the Northern Rhodesia Customs Authorities states that in future duty levied *ad valorem* on imported goods will be assessed on the true current value of the goods when sold for home consumption in the open market in the principal markets of the country from which, and at the time when, the goods were exported, including carriage to the port of shipment and the cost of packing and packages, but not including agents' commission when such commission does not exceed five per cent., provided that in no case shall the value for purposes of assessing duty be less than the cost of the goods to the importer at the port of shipment.

COSTA RICA.—A Presidential Decree recently issued provides for a surcharge of two per cent. on the duties on all imported goods, to be levied from February 1st. Goods imported for consumption in the Province of Lima will, however, be exempt from this surcharge as they are already subject to a similar surtax imposed by a previous decree.

BRITISH COLONIES AND PROTECTORATES.—Regarding the proposed application of the United Kingdom rules respecting the requirement of certificates of origin for various goods shipped from certain neutral European countries to the various British Colonies not possessing responsible Government and the Protectorates, the Board of Trade have now been informed by the Foreign Office that goods shipped from such countries to any British Colony or Protectorate on or after March 15th last must be accompanied by a certificate of origin exactly as if they were being shipped to the United Kingdom. No certificates are, however, at present required in ordinary circumstances in the case of goods shipped to Egypt. It may be stated that regulations have already been adopted regarding the requirement of certificates of origin in the case of goods shipped to British India, Australia, New Zealand and South Africa, but similar certificates are not at present required for imports into the Dominion of Canada and Newfoundland. This is, of course, irrespective of the ordinary certificates of origin required for British goods to secure entry under the Preferential Tariff.

SOUTH AFRICA.—The Board of Trade have received from H.M. Trade Commissioner in South Africa information as to a revision of the South African tariff. In addition to certain alterations in the duties on specific goods not of interest to the electrical trade it has been decided to increase the general rate on goods not specially mentioned in the tariff from 15 per cent. *ad valorem* to 20 per cent. *ad valorem* with a rebate of 3 per cent. *ad valorem* as formerly in the case of goods of British origin. This rate is applicable to a large number of electrical goods. The new duties are payable as from March 5th last.

HOLLAND.—A recent Royal Decree re-imposes the prohibition of the exportation of nitric acid, which has been suspended since August 23rd last. A further decree withdraws previous decrees relating to the prohibition of the export of copper and copper alloys, and prohibits the export of copper and copper alloys whether as raw material or as manufactures, unless used as part of any manufactured article of which copper or copper alloy does not constitute a main component part. The right to decide whether copper or copper alloy forms a "main component part" of any manufactured article is reserved to the Minister of Finance.

FRANCE.—A Presidential Decree, dated March 3rd, suspends the import duties on rails and fishplates for the repair of ways and communications which are of importance for national defence. This latter condition is to be proved by means of certificates delivered by the Administration des Travaux Publics. A further Decree of the same date suspends, as from March 4th for a period of six months, the import duties on rails and fishplates for tramways up to a total quantity of 5,000 metric tons of rails and 250 metric tons of fishplates. The privilege of duty free admission under the terms of this Decree is contingent upon the production, in the case of each consignment, of a certificate from the local authority attesting that the material imported is actually destined for the installation or repair of tramways.

BRITISH ELECTRICAL PATENTS APPLIED FOR OR COMMUNICATED BY RESIDENTS IN GERMANY, AUSTRIA OR HUNGARY.

The following list of British Patents, applied for or communicated by residents in Germany, Austria, and Hungary will be found of interest to manufacturers or others desiring to avail themselves of the provisions for Compulsory Licence under the new Patents Act. Intending licensees should, however, not assume without further enquiry that any patent in the list is not already assigned or licensed, or that the applicant is an "enemy subject."

[illegible] the ELECTRICAL REVIEW by Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and 6, Lord Street, Liverpool.

1905.

No. 8,168.—H. Usener, Kiel. Electric signalling.
No. 8,975.—B. Kugelmann, Bad Kissingen, Bavaria. Telephone systems.
No. 9,443.—A. Clemm, Mannheim. Electrolysis.

1906.

No. 302.—Siemens Bros. & Co. (communicated by Siemens-Schuckertwerke Ges., Berlin). Measuring electricity.
No. 2,707.—Siemens Bros. & Co. (communicated by Siemens-Schuckertwerke Ges., Berlin.) Distributing electricity.
No. 2,911.—[illegible], near Breslau. Spark-arresters.
No. 4,813.—Siemens & Halske A.G., Berlin. Telegraphs controlling electric generators, etc.
No. 5,153.—Elektrizitats A.G. Vorm., W. Lahmeyer & Co., Frankfurt/Main. Electric motors.
No. 5,250.—Allgemeine Elektrizitats Ges., Berlin. Electric distribution.
No. 8,526.—Elektrizitats A.G. Vorm. W. Lahmeyer & Co. Frankfurt/Main. Dynamo electric machines.
No. 10,457.—R. Hopfelt, Berlin. Electric conductors.
No. 10,778.—Siemens & Halske A.G., Berlin. Railway signals and points.
No. 11,181.—Siemens Bros. & Co., London (communicated by Siemens & Halske A.G., Berlin). Electric switches.
No. 11,498.—[illegible], Vienna. Electro-deposition.
No 12,153.—H. Kuzel, near Vienna. Electric lamps.
No. 12,52[illegible]—H. Rochling & W. Rodenhauser, Volklingen/Saar. Electric furnaces.
No. 13,693.—F. Kuhlo, Berlin. Electric conductors.
No. 14,616.—A. Reimann, Prague, Weinberge. Non-conducting coverings.
No. 14,901.—Deutsche Gasgluhlicht A.G. (Auerges.), Berlin. Electric lamps.
No. 14,935.—Allgemeine Elektrizitats Ges., Berlin. Dynamo-electric machines.
No. 14,945.—Siemens Bros. Dynamo Works (communicated by Siemens & Halske A.G., Berlin). Dynamo-electric machines.
No. 15,021.—Consortium für Electro Chemische Industrie Ges., Nuremberg. Electric lamps.
No. 15,231.—Siemens Bros. & Co., London (communicated by Siemens-Schuckertwerke Ges., Berlin). Electric distribution.
No. 16,087.—A. Scherbius, Frankfurt/Main. Electric motors.
No. 16,323.—H. Junkers, Aachen. Thermostats.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

3,657. "Electric switches." E. G. K. Anderson. March 8th. (Convention date, March 7th, 1914, United States.) (Complete.)

3,660. "Electric condensers." W. H. Wilson. March 8th.

3,668. "Method and means for protecting apparatus on alternating-current systems." A. G. Collis March 8th.

3,672. "Electric cigar or cigarette lighters." G. A. Vandervell. (Complete.)

3,676. "Synchronisers." G. J. van Swaay & H. I. Keus. March 8th. (Convention date, March 12th, 1914, Holland.) (Complete.)

3,688. "Control apparatus for searchlights and the like." H. S. Hele-Shaw & F. L. Martineau. March 8th.

3,690. "Electric igniting apparatus for gas burners." South Metropolitan Gas Co. & W. J. Buckett. March 8th. (Complete.)

3,710. "Frames or racks for use in charging secondary electric batteries." J. G. Patterson. March 8th.

3,723. "Process for the electro-deposition of lead." S. O. Cowper-Coles. March 9th.

3,724. "Process for coating or plating metal sheets with other metals by electro-deposition." S. O. Cowper-Coles. March 9th.

3,728. "Method and means of renewing the wearing parts of trolley wheels of electric tramcars, omnibuses, and the like." L. Loukes & W. J. Hunter. March 9th.

3,733. "Electrical switches." A. C. Wynne. March 9th.

3,760. "Incandescent electric lamps." A. A. Canton. March 9th.

3,762. "Connections for electrical conduit fittings." G. A. Edman. March 9th.

3,763. "Electrical fuse-boards or the like." J. H. Tucker & J. A. Crabtree. March 9th. (Complete.)

3,774. "Electric signalling apparatus." E. Walker. March 9th.

3,796. "Collector gear for overhead trolleys." T. G. Poole. March 10th.

3,805. "Process for forming the driving-bands on projectiles." S. O. Cowper-Coles. March 10th.

3,837. "Electro-magnetic switches." Igranic Electric Co., Ltd. March 10th. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

3,840. "Apparatus for igniting miners' safety lamps." R. Lambourne. March 10th.

3,841. "Step-by-step signalling apparatus." Sterling Telephone & Electric Co., Ltd., F. G. Bell & H. W. Barclay. March 10th.

3,855. "Electric heating and cooking apparatus." Landis & Gyr Akt. Ges. March 10th. (Convention date, March 18th, 1914, Germany.) (Complete.)

3,856. "Method of and means for measuring electric current." Landis & Gyr Akt. Ges. March 10th. (Convention date, March 10th, 1914, Germany.) (Complete.)

3,860. "Electric fire alarm contacts." R. G. Hislop. March 11th.

3,880. "Means for operating bells by electricity." C. Herrde. March 11th.

3,882. "Magnetos." G. A. Lister, E. A. Watson & M.-L. Magneto Syndicate, Ltd. March 11th.

3,891. "Electric apparatus for therapeutic and like purposes." G. Vernon-Ward. March 11th.

3,910. "Magnetic clutches, brakes, or the like." Compagnie de Fives-Lille. March 11th. (Convention date, May 1st, 1914, France.) (Complete.)

3,912. "Incandescent electric lamps and the like." G. Hookham. March 11th.

3,914. "Light-reducing device for motor-vehicle electric lamps." W. Holt. March 12th.

3,918. "Electrical high-tension fuse-boxes." D. T. H. Miles and A. Lawrence. March 12th.

3,925. "Electric heating vaporiser or system of electric heating for vaporising purposes in connection with internal-combustion engines." A. McA. Fyfe. March 12th.

3,927. "Incandescent electric lamps." E. Booth & N. R. Booth. March 12th.

3,928. "Bonding devices for electrical conduit systems." D. L. J. Broadbent. March 12th.

3,932. "Method of and apparatus for winding the armatures of electric machines." G. Schongut. March 12th. (Convention date, March 13th, 1914, Hungary.) (Complete.)

3,949. "Incandescent electric lamps." C. A. Harrison. March 12th.

3,950. "Wireless receiving systems." L. de Forest & C. V. Logwood. March 12th. (Convention date, March 12th, 1914, United States.) (Complete.)

3,953. "Electric furnaces." E. K. Scott & F. Howles. March 12th.

3,954. "Wireless telegraphy or telephony." Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. March 12th. (Convention date, February 5th, 1915, Germany.) (Complete.)

3,975. "Manufacture of dynamos and electric motors." Royce, Ltd., and W. C. M. Matterson. March 13th.

3,984. "Controlling systems." A. F. Dixon. March 13th. (Convention date, March 16th, 1914, United States.) (Complete.)

3,985. "Synchronising system for multiplex telegraphy." P. M. Rainey. March 13th. (Convention date, March 26th, 1914, United States.) (Complete.)

3,986. "Line indicators." A. F. Dixon. March 13th. (Convention date, March 16th, 1914, United States.) (Complete.)

3,987. "Printing-telegraph receivers." A. F. Dixon. March 13th. (Convention date, March 19th, 1914, United States.) (Complete.)

3,993. "Process for coating metallic surfaces with lead." S. O. Cowper-Coles. March 13th

3,997. "Electrically-driven radial-arm drilling and the like revoluble-head machines." H. Wilkinson. March 13th.

4,006. "Attachments or fittings for telephone mouthpieces and earpieces." A. M. Vargas. March 13th.

4,012. "Apparatus for cut-out switches of the push or pull type." T. Bozzetti. March 13th. (Convention date, March 14th, 1914, Italy.) (Complete.)

4,017. "Devices for wireless telegraphy and telephony." A. U. Sarnmark. March 13th. (Convention date, March 13th, 1914, Sweden.) (Complete.)

4,026. "Morse key." W. Lamont & R. Craig. March 13th.

PUBLISHED SPECIFICATIONS.

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1914.

4,292. Automatic Recording and Alarm Apparatus for Measuring Instruments. J. Harger. February 19th.

4,472. Thermo-electric Regulators. British Thomson-Houston Co. February 20th. (General Electric Co.)

4,554. Electric Motor-control Systems. British Thomson-Houston Co. (General Electric Co.). February 21st.

4,562. Ignition Magneto Generators. H. C. Mueller. (July 17th, 1913.) February 21st.

4,618. Thermal Switch. G. A. James. February 23rd.

4,655. Electric Light Lamps for Motor-driven Power and Motor Vehicles. A. Christmas. February 23rd.

4,747. Diaphragm Horns. E. V. Gratz. February 24th.

4,798. Timing and Stop Mechanism for Illuminated Advertising Devices. W. R. Scott. February 24th.

4,934. Incandescent Electric Lamps and Connectors therefor. C. C. Regnart. February 25th.

4,943. Electrical Heating Apparatus. M. A. V. London. February 25th.

4,964. Locking Devices for the Bulbs of Incandescent Electric Lamps. J. A. Vice. February 26th.

5,038. Acoustic Instruments. H. W. Hess. February 26th.

5,069. Electric Switches. St. Helens Cable & Rubber Co., and J. C. White. February 27th.

5,115. Metering Systems for Machine Switching Telephone Exchanges. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). February 27th.

5,359. Electrical Fuse Boxes. P. Rosling, W. H. Nichols & W. T. Henley's Telegraph Works Co. March 2nd.

THE
ELECTRICAL REVIEW.

Vol. LXXVI. APRIL 2, 1915. No. 1,949.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: April 2, 1915. [No. 1,949.

	Page
The Ilford Railway Collision	461
Rubber	462
Artistic Lighting Fixtures	463
Electric Towing System for the Panama Canal Locks (*illus.*)	464
Battery-Charging for Electric Vehicles, by F. Broadbent ...	467
Stresses in Convex Dished Ends (*illus.*)...	468
New Electrical Devices, Fittings and Plant (*illus.*)	469
Legal	470
War Items	471
Correspondence—	
Power and Lighting Rates	472
Business Notes	472
Notes	476
City Notes	479
Stocks and Shares	485
Market Quotations	486
Electricity in Mines	487
Reviews	489
Electricity Applied to Mining (*illus.*)	491
Imports of Holland	493
Utilisation of Water-Power (*illus.*)	493
New Patents Applied for, 1915	496
Abstracts of Published Specifications	496
Contractors' Column	Advertisement page xx

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.
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MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1 307.
SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132 Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

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THE ILFORD RAILWAY COLLISION.

LIEUT-COL. VON DONOP'S report on the collision which occurred on the Great Eastern Railway at Ilford, on the first day of the year, has now been issued, and, as was, perhaps, to be expected from the evidence given at the inquest and from the character of the signalling apparatus in use, the Colonel comes to the conclusion that there can be no doubt the driver did not exercise sufficient care in noting the positions of his signals "when approaching Ilford," and "that it is entirely to this want of care on his part that this collision must be attributed." There are, however, some points arising from the report which are of very considerable interest.

In dealing with the lay-out of the station and signal-boxes at Ilford, Colonel von Donop gives the distance between the East and West boxes as just over 250 yards. This being the case, it would have been thought that passenger trains would have been dealt with under the "400 yards rule," as laid down in the third paragraph of Rule 4 of the Regulations for Train Signalling by Block Telegraph on Double Lines of Railway. This paragraph reads as follows:—"When the home signal at the signal-box in advance is less than 400 yards ahead, permission for a train to approach must not be given to the signal-box in the rear until permission for the train to proceed has been received from the signal-box in advance, except in the case of a train not conveying passengers, which may be accepted under Regulation 5, when the advance section is not occupied by a train conveying passengers."

In his evidence, the signalman on duty at the East box at the time said: "I remember being offered the Clacton train from Ilford carriage-sidings signal-box (from which the Clacton train was approaching) at about 8.37 a.m. I accepted it at once. At the same time I also offered it to the West signal-box. He did not accept it." The procedure seems to have been in this case exactly the reverse of that laid down by the rule quoted. Had the rule been carried out, the signals at the Ilford carriage-sidings signal-box would have been kept against the train, and an additional check against over-running at the critical point would have been interposed. It does not necessarily follow that the driver would have run past the latter signals: from his evidence it appears that he had noticed other signals at danger, since he said in giving his evidence: "after leaving Shenfield we were just checked at Brentwood." A driver is entitled to the protection of all the signals which a due observance of the rules of signalling afford him. In this case it would seem that full protection has hardly been given.

The signalman at the East box made no mention in his evidence on January 5th of having received from the West box the blocking-back signal, which the signalman at the latter box said he had sent, but when further examined on February 2nd he remembered the circumstance. What was the object of giving this signal, or what gave rise to the necessity, is not made apparent. That such a signal should be given seems very strange, since it was inapplicable to the conditions and the place. The rule for blocking back says: "Trains or engines approaching a junction on a line converging to a fouling point, or when leaving an independent line, or a siding, to at once proceed on their journey, or crossing directly over another running line are exempted from the operation of blocking back, and must be dealt with under Regulation 4." The blocking-back signal requires permission from the man receiving it before it can be acted upon, and such permission could not be given by the man at the East box, since he had already accepted the Clacton train, and the necessary distance of half a mile between his home signal and that of the box from which the signal was received did not exist. The quotation from the blocking-back regulations shows that that signal was inapplicable to the conditions existing, since the Gidea Park train was merely crossing from the local to the main line and was intending to continue its journey at once. The 400 yards rule is obviously intended to prevent the chance of over-running of signals in precisely the circumstances obtaining in the Ilford accident. The inspector summarises the evidence of the two signalmen in question, together with other evidence submitted, but makes no comment with regard to the apparent non-observance of the 400 yards rule quoted, or the effects that might have followed from carrying it out; nor does he remark upon the use of the blocking-back signal by the West box signalman when offered the Clacton train from the East box, or the apparent want of reason for the use of that signal.

Another point brought out by the report is that in advancing from the east towards Ilford Station a train passes first the Ilford East box up-distant signal, and afterwards the up-advance of the box in the rear, *i.e.*, of Ilford carriage-sidings signal-box. Similar arrangements might be found on other lines besides the Great Eastern, and there may be good reasons for them from the traffic-working point of view, but there are none from the point of view of signalling. A driver, when he has passed the distant signal for any section, has the right to consider that all stop signals he meets subsequently will refer to the section covered by the distant, and not to the section behind it. The signalman at Ilford carriage-sidings signal-box said that all his signals, including the advance in question, were off for the Clacton train; and the question arises whether this was not the signal which the driver "sighted" as the East box distant and "took it to be off: it was not in a doubtful position." It must not be forgotten that the Ilford East box up-distant was not "repeated" under the Ilford carriage-sidings box advance; that the only difference between the two arms would be the slot in the end of the distant arm; and that the two signals each occupied the other's position on the line under the usual conditions of erection. Nor must it be forgotten that drivers are acquainted with the rules guiding the signalmen, not, perhaps, to the full extent, but sufficiently to recognise the general conditions applicable to such a case as this, and sufficiently to lead the driver to infer from such knowledge that if all the signals were off for the Ilford carriage-sidings box, as was the case, the working of the 400 yards rule would ensure the line being clear to the Aldersbrook box west of Ilford West box. It is not sought by these remarks to minimise the driver's responsibility for the accident. It was undoubtedly his duty to observe and obey the signals, and his own evidence and that of others shows that in the words of the report "the morning on which the accident occurred was a clear one." Nevertheless, as the report shows on examination, there were other circumstances in connection with the occurrence which might well have been the subject of explanation.

The concluding paragraph of the report deserves special attention. Colonel von Donop draws attention to the desirability of providing "an unmistakable warning" as to the position of a distant when being passed: to the fact that several railway companies have made trials of devices for the purpose, and that on some lines such devices are in use to a limited extent; that the Great Eastern does not come into the category of the lines alluded to, although it has provided around London a large number of emergency detonator machines at its home signals; that it is at the distant signal that the warning is specially needed; and, finally, "in the face of this accident," the company's attention is called to "the desirability of this provision."

The paragraph seems to lack that directness of statement that one looks for in such reports. One is led to infer from the opening sentences that Col. von Donop refers to cab-signalling as providing something in the way of "an unmistakable warning," and probably it is so, but it is not so stated. The paragraph then refers to the detonator machines at the home signals; states that it is at the distant that the warning is especially needed, and calls the attention of the company to the desirability of *this* provision. Which? Cab-signals or detonators? It is possible to argue that only cab-signals giving both on and off indications can be meant, for the reason that detonators only indicate one position, and would not, therefore, meet the conditions, and give a warning showing the (actual) position when being passed, but it should not be necessary to have to revert to such reasoning.

Rubber. There has been a pretty steady tone in the market for crude rubber during the past few weeks, and price movements have been of but small importance though the tendency has been quite satisfactory from the point of view of producers, and this, notwithstanding the rather more subdued demand experienced from home trade manufacturers. There has been considerable apprehension entertained in connection with the difficulty of shipping material from Singapore, owing to the exceedingly limited freight facilities (which, by the way, look like being rendered more restricted still), and this may have a by no means unimportant bearing upon the position in a few months' time. Not only so, but there has been very slow progress made with the discharging of steamers arriving at London, and this has necessarily much hampered operations, whilst restricting the supply of parcels available for early delivery. There is no doubt that the demand which was experienced for parcels readily available, contributed substantially to the firmness of the market until towards the middle of the month, but latterly labour conditions at the docks have been slightly improved, the working of the vessels proceeding rather more smoothly, and there seems now to be a more ready supply of spot and ready parcels available for the satisfaction of current needs. This, however, has not had much influence upon the tendency of the market generally. The clearances which have been made for the United States have been well below requirements, but it is hoped that the execution of outstanding orders will make more headway in future, and that at the same time United States demands will undergo an expansion within the next few weeks. Meantime the prospects as regards home consumption during the spring months are regarded as very encouraging, the demands for tires and other material of first-rate importance in the successful pursuit of the war on the Continent being such as to keep all working forces available employed at the utmost limit of productive capacity.

The efforts which have been made so consistently for two or three years in the direction of bringing down the cost of production of plantation rubber are now beginning to tell, and some of the reports of producing companies issued lately reveal the extent of the progress which has been made in this direction. It is significant, too, that these costs have been reduced, notwithstanding the very great difficulties which had to be faced in connection with the outbreak of war. The reduction in cost per lb. is rather startling in some cases. The Bikam concern, for instance, has dropped its all-in cost 5d. a lb. Selaba is 4½d. to the good, Golden Hope 3¼d., and Pataling 2¾d. a lb. on the right side compared with 1913, the cost of the last-named company being now actually below 10d. per lb., and these costs also include war risk insurance. The improvement does not arise entirely, moreover, from increased production, but is largely due to more efficient management of estates and the determined adoption of more economic conditions.

According to official figures issued, the exports of plantation rubber from the Straits Settlements during February amounted to 2,741 tons, as compared with 2,576 tons in January, and 1,703 tons in the corresponding month last year. The following table gives the comparison month by month for three years :—

	1913.	1914.	1915.
January	784	1,181	2,576 tons
February	743	1,703	2,741 „
Total ...	1,527	2,884	5,317 „

These figures include transhipments of rubber from various places in the neighbourhood of the Straits Settlements, such as Borneo, Java, Sumatra, and the non-Federated Malay States, as well as rubber exported actually from the colony, but they do not include rubber exports from the Federated Malay States.

Artistic Lighting Fixtures.

It cannot be denied that in this industrial age the artistic development of lighting fixtures has frequently fallen far behind their development in efficiency, but even in industrial concerns where economy is rightly given first consideration, it is becoming realised that colour and effect may compensate for some difference in actual cost. Industrially, this applies chiefly to the light itself, but in domestic and public interiors, and in exterior lighting, fixtures play, or should play, an important part in the decorative scheme. There is an artistic as well as a practical aspect of artificial lighting, and now that such efficient luminous sources are available, we can afford to pay attention to effect as well as efficiency.

Antique and mediæval lighting fittings were evolved to utilise the crude lighting agencies then available. Though at first as crude as the sources themselves, these fittings were gradually brought to a very high art level, and with the universal adoption of electric lighting, which can be adapted easily and safely to any form of fitting, there is a pronounced tendency to revert to Renaissance styles, Flemish models, and the styles of the seventeenth and eighteenth century French periods. Is it wise to follow these traditional styles, or ought we to create new and distinctive styles? In a paper before the Illuminating Engineering Society, Mr. F. W. Thorpe showed recently the very pronounced effect of even the earliest lighting devices on modern fixture design, and maintained that in interiors where it is sought to reproduce the atmosphere and spirit of the past, lighting fixtures should be as true to style as the other details of furniture. The inherent characteristics of electric lighting make this possible without risk and without incongruity.

On the other hand, the fittings of the past, particularly candelabra with their wide-spread, low-reaching arms, were evolved to suit dim and feeble sources of light, and attempts to reproduce them for artistic reasons are not facilitated by the relatively high domestic supply pressures and high-efficiency lamps now employed. Art is certainly not a product of modern civilisation, and there is no reason to suppose that in these days it can be carried to a higher level than was attained by the craftsmen of the past. Reproductions of their work, adapted with rigorous conservatism to modern requirements, often make up by their importance in the decorative scheme of an interior for what they lack in efficiency. The latter deficiency can frequently be made good by inconspicuous high-efficiency lighting to which the artistic fittings are supplementary as regards lighting, but predominant in æsthetic effect.

For modern interiors, however, where rigid purity of style is not required, advantage can be taken of the charm of contrast, and there is, no doubt, room for distinctive twentieth-century styles, if these can be evolved as a reasonable compromise between beauty and efficiency. Many modern fittings—particularly those of foreign origin—bear painful witness to the influence of cheap production on art. At the other extreme—in the production of art fixtures more or less regardless of cost—fittings manufacturers complain that unless they follow rigidly one or other of the fashionable traditional styles in vogue among architects, they can find no market for their products. Co-operation between architect, fittings manufacturer, and illuminating engineer is desirable and practicable. There is no reason why one of these should dictate to, or restrict the initiative or spoil the work of, either of the others. A flagrant example of neglected opportunity is to be found in almost every new building erected for commercial purposes or as a place of entertainment. It is known from the first that electric signs will be erected, but no place is left for them in the architect's scheme. As a result, the sign loses in its own beauty and effect, and only too often constitutes an eyesore by day.

In interiors there is room for individuality in the selection of fixtures, and the owner alone is credited with good or bad taste. Public lighting is, however, credited—or more usually debited—to national taste, though it is rarely representative thereof, even in the case of buildings erected by public authorities. There seems to be a tendency to think about lighting at the last moment, when either opportunity or funds available do not permit the provision of illumination worthy of and harmonising with the architectural scheme. As many public buildings are used more by artificial light than by day, this policy is the more inexplicable.

The lighting of streets should, at any rate in times of peace, be first of all efficient. At the same time, there is no reason why the considerable annual expenditure on new lamp-posts should not produce rather more acceptable standards than are generally to be found in our streets. Except in special cases, very ornate and costly designs would be out of place, and it does not seem generally necessary to make special arrangements for the lamp-post to be seen in all its details by night—with many existing designs, darkness is certainly merciful. True art may be quite simple; indeed, many of the lamp-posts now in use would be far more artistic, as well as cheaper, were their "decorations" omitted. Without emulating the extraordinary and often hideous fixtures which provide "display" lighting in the White Ways of the States, there is no reason why we should not use, at the same or less cost than at present, street standards which are effective by night, and, at least, not offensive excrescences by day.

ELECTRIC TOWING SYSTEM FOR THE PANAMA CANAL LOCKS.

The towing system described below was designed and patented by Mr. Edward Schildhauer, electrical and mechanical engineer of the Isthmian Canal Commission; and the 40 towing locomotives and all the electrical apparatus for operating the locks were built by the General Electric Co., of Schenectady, U S.A. Some particulars of the system have already appeared in our pages.

In passing through the Canal from the Atlantic to the Pacific, a vessel will enter the approach channel in Limon Bay, which extends to Gatun, a distance of about 7 miles. At Gatun it will enter a series of three locks in flight and be raised 85 ft. to the level of Gatun Lake. It may then steam at full speed through the channel in this lake, for a distance of 24 miles, to Bas Obispo, where it will enter the Culebra Cut. It will pass through this cut, which has a length of 9 miles, and reach Pedro Miguel, where it will enter a lock and be lowered 30 ft. Then it will pass through Miraflores Lake for a distance of $1\frac{1}{2}$ miles until it reaches Miraflores, where it will be lowered 55 ft. through two locks to the sea level, after which it passes out into the Pacific through an $8\frac{1}{2}$-mile channel.

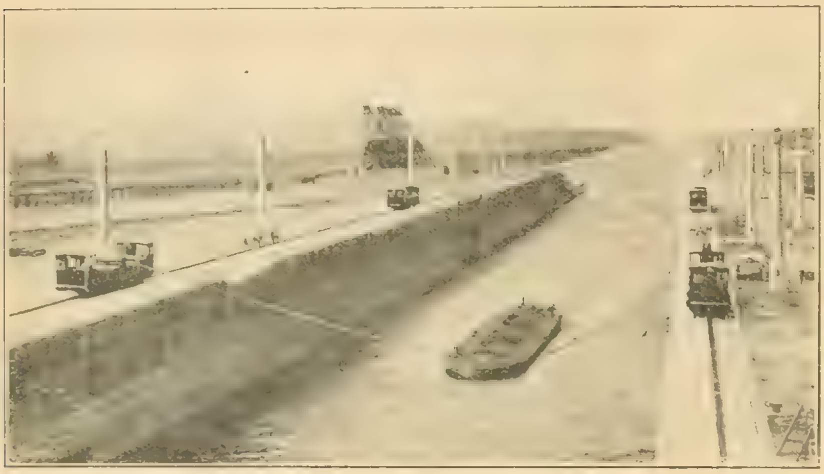


Fig. 1.—Towing Locomotives' First Trial Run with Barge through Gatun Locks.

The main features of all the lock sites are identical, and the Gatun Locks may be taken as a typical example. There are two ship channels, one for traffic in each direction, separated by a centre wall, the total length of which is 6,330 ft. There are two systems of tracks, one for towing and the other for the locomotive returning idle. The towing tracks are placed next to the channel, and the system of towing utilises normally not fewer than four locomotives running along the lock walls. Two of them are opposite each other in advance of the vessel, and two run opposite each other following the vessel, as seen in fig. 1. The number of locomotives is, however, increased when the tonnage of the ship demands it.

Cables extend from the forward locomotives and connect with the port and starboard sides respectively of the vessel near the bow, and other cables connect the rear locomotives with the port and starboard quarters of the vessel. The lengths of the various cables are adjusted by special winding drums on the locomotives to place the vessel substantially in mid-channel. When the leading locomotives are started, towing the vessel, the trailing locomotives follow and keep all the cables taut. By changing the lengths of the rear cables, the vessel can be guided; and to stop the vessel, all the locomotives are slowed down and stopped, thus bringing the rear locomotives into action to retard the ship. In this way the vessel is always under complete control quite independently of its own power, and the danger of injury to the lock walls and gates is very greatly lessened.

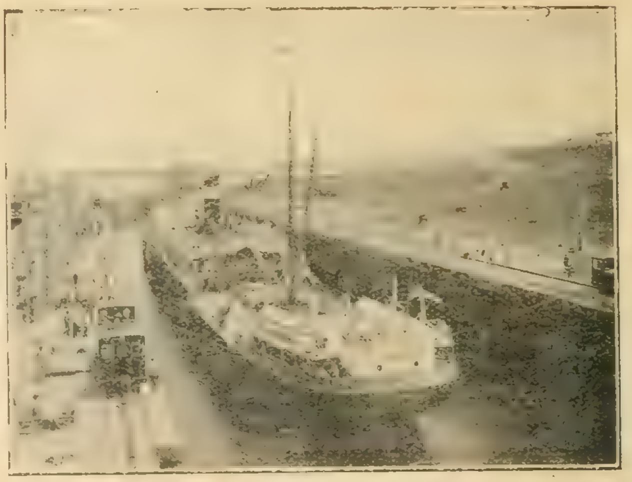


Fig. 2.—S.S. "Ancon" entering Upper Lock, towed by Electric Locomotives.

Fig. 1 shows how effectively the four locomotives keep the vessel under control and in the centre of the channel, while figs. 2 and 4 give a general idea of the method of handling vessels of various sizes. They also show general views of the lock walls, towing tracks and the inclines, the steepness of the latter being especially noticeable.

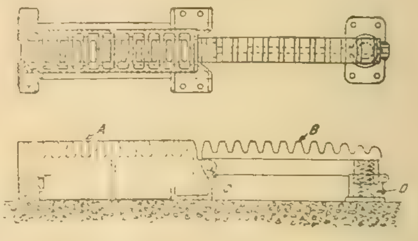


Fig. 3.—Approach Section of Rack Rail.

The towing tracks have a specially designed rack rail extending the entire length of the track and located centrally with respect to the running rails. It is through this that the locomotive exerts the traction necessary for propelling large ships and climbing the steep inclines.

A rack rail (A, fig. 3) is also provided on short portions of the return track so as to lower the locomotives safely from one level to the next. The steepest slope is 26°, or 44 per cent., hence the need will be seen for rack rail even on the return track, it being noted that any traction locomotive with the usual wheel drive, even with the brakes set, would begin to slide on a 16 per cent. grade, and therefore could not be controlled.

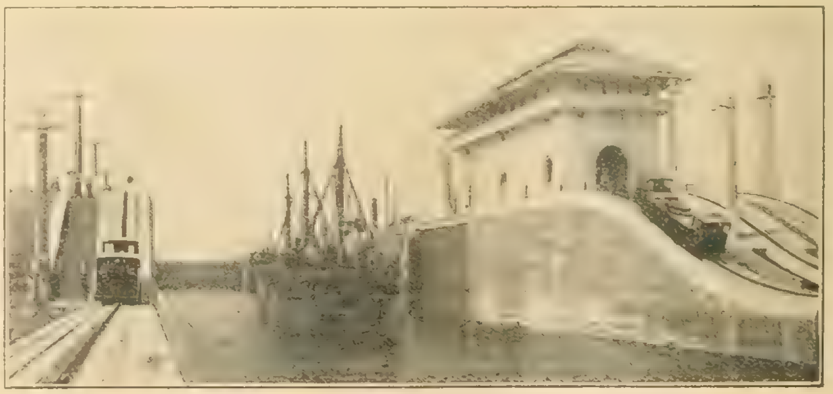


Fig. 4.—U.S. Tender "Severn" and five Submarines passing through Gatun Locks

A small portion, B, at the end of the rack rail is hinged at c, so that it can be depressed on the approach of the rack pinion of the locomotive; the teeth of this approach section are under size and shaped off at the extreme end, so that the teeth of the pinion will mesh properly and prevent excessive strain on the pinion and the axle. A spring, D, restores the approach to the proper position after the locomotive has passed over. The rack rail is of the shrouded type, and each tooth space has a drain hole cast in the bottom.

The rack rail also has projecting edges, which permit thrust wheels attached to the locomotive to run along the under side and prevent overturning of the locomotive, in case some unforeseen operating condition should produce an excessive pull on the towline. These thrust wheels serve to counteract the lateral component of the towline pull, and the flanges act for emergency only, as the weight of the locomotive is sufficient to prevent overturning with a normal pull of 25,000 lb. on the towline.

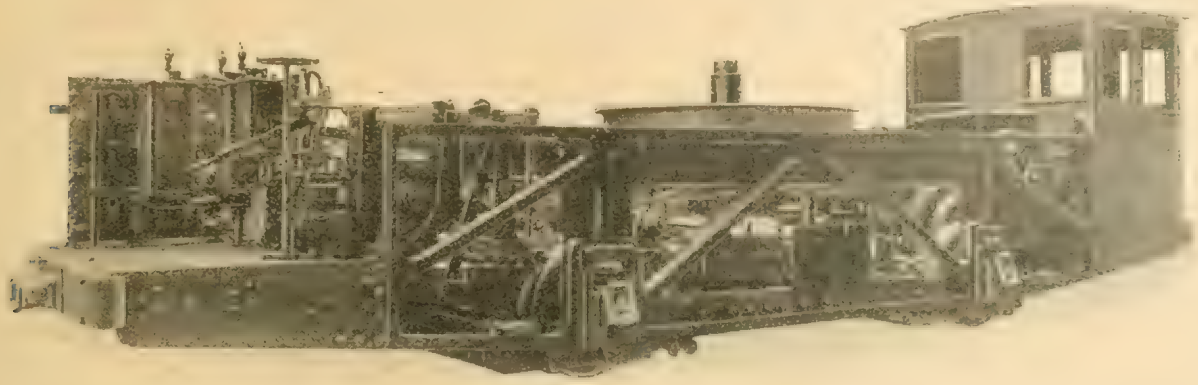


Fig. 5.—Electric Locomotive, with Covers and one Cab removed, showing Controllers, &c.

Three-phase, 25-cycle, 220-volt alternating current is used for operating the locomotives, and the current is supplied to them through an underground conduit adjacent to the running rail on the side remote from the lock; two T-rails form two legs of the three-phase circuit, and the third leg is formed by the main track rails. A specially-designed contact plough slides between the two conductors and collects the current from the rails.

The working parts of the locomotive are supported by two longitudinal upright side frames of cast-steel, connected by transverse beams; these frames are in effect deep rigid trusses, having upper and lower members connected by posts and diagonal braces. The pedestals for the wheel axles are of the usual locomotive type, having vertical parallel jaws between which the journal slides. Springs are interposed between the tops of the journal boxes and the tops of the pedestals, and the locomotive is thus mounted upon four wheels, the wheel-base being 12 ft., and the overall length of the locomotive over 32 ft.

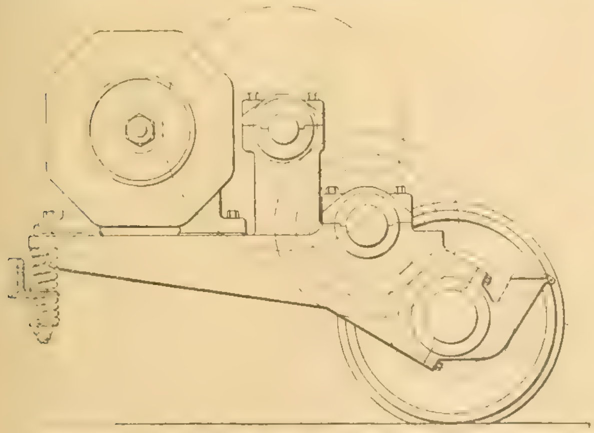


Fig. 6.—Arrangement of Motor, Gearing and Spring Suspension.

Each axle is driven by its own motor, independently of the other. A cast-steel suspension bracket is hinged at one end on the axle (fig. 6). The bracket is provided with bearings for a transverse jack shaft, parallel to the axle; and it has pillow blocks for a countershaft, also parallel to the axle. It has a substantial horizontal platform to support the driving motor, and its outer end is supported at each corner by two springs, placed above and below a stationary angle iron, and connected to the bracket by a bolt, so as to afford a yielding support in both upward and downward movements of the bracket.

The motor is of the three-phase, enclosed slip-ring type, geared by a pinion and spur gear to the countershaft, which carries a pinion meshing with a spur gear, keyed to the jack shaft. On the outer side of the spur gear are formed clutch teeth, which co-operate with similar teeth on the adjacent side of a gear which is sleeved upon the jack shaft, and can be slid lengthwise thereon to engage and disengage the clutch teeth. A pinion keyed to the main axle is wide enough to mesh always with the gear, so that when the clutch teeth are engaged, the motor will propel the locomotive by the adhesion between the wheels and the rails of the track. The gearing is shown in fig. 7.

When the locomotive reaches one of the inclines between the locks, or when it is towing a ship, the cog rail system is utilised to enable the locomotive to climb the grade and exert the traction necessary. The cog or rack rail is laid between the track rails, and the locomotive is provided with a rack pinion secured to a sleeve which rotates freely on the axle.

A gear wheel secured to this sleeve meshes with a gear turning loosely on the jack shaft. Clutch teeth on this gear can be engaged by the teeth on a clutch which is splined to the jack shaft. A lever, pivoted to a collar riding in a groove in the clutch, is connected by a laminated flat steel spring with a handle in the cab of the locomotive, and is also pivoted to a rod which throws out the former clutch when the latter is thrown in, and *vice versâ*.

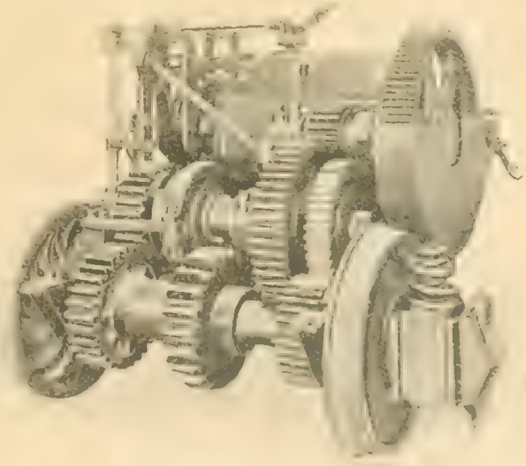


Fig. 7.—Front View of Traction Motor Unit, Clutches and Brake Gear.

The jaw clutches in most cases do not mesh when thrown, but the operating handle is thrown full stroke and locked. This puts the springs under heavy tension. The locomotive is then started slowly, and when the clutches are in alignment the springs throw them without any attention by the operator.

The two traction motors are controlled by suitable controllers installed in the cabs at the ends of the locomotives; the circuits are such that both motors can be controlled from either cab, and they can be operated singly or in parallel, as desired.

Each motor, with all its gearing and clutches, is mounted independently of the frame of the locomotive, to which it is connected only by springs, which give an elastic support for the outer end of the bracket, on which the mechanism is carried, as shown in fig. 6.

In connection with each motor a powerful brake is installed; and as during operation the motors are at all times geared either to the axles or to the cog wheels, the truck wheels are not provided with any brake rigging. On the motor shaft is keyed a brake drum, and to opposite sides thereof are applied the brake shoes, carried by levers pivoted on a stationary bar. The movable core of a solenoid is pivoted to the long arm of a lever, which, with the brake levers, constitutes a sort of toggle. When the core of the solenoid drops, it actuates the mechanism in such a manner as to apply the brake shoes to the drum. The winding of the solenoid is in circuit with the controller of the motors, so that when the current is turned on to energise the motor windings, the solenoid will lift its core and thereby release the brakes. The first point of the controller raises the brakes without applying power to the motors, thereby providing a coasting point. But should the motor current be shut off, either intentionally or accidentally, the core will instantly drop by gravity, and its weight will exert a powerful leverage upon the brake levers to stop the motor and the locomotive. In addition to this automatic brake, means are provided for applying the brakes manually, in order to supplement the action of the automatic feature, if necessary, when descending a grade or where approaching a rack rail.

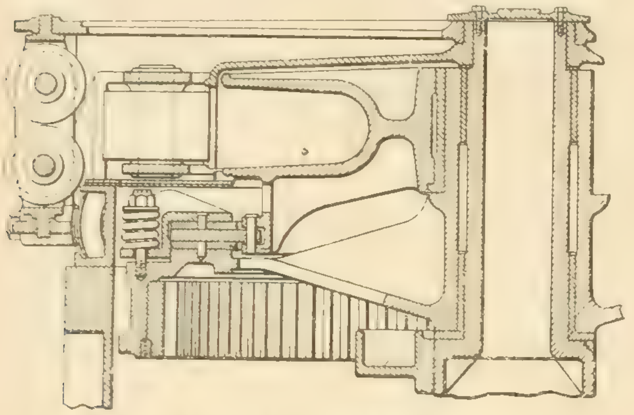


Fig. 8.—Part Section of Cable Guides, Drum and Friction Clutch.

The drum on which the cable is wound is located midway between the ends of the locomotive and above the upper member of the side frames, so that the cable can be led off on either side of the machine and through a wide range of angles to the line of travel. The hub of the drum is pivoted to the hub of a spider, which, in turn, rotates upon the upper portion of a massive tubular vertical column rising from a pedestal secured to the baseplate, which is supported on the lower members of the side frames. As shown in section in fig. 8, the spider supports a circular rim with a horizontal upper surface, to which is applied a powerful friction clutch connecting the spider and the drum.

Inside the flanged rim of the spider is secured a large internal gear, with which mesh two driving pinions, secured respectively to two upright shafts.

A wormgear is clutched to one of the shafts, and is driven by a worm on the shaft of an electric motor bolted to the base of the locomotive.

A bevel gear is keyed to the other shaft, and meshes with a bevel pinion on the shaft of an electric motor fastened to the base. The latter is used for driving the drum at a high speed when coiling the cable that has been cast off, and it remains permanently in gear. The other motor, with wormgear drive, is used for taking in the cable when it is under load, and the drum operates as a windlass or capstan. The wormgear drive is disconnected from the drum when not in use, by means of a clutch. The first point of the controller which operates the bevel-geared motor raises the clutch by means of a solenoid, and on the second point the motor starts.

The guide which directs the cable, as it pays out or winds up, is mounted so as to revolve on the axis of the drum. One portion of it is a circular bell which serves as a cover for the winding drum; the hub of the bell is journalled on the upper end of the column, being stepped on a shoulder thereon (fig. 8). At one side the housing is cut away to admit the cable to the drum, and on each side of this opening is bolted one end of a frame carrying two upright guide rolls, which have cylindrical faces.

The other guide member is a radial casting turning freely on the hub of the cover, and carrying at the outer end two grooved sheaves on horizontal axes. The edges of these sheaves are in close contact, so that their grooves form an opening through which the cable passes, approximately in line with the middle of the guide rollers. The drum is in the form of a deeply grooved wheel, the groove being U-shaped.

The cable guard or cover is a steel casting having a thickness of only $\frac{3}{8}$ in.; the diameter is 4 ft. 6 in. and the circular flange is 17 in. deep. This casting was pronounced to be beyond the possibilities of the ordinary open-hearth furnace by a number of steel foundries. The castings were eventually produced in the contractor's electric furnace, where it is possible to intensify the heat so as to make the metal flow more rapidly.

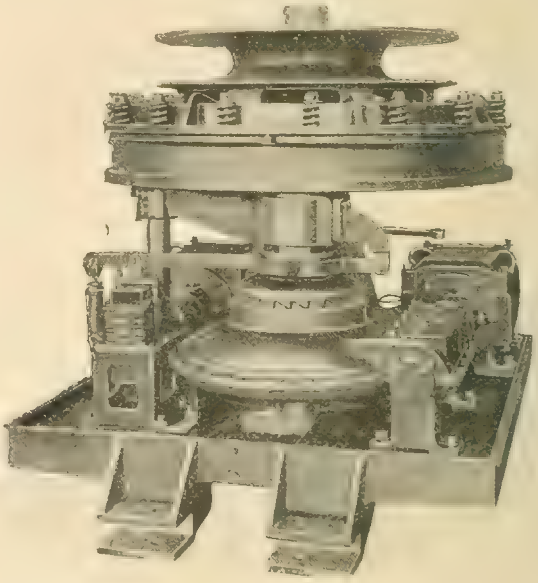


Fig. 9.—Windlass and Base Assembled Complete, with Motors.

One of the most important parts of the locomotive is the "slip-friction" device, consisting of two special bronze rings mounted on the spider, as has been previously mentioned. Between these rings a steel disk is fastened to the rope drum; the amount of tension on the towline is adjusted by the pressure between these three disks, which is obtained by tightening spiral springs on the clamping ring (figs. 8 and 9). In order to make the slipping tension of the towline proportional to the pressure between the friction disks, a rubbing surface having a constant coefficient of friction was essential. In order to find such a metal, experiments were made, and it was found that a certain alloy possessed the required properties with a friction coefficient of 0·1. This metal also showed but very little difference in coefficient between starting and running. The results of the special tests were amply verified by the final test of the friction disks of each machine under the full rated towline pull of 25,000 lb. by means of a dynamometer testing outfit; all 40 machines were given this slip test 25 times from each cab, and all passed the Government requirement not to exceed a variation of 5 per cent. above or below the normal of 25,000 lb.

The winding motor is a 20-h.p. (one-hour rating), three-phase, squirrel-cage induction motor, and has ample power to take care of any sudden pull on the towline up to 40,000 lb., which is well above the normal requirement. The speed of winding is at the average rate of 12 ft. per minute.

The rapid-coiling motor is permanently geared to the drum, and is of the same type, size and capacity as the winding motor. It is subjected to its maximum load when accelerating the heavy drum to the high speed required for coiling or paying out the rope, this being 16 times the slow winding speed at full load, or about 200 ft. per minute.

The slow-winding and the rapid-coiling motors are operated by similar controllers, and the circuits are electrically interlocked so as to prevent the application of power to either motor unless the controller of the other motor is in the "off" position.

Each of the two main traction motors has a rating of 75 H.P., and is of the slip-ring induction type, operated by a system of contactors with master controller in each cab. The motors, by means of the change in gearing from straight traction to rack-rail towing previously described, drive the locomotive at a speed of 2 miles per hour when towing and 5 miles per hour when returning idle. These motors act as induction generators running above synchronous speed when the locomotive is passing down the steep inclines, and thereby exert a retarding brake effect to keep the speed uniform.

The locomotives, which weigh 38½ tons each, have fully demonstrated in actual operation that the requirements contemplated by the engineers of the Isthmian Canal Commission have been successfully met.

We are indebted for the foregoing particulars and illustrations to the General Electric Co., U.S.A., through the British Thomson-Houston Co., Ltd., Rugby.

BATTERY-CHARGING FOR ELECTRIC VEHICLES.

By FRANK BROADBENT.

The increasing popularity of the electric vehicle again raises the important question of battery charging. The method of charging a petrol car—viz., the pouring of a quantity of petrol into a tank—is simplicity itself, compared with the charging of an electric vehicle, which, besides being a relatively complicated process, takes about as many hours as the petrol car takes minutes. The introduction of the Edison battery, and the claim made for it, that it can be charged at a rapid rate without detriment, has reopened the question of constant potential charging for lead batteries. Although it has been recognised for many years that when fully exhausted a lead battery may with safety be charged at rates far in excess of what are called the normal rates, the common practice has been to charge at a practically constant current with a rising voltage until the battery gases freely. By this method a battery ordinarily requires charging for seven or eight hours to raise it from a fully exhausted to a fully charged state.

In ordinary practice with stationary batteries, it is not usual to exhaust a battery entirely. Thus on an isolated installation, such as that of a country house, the attendant charges two or three times a week, depending upon the season. He adjusts his voltage for the normal charging rate, and charges until the battery gases freely, the dynamo volts rising automatically as the current tends to decrease, due to the back E.M.F. of the cells. Gassing is not only detrimental, but wasteful, as the current consumed in converting the electrolyte into gas serves no useful storage purpose.

So long as a good modern battery on charge is not gassing or heating, it is usefully absorbing the current, so that if, when exhausted, the charging current is adjusted to a value just below the gassing point, it should take no harm. Under these conditions, it will be found that the initial current may be as much as three to five times what is commonly reckoned as the normal current, the permissible excess depending upon the make of battery. Generally speaking, if the applied voltage be approximately (but not exceeding) 2·3 volts per cell, the battery will take the current it can safely absorb, and as its back E.M.F. rises the current will automatically fall off.

For country-house work or other isolated battery installations, the constant-potential method of charging would necessitate a considerably larger generating plant than is ordinarily supplied. For instance, if we have a 54-cell battery whose normal charging rate is 50 amperes, the dynamo would be rated to give, say, 50 amperes at 100 to 140 volts or 7 KW., whereas if arranged for the constant-potential method, the output would need to be about 150 amperes, with a voltage not exceeding 125, or over 18 KW. Although the dynamo might be calculated on the basis of a 1-hour rating, and would therefore not be as large and expensive as the output suggests, the engine cannot be treated in the same way. The generating plant, therefore, unless used for other purposes than charging, would be much more costly. Where charging is done from public supply mains through a motor-generator, both the motor and generator armatures might be rated on the 1-hour basis at the maximum current.

This question of plant capacity has, no doubt, perpetuated the approximately constant current method of charging for isolated installations, and as in many cases a quick rate of charge offers little or no advantage, this method is, all things considered, probably the most suitable. Moreover, we have to bear in mind that in fully charging a battery on the constant-potential method we do not save much time, because the rate of charge tapers down nearly to the vanishing point after a few hours. Its great advantages are that we can put back such a large proportion of the discharge during the first hour, and that if left on for the full time we can obtain a greater ampere-hour capacity than by the constant-current method; and that it is better for the battery. There appears to be no reason, however, why in ordinary installations we should not start with a current very much in excess of the normal, and then, if we have voltage enough, we can keep the current up to the normal when it falls to this level. In this way the charging time can be materially shortened.

But the chief advantage of the high initial charge which the modern battery will stand is in connection with the electric vehicle. A brochure issued by the Chloride Electrical Storage Co., on "Boosting Charges for 'Exide' Vehicle Batteries," states the case very clearly. It is shown that when a battery is fully discharged a 30-minutes' boost at a pressure of 2·3 volts per cell gives us back 30 per cent. of the original capacity, and a 1-hour's charge puts back 50 per cent. This means that if we have a battery vehicle which will run for 40 miles on one complete charge, an hour's boost at the end of the run will carry us another 20 miles, that is, 60 miles in all. If, say, only 75 per cent. of the battery capacity has been used, corresponding to a run of 30 miles, an hour's boost will put back 42 per cent. of the original capacity, which, added to the unused 25 per cent., gives us a capacity equivalent to an additional 27 miles, or a total run of 57 miles. The advantages of this method, more particularly for commercial vehicles, which can return to headquarters at mid-day for an hour's boost, are very great. It means that a vehicle rated at 40 miles per complete charge can do 30 miles in the morning, and after an hour's mid-day boost is good for almost the same distance in the afternoon. A full charge would then be given during the night. Hence a 40-mile-a-day vehicle is converted into one having a range of almost 60 miles by taking a mid-day "pick-me-up."

Some useful experience has been recently gained in Hollywood garage in Chicago, equipped on the constant-potential system. It is found that if a battery is only 75 per cent. discharged, it can be recharged up to 85 per cent. of its rated capacity in two hours, and up to 90 per cent. in three hours. It is not stated how long it takes to charge up to 100 per cent., but obviously the last 10 per cent. will take longer than two hours as the current is continually diminishing. As the average duration of charge is given as 3½ hours, either the batteries are not discharged 75 per cent. on the average, or the charging rate is accelerated towards the end.

According to the description in the *Electrical Review and Western Electrician*, the method is not absolutely a constant-potential method, as the initial current is limited to 60 amperes by means of a rheostat—apparently regardless of the size of the battery—the rheostat being gradually cut out during the first 10 minutes until the battery is directly across the line, after which the charge proceeds without further attention. It is not clear from the description what is the charging voltage per cell, but it may be assumed that after the first 10 minutes it is higher than would be desirable at first, and it is, no doubt, due to this that the charging period is found to be considerably less than on the old method.

This garage deals principally with passenger cars, of which many are run till midnight, so that they do not reach the garage till about 1 a.m.; and as they have to be delivered fully charged to the owners by 7.30 a.m., it is affirmed that the old method of charging would render this almost impossible.

Energy is taken from the Commonwealth Edison Co. under a restricted-hour contract, no charging being permitted until 9 p.m.; the rate is approximately 1·7d. per unit delivered to the A.C. converters.

All cars are garaged at a flat rate of $40 per month (say £8) for 40 to 42-cell cars, the cost covering charging, washing and polishing, adjustments, care of battery, and delivery to and from the garage. Smaller cars are garaged for $35 (say £7) per month.

The popularity of the commercial electric vehicle is growing so rapidly in England that there is a danger of its outstripping the growth of charging facilities. In a place like London, where electricity generating stations are so numerous, this might appear a somewhat remote possibility, but it is very doubtful if public generating stations are the best places for the purpose. Many of them are alternating-current stations, but, even so, they are not much worse adapted for charging purposes than those supplying direct current. In both cases, in order to do the business economically, motor-generators are necessary for obtaining the necessary charging voltage. True, it is possible to charge several batteries in series, but this is a very unsatisfactory method at the best, even if several batteries were available simultaneously; they would need careful watching to see that each received its proper charge, and that it was taken off at the right time and so on. It would, in fact, be such a nuisance that it would not pay any supply company to bother with the business on these lines. The constant-potential method, on the other hand, is simplicity itself. The battery is simply plugged in and the voltage does the rest. Nothing can go wrong, assuming the battery itself to be all right. But even under the best conditions battery charging is hardly the sort of thing for which a central generating station is laid out. To do it properly, a charging garage should be erected and treated as a separate department. It should be put on the same basis as a bulk consumer and allowed to make its own terms with customers so as to show a profit on the business done. The department would, it is true, be in competition with outside garages, taking current from the same station. But it would be a fairer form of competition than if no separate department existed and batteries were charged in a haphazard sort of way (under the supervision of someone who had really no time to give to it) at rates sufficient only to cover generating costs. Under the charging-garage system it is quite possible that an outside garage would be able to compete in price with a generating-station garage, because the rates paid to the station would depend upon the amount of business done, and this might very easily be in favour of the independently run garage, which would be erected in a convenient locality, and would be run by people who would lay themselves out to attract customers and to make the business pay.

STRESSES IN CONVEX DISHED ENDS.

Serious accidents have occurred owing to the failure of the dished ends of steam drums, one some few years ago at a London electricity station having lamentable results. In *Power* the strength of these ends has been mathematically investigated by Mr. F. G. Gasche, of the Illinois Steel Co., who has noted the frequency with which failures have happened in the curve or bending of the flange, and to this special point attention is directed. Unfortunately, the author finds it necessary to say "for the sake of simplicity in the analysis it is necessary to assume a perfectly rigid cylindrical drum as a basis for establishing a numerical value for a certain reaction." These assumptions of things which do not exist always raise fears that the whole investigation is unreliable. However, the conclusion of three pages of very elaborate figures is that large spherical heads should not depend on large-radius flange fillets, but that the radius should be as small as possible even for moderate diameters of drum, and the two illustrations, figs. 1 and 2, show the connections suggested by the author to take the place of the simple flanged dish. Figs. 3 and 4 show the ordinary form of head, fig. 3 being the form condemned, and fig. 4 the form recommended with a very small radius between the curvature of the end and the flange. The dished end to a pressure vessel which has a radius greater than the radius of the cylindrical drum of which it forms the end is wrong in principle, for there must be a bending stress at the corner of the flange, and no amount of ingenuity of structural form can get over this. A head that is flatter than hemispherical will always be striving when under pressure to pull inwards the end of the drum to a smaller diameter, thus making of the drum end a frustum of a cone, though very slightly, of course. Still, the stress will be enough to cause grooving round the most strained locus if exposed to water in the slightest degree corrosive, and wherever grooving is set up under water it may be taken for granted that there is excessive fibre stress. The dished ends of steam drums and the flat ends of Lancashire boilers, with their gussets and, formerly, bar stays are all concessions to appearance, and to the difficulties of forming hemispheres of plate. The Lancashire boiler head is now also a shallow dished end, and is exposed to the undesirable stresses noted above. Formulæ proposed for calculating dished ends are given in the article referred to.

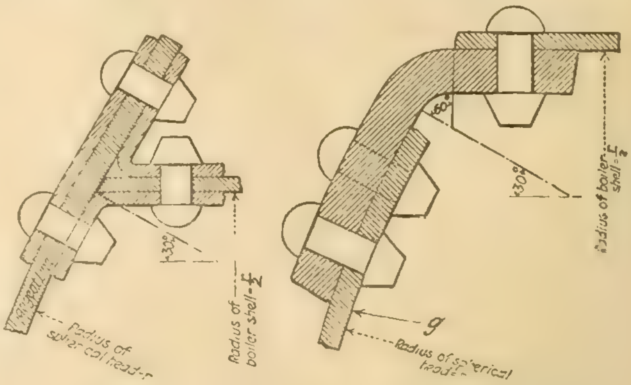

30°
Radius of spherical head=r
Radius of boiler shell=L/2
60°
30°
Radius of boiler shell=L/2
g
Radius of spherical head=r

Fig. 1.—For Moderate Pressures.

Fig. 2.—For High Pressures.

Proposed Flange Connections for Large Drums with Convex Heads.

Comparisons between calculations for convex boiler heads based on various rules used in the U.S.A. are not very reassuring, for the allowable pressures found by three formulæ are in the ratio of 3, 2 and 1, the lowest value being that arrived at by the author, Mr. Gasche.

In boiler work there can be no really reliable formula for any part exposed to secondary stresses. There may be a life of such parts that will endure until the boiler is sold second-hand, to fail in its new position from a sufficient number of millions of stress applications. But for high-pressure work all dishing carries in it the elements of its own self-destruction.

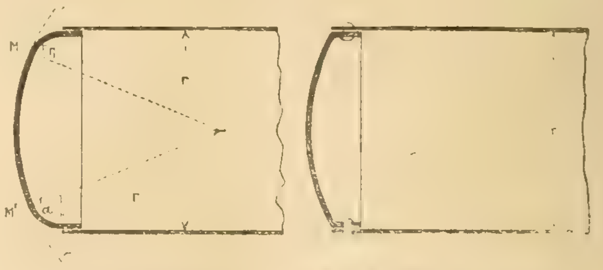


Fig. 3.—Ordinary Design.

Fig. 4.—Form preferred by Mr. Gasche.

Convex Dished Ends.

As regards fig. 3, it always has appeared to the writer of this note that this form was based on an attempt to make a dished end look as though its stresses were all primary. But one cannot juggle with stress forms. Fig. 4, the new suggested form, may be better than fig. 3, but there is more risk in pressing out these small corners.

Mr. Gasche is forced by his investigation to the forms, figs. 1 and 2, which do but tell us that the dished end is inherently bad. As to fig. 2, more particularly we suggest grooving stresses at g.—B.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Explosion-proof Switchgear.

The latest development in the range of G.E.C. explosion-proof switchgear for fiery mines is a 20-ampere, 500-volt, double-pole explosion-proof switch with fuses. It consists of a standard double-pole "Twinbreak" switch actuated by an external handle working through an explosion-proof gland. The interlock between the switch and the lid gives the device all the usual G.E.C. mistake-proof characteristics. The fuses, which are of the standard bobbin type, are contained in a separate fire-proof compartment; arcing shields and thorough fire protection are provided throughout. If desired the switch can be had without the fuses.

The joint between the lid and case is made by well-machined flanges giving a close metal-to-metal joint; special attention has been paid to the part where the switch spindle enters the case, and a special flame-proof gland is provided. The switch is designed to take the standard G.E.C. flame-proof cable glands, which also afford a ready method of attaching the armouring of the cable to complete the earth connection.

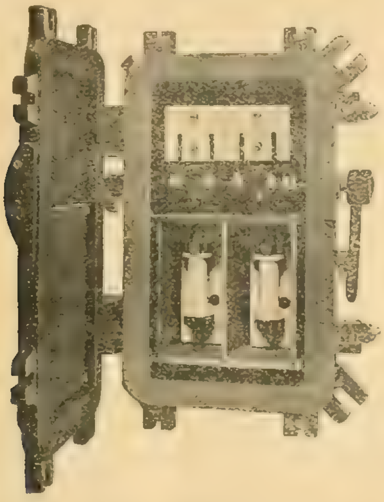


Fig. 1.—G.E.C. 20-Ampere Explosion-Proof Double-Pole Switch with Fuses.

Further additions to the range of mining gear are explosion-proof fuses; these are contained in flame-proof cast-iron cases, which, as will be seen from the accompanying illustration, are of substantial design. As in the switches, particular attention has been paid to the flame-proof flanges, which effectively cool the products of any explosion inside the case. The fuse holders are of the G.E.C. Home Office bobbin type, and thoroughly protect the hand against dangers of shock, or from the effects of a blowing fuse. The cases are designed to take the standard G.E.C. flame-proof cable glands.

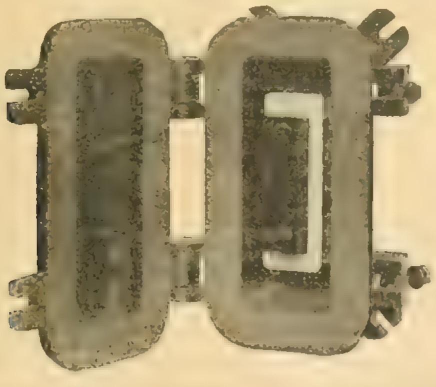


Fig. 2.—G.E.C. Explosion-Proof Mining Fuse.

The switches and fuses are made by the General Electric Co., Ltd., of Witton, Birmingham.

Kasenoid.

Mr. A. W. Kanis, of 66, Aldersgate Street, E.C., has brought to our notice the material called "Kasenoid," which has been developed to fill the place hitherto occupied by Galalith; it can also be used instead of ebonite and xylonite for many purposes. We have inspected a number of samples of this very interesting substance, which is of purely British origin and manufacture, and strongly recommend our readers who use this kind of material to look into it. The properties of "Kasenoid" are quite similar to those of Galalith; it is tough, resilient, easy to machine, non-inflammable, a good insulator, capable of being moulded to a certain extent, and is made in a variety of colours, either as sheet (up to 8 mm.) or rod (up to 12 mm. in diameter).

It can be turned and polished, and takes an excellent thread. Large quantities are being made for use in non-electrical industries also, and we understand that it is meeting with a very favourable reception.

The Dictograph.

The General Acoustic and Dictograph Co., Ltd., of 7, Southwark Street, S.E., have recently introduced a modified pattern of their loud-speaking telephones for single lines, as illustrated in figs. 3 and 4. Simplicity of operation is one of the chief features of the system; the caller simply lifts the receiver, fig. 3, and talks to the box in an ordinary tone, while the voice is received, or delivered, in a loud and clear tone at the telephone shown in fig. 4; the person at the latter station replies in the same way, but without using a receiver or mouthpiece—neither being provided. If desired, the instrument shown in fig. 4 can be fitted with a push-button to call No. 1. The complete Turner-Dictograph system provides for any number of stations connected with a master station, such as that shown in fig. 5; this is fitted with a loud-speaking receiver and a Turner transmitter, and the user can sit at his desk or walk about the room while he talks to his subordinates. The receiver shown is used when it is desired that the replies shall not be heard by any other person in the room; the act of lifting it from the hook cuts out the loud-speaking receiver. Each department is provided with a Turner station like that shown in fig. 6, which, it will be seen, has not a loud-speaking receiver. To call any station, the user presses the corresponding key. When the master station is called, a buzzer sounds and a shutter drops; the master station depresses the corresponding key, and is then connected direct with the caller, no one else being able to cut in on the line. The master station can also converse with any number of departments at once by throwing the various keys.

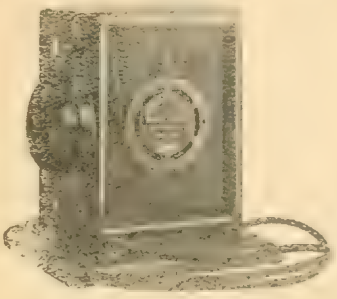


Fig. 3.—Head Station.

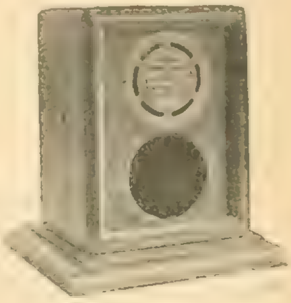


Fig. 4.—Station Called.

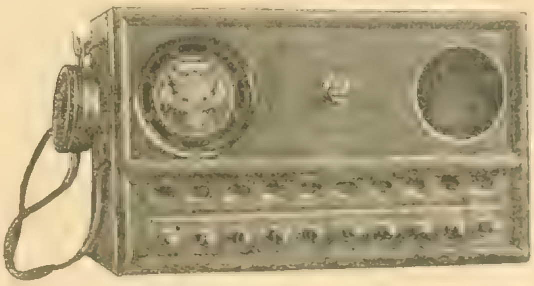


Fig. 5.—Master Station.

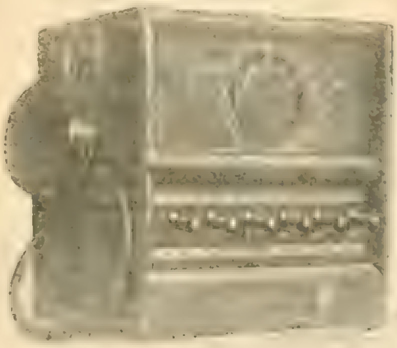


Fig. 6.—Turner Telephone.

We have had an opportunity of testing the sensitiveness of the instruments, and can vouch for the ease and convenience with which one can both speak and hear at a distance of many feet from them, and without elevating the voice—indeed, a whisper can be heard plainly. The fatigue of holding a receiver to the ear is avoided, and for such purposes as dictating to a typist, for example, the system is admirably adapted.

LEGAL.

British Insulated & Helsby Cables, Ltd., v. Crittall Manufacturing Co.

Mr. Muir Mackenzie, one of the High Court Official Referees, on March 22nd gave judgment in this action, in which the plaintiffs sought to recover from the defendants the price of an electric welding machine for making steel casement frames, and material in connection therewith.

The Referee, in giving judgment, said that the case was one which presented features of considerable difficulty, and it had been the practice of the Appellate Courts to require that the Judge who tried the case should give his reasons for the decision at which he arrived, and he had therefore thought it right to put his conclusions into writing. The action was commenced in February, 1914, and was originally brought to recover £104 2s. 2d., which was made up of two items, as to one of which, £47 16s., the defendants admitted liability and paid that amount into Court. As to the balance in dispute, the defendants said that the goods were supplied in connection with tests of an electric welding machine which did not prove satisfactory, and that they were, therefore, entitled to refuse payment. The plaintiffs said that the goods supplied were kept by the defendants and used by them for the machine which was delivered, and that they therefore could not refuse to pay. The plaintiffs claimed a further sum of £444, the price of the welding machine, together with a copper coil to be used in testing. The defendants contended that the machine did not conform to the conditions to which by the contract it was to conform, and that they were therefore entitled to reject it. They counterclaimed for damages by reason of the failure. The first question to be decided was what was the contract between the parties. The defendants were makers of iron casement frames for windows, and before the negotiations with the plaintiffs they used gas for welding. They desired to adopt the more economical and more rapid process of welding by electricity. The two features of the plaintiffs' machine were, first, the generation of heat by electricity, and, secondly, the application of pressure to the ends of the bars where they were to be welded. Negotiations between the parties commenced in 1911, and continued during 1912, when the contract was made with the plaintiffs to supply a machine, and in the course of the negotiations specimens of the defendants' steel bars, which they wanted the machine to weld, were sent to the plaintiffs, so that they knew the work their machine would be required to do. The plaintiffs decided that they could make a machine as required, and an order was accordingly given to them. One speciality of the contract was that the machine should be capable of welding to an accuracy of $\frac{5}{1000}$ inch, that it should be able to produce 12 frames in an hour, and that it should be able to make frames of from 1 ft. to 10 ft. square. The order was given conditionally upon the work being submitted to the defendants for approval before the machine was put in hand. The work was to be of the best quality, and the electric conductors were to be of sufficient area to admit of continual working without undue heating. Part of the machine consisted of clamps made of copper which were to fit closely to the bars, and it was, therefore, necessary for the makers to have the proper dimensions of the bars. The defendants took steps for supplying the electricity for working the machine and for laying down the foundations for fixing it. The alternator was obtained and fixed by September 12th, 1912. Although the plaintiffs proceeded with the manufacture of the machine it was not ready within the time specified by the contract. In October the machine was ready, but the necessary clamps were not made, because the material had not been sent. The machine was sent by arrangement to the defendants' works at Braintree, and they arranged to re-design the clamps and test it. The test was made in the presence of representatives of the plaintiffs; but the results were not satisfactory, and the opinion was that the cause of failure was that with the clamps, as then made, their bars could not be properly welded. Subsequently the machine was tried again with unsatisfactory results, and the plaintiffs raised the point that the cause of the failure was the variation in the dimensions of the bars. The defendants, however, said that the welder was not fit for the work, and it was arranged that it should be sent back to plaintiffs to make alterations in order to overcome the difficulty occasioned by the variation in the dimensions of the bars. The plaintiffs declined to accept responsibility for the expense to which the defendants had been put, and difficulties arose in consequence, and when the plaintiffs began to press for the price of another electric welder, defendants objected to pay, on the ground that they had suffered a loss of between £400 and £500 by the failure to make the machine according to contract. Differences having become acute, a meeting of the representatives of both sides was arranged for June 11th, 1913, when a certain settlement was arrived at. It was part of the terms of that settlement that the machine was to be made so that it could be demonstrated, by test with material to be supplied by the defendants, that it was commercially valuable. By September, 1913, the plaintiffs having made alterations in the design of the clamps, they invited defendants to send representatives to see the machine at the plaintiffs' works; but it was found that the work was not good. Further tests were made afterwards, but it was not shown that the machine could weld the bars satisfactorily, and the defendants, therefore, refused to accept it. He found that the obligation of the plaintiffs under the settlement of June was to make the machine so that by test and demonstration it would reasonably satisfy the defendants that it was fit for their requirements. The plaintiffs failed to do that, and he therefore found that the defendants were not bound to accept the machine. As regards the claim for goods supplied (£56 16s.), they were delivered for trials of the machine; and as the machine failed, the defendants were not bound to keep the goods. That claim of the plaintiffs failed also. As to the counterclaim, the defendants alleged that plaintiffs failed to make and deliver the machine according to contract, and they claimed for the price of the alternator, the cost of the foundation for the alternator, the expenses connected with the work, the expenses of their representatives in attending the tests, and some other small incidental expenses. His opinion was that the plaintiffs were made sufficiently aware of the nature of the materials defendants used for their casement frames, and that the plaintiffs' contention that the contract was not broken because the material varied, was ill-founded. The defendants were entitled to reject the machine, because it was not in accordance with the contract. As to the machine not being up to the requirements, the plaintiffs said that it was put to work which it was not designed to do. Although the contention of the plaintiffs was erroneous, it was one which they were entitled to use. The arrangement which was come to disposed of the counterclaim for damages up to that date, and the claim of the defendants to recover such damages failed. Their claim for expenses in relation to the tests was very much exaggerated. He directed that judgment in the action should be entered for the defendants, with costs of the action, and that judgment on the counterclaim should be entered for the plaintiffs, with the costs of the counterclaim. As he had decided against both of the parties, he would stay proceedings under the judgment for ten days, and if both or either of the parties entered an appeal within that time the stay would continue until the appeal, which in the present state of the lists, would only be a short time.

Judgment was entered accordingly.

Extraction of Water from Peat by Electricity.

For several days last week the Court of Appeal, composed of the Master of the Rolls and Lord Justice Phillimore and Mr. Justice Joyce, was engaged in hearing an appeal by Witcarbonising, Ltd., from a judgment of Mr. Justice Warrington, in the Chancery Division, dismissing their petition for revocation of Letters Patent, No. 10,370 of 1911, granted to John Eustice Jameson, Oliver Harris Valpy and Edmund Arthur Buckle for improvements in the treatment of peat and the like. One of the claims was as follows:—"In the process of extraction of water from peat and like substances, passing an electric current through the pulp of the same heated to a temperature of at least 100° C., under a pressure such that no steam is produced, substantially as described."

The petitioners (the appellants) applied for revocation of the patent upon the ground that it was invalid for want of utility and insufficiency of directions. It was proved that the water in peat was partly free and partly combined in the form of "hydrocellulose," and that the combined water could not be got rid of by pressure as the free water could. Prior to the patent it had been suggested that the water could be removed by the use of a comparatively high temperature and pressure. The patentees (the respondents upon the appeal) alleged that the result could be attained by the use of an electric current at a lower temperature. The petitioners contended that the only result obtained by the use of the current was due to its heating effect.

Mr. Justice Warrington, in the Court below, held that the specification described a process in which the electric current was used to effect the decomposition of the "hydrocellulose" without recourse for that purpose to heat, while the earlier process depended on the effect of heat alone; that the process was useful; and that the directions were not insufficient. His Lordship accordingly dismissed the petition with costs, and granted the respondents a certificate of validity. Hence the present appeal of the petitioners.

Mr. Walter, K.C., Mr. Colefax, K.C., and Mr. Frost appeared in support of the appeal; and Mr. Bousfield, K.C., and Mr. J. Hunter Gray for the respondents.

The hearing was concluded on March 26th, when their Lordships reserved judgment.

Lighting Regulations.

At the Hull Police Court on March 23rd, Mr. Frank Garnett Jones, manager for Messrs. Ostler, was summoned for failing to comply with the Order of the General Officer Commanding the Humber Defences, in regard to the reduction of shop lighting.

It was stated by the police that the defendant had had lights in the shop which were so strong that they illuminated the whole street. There were 13 electric lights, and it was believed that half of these would have been all that were necessary under the present circumstances for the conduct of the business.

The Defendant said he had forgotten about the regulation, but Inspector Gall stated that he had spoken to the defendant on five previous occasions about the matter.

The Bench imposed a fine of £10, including costs, and ordered the defendant to pay £2 2s. solicitor's fee, with an alternative of two months' imprisonment.

London Tramway Assessment Appeal.

In the House of Lords, on March 26th, the Lord Chancellor and other Lords dealing with the matter gave their reasons for having recently allowed the appeal of the L.C.C. in their tramways litigation with the Borough of Islington. We shall refer to the matter later.

Marconi Agreement Dispute.

After a hearing extending over 15 days, Mr. Justice Avery and a special jury in the King's Bench Division, concluded the hearing of the action brought by Mr. John William Hamilton, civil engineer, and a former agent of the Marconi Co. in Australia, against the Marconi Wireless Telegraph Co., Ltd., claiming damages for alleged wrongful dismissal. He also claimed commission alleged to be due under an agreement under which he acted as the company's agent in Australia. The defendants pleaded that they were justified in their action and counterclaimed against the defendant in respect of alleged breach of duty.

Sir Edward Carson, K.C., M.P., and Mr. Eustace Hills were counsel for the plaintiff, and defendants were represented by Mr. Duke, K.C., M.P., and Mr. Stuart Bevan.

Sir Edward Carson, in opening the case, said that with regard to the commission certain sums were admitted, and on that part of the claim a question of construction arose which would be for his Lordship's decision. The jury would not be troubled with amounts as it had been agreed that that should be held over until the question of construction had been determined; the main claim for the jury would be for breach of agreement owing to the alleged wrongful dismissal under circumstances which, whether right or wrong, had brought about a loss of many years in the Colony in which the plaintiff was a man of influence and with long business connections. In 1910 it was agreed that the plaintiff should act as sales agent for the company in all the British Colonies situated within certain limits. The agreement was for three years, and would not terminate until May, 1913, but the company dismissed him in January, 1913. The plaintiff was to receive 5 per cent. of the gross value of sales in his territory, and if satisfactory the agreement was to continue for a further three years. In July, 1912, the plaintiff had an unfortunate dispute with Mr. Godfrey Isaacs. That was not put forward as a reason for determining the agreement, but from that time he was not allowed to do business for the company, and was refused all information as to what was going on. The reason given was that the Amalgamated Wireless Co. was to represent the defendant company in Australia.

A great mass of correspondence was read, and several witnesses were called on both sides, Mr. Godfrey Isaacs being amongst those who gave testimony for the company.

His Lordship concluded his adjourned summing-up on Wednesday, March 24th, and the jury, after an absence of four hours, returned to Court with a verdict for the plaintiff on all questions submitted to them.

Legal arguments on the questions of law raised in the case were adjourned until the following day.

On March 25th, after hearing arguments by counsel on the finding of the jury, Mr. Justice Avory entered judgment for the plaintiff. Judgment, he said, must be entered for the plaintiff for £300 and £2,340 which had been awarded by the jury, and also on the counterclaim. There would also be judgment for the plaintiff for the sums admitted to be due—namely, £35 15s. 4d. and £82 2s. 9d. Further, he would direct an account as to commission on a 5 per cent. basis, and judgment for the plaintiff for the amount found due. In ascertaining the commission, the prices must be taken to mean the contract price for the apparatus supplied for the installations carried out by the defendant company, where it was clear under the agreement he was himself to effect the contract for supplying the apparatus and installations.

Stay of execution was granted pending an appeal.

An Aberdeen Claim.

The record has been closed in the Sheriff Court in an action at the instance of a local watchmaker against James Pirrie, electrical engineer, 4, Hosefield Place, Aberdeen, for payment to the pursuer of damages laid at £700. The claim is in respect of bodily injuries caused to the pursuer through the alleged negligence of the defender, who, while driving a motor cycle and side-car along Cornhill Road, turned it on to the pavement and knocked down pursuer. Defender pleads that the accident was not due to any fault of his, but he has offered £140 in settlement of all claims against him by pursuer, which offer has been refused.

WAR ITEMS.

German Electrical Companies in War Time.—The Elektrotechnische Fabrik Rheydt (Max Schorch & Co.), of Rheydt, proposes to pay a dividend of 12 per cent. for 1914, as compared with 8 per cent. in the preceding year.

The gross profits of the Elektrochemische Werke, of Berlin and Bitterfeld, arising from the working community with the Griesheim-Elektron Chemical Works, and from manufacturing and investments, amounted to £86,000 in 1914, as compared with £84,000 in 1913. After defraying general expenses and providing for depreciation, the accounts show net profits of £62,000 as against £61,000 in the previous year, permitting of the payment of a dividend of 10 per cent. as in 1913. Under the company's agreement with the Griesheim-Elektron Works, which was concluded in 1889 for a period of 30 years, the former leased most of the works plant to the latter for the manufacture of chloride products and alkalies, carbide, sodium and magnesium.

The directors of the A.G. Mix und Genest, of Berlin, Telephone and Telegraph Works, state that the development of the works in 1914 was such that it was only possible to meet the requirements by a rapid accommodation of working methods to the new problems raised by the war. In addition to the usual business a considerable turnover was also effected by the execution of war orders, although the profits realised by the inland branches were less than in the preceding year in consequence of the war. On the other hand, the oversea business had been almost at a complete standstill since the outbreak of hostilities. It was proposed to liquidate the subsidiary company in Italy, but this would not result in any loss as compared with the balance sheet. The gross profits amounted to £107,000. After meeting general expenses and setting aside £18,000 for depreciation, the net profits are £60,000, as against £14,000, and a dividend of 12 per cent. is in contemplation, as contrasted with 4 per cent. in 1913.

The report of the Kabelwerk Duisburg, of Duisburg, characterises the past year as having yielded gratifying results, which are attributed, in addition to the great activity in the first half of 1914, to the favourable purchase of raw materials. After appropriating £23,000 for depreciation, as against £35,000 in 1913, the net profits are returned at £56,000, as compared with £46,000. The reduction in the amount set aside for depreciation is explained by the fact that a sum of £20,000 for special depreciation was allocated in 1913, thus bringing the book value of the machinery account down to one shilling. It is proposed to pay a dividend of 18 per cent. for 1914, as contrasted with 16 per cent. in the preceding year, and to place £12,500 to the guarantee fund for foreign debt risks and £12,500 to the contingency fund, leaving £1,800 to be carried forward. The report states that the extensions of the works were interrupted by the outbreak of war, but it is hoped to complete them by the end of June.

Power Transmission and the War.—How the activity of a company can be adversely affected by the prevalence of war when a portion of its area of supply is situated within one part of the war zone is strikingly illustrated by the experience of the well-known Rheinfelden Power Transmission Co., of Rheinfelden, down to the end of last year. During the first seven months of the year, the company's report states, a further development in the utilisation of the hydro-electric works at Rheinfelden and Wyhlen took place, the increase in consumption having almost entirely absorbed the output of the works. On the outbreak of war, however, the first effect on the works was the withdrawal of the German workmen; and secondly, the large bulk consumer represented by the Upper Rhenish Power Works Co., of Mulhausen, was compelled almost entirely to suspend the supply from August 8th, after the transmission lines and various installations in Alsace had been severely damaged by incidents of the war. In addition, the Wiesenthal railway, which receives electrical energy from the Wyhlen Works, was also compelled to stop the electrical service of trains. The result of these unfavourable developments was that the total delivery of energy, which amounted to a load of approximately 23,000 kw. at the end of January, 1914, receded to 4,000 kw. by the middle of August, which was almost uniformly divided between the Rheinfelden and Wyhlen works. It was, however, possible, in connection with the Upper Rhenish Power Co., to repair the transmission lines in Alsace in the first week of September, and the normal delivery of energy to Mulhausen was then resumed. The installations of most other consumers were also brought into operation gradually, so that the total load was increased to about 17,000 kw. in the last three months of 1914, but a reduced consumption prevailed down to the end of the year in the case of the Wiesenthal railway, an electro-chemical works, and the Zell Electricity Supply Co.

Lampmakers and the War.—We learn that the employés of the Osram and Robertson Lamp Works have collected by weekly subscriptions, up to March 24th, a total of £349 towards the Prince of Wales's War Relief Fund. The Lamp Works have 73 men who have joined H.M. Forces, and information has been received of four of the men being wounded. Fortunately, so far, no fatal case has been reported.

New Zealand.—An Auckland firm is prepared to take up agencies for United Kingdom manufacturers of cast-iron pipes and fittings, steel girders and channels, wrought-iron and overhead cables and electric wires, motor-car accessories and tires. A firm of electrical engineers and contractors in Invercargill desires to represent United Kingdom manufacturers of all classes of electrical machinery, appliances and fittings. The names may be ascertained at the Board of Trade Commercial Intelligence Branch, London, but communications should be sent to H.M. Trade Commissioner for New Zealand, P.O. Box 369, Wellington.

Australia.—Representation for a British firm of electric crane-makers is wanted by an agent in Melbourne, whose name may be ascertained at the Board of Trade Commercial Intelligence Branch in London. Communications to H.M. Trade Commissioner for Australia, Commerce House, Melbourne.

War Bonus Protest.—The Executive Committee of the Manchester Ratepayers' Association has organised a strong protest against any proposals to grant municipal employés a war bonus.

Russia.—It is announced that a meeting of prominent British and Russian merchants was held in London (at 1, Charing Cross Road, S.W.) last week, at which it was resolved to form the "Russian Chamber of Commerce in London" for the purpose of facilitating the promotion and extension of trade between the two countries.

Italy.—The British Chamber of Commerce is forming a branch at Rome.

Board of Trade Assistance.—The Board of Trade Commercial Intelligence Branch has issued list No. 13 (for the week ending March 20th) giving particulars of further inquiries received for sources of supply of goods.

Roll of Honour.—The "City Press" states that Private W. W. Pullen, Engineers' Section of the Royal Naval Division, who died on March 12th at the R.N. Hospital, Malta, was assistant engineer at the Leatherhead Power Station. He was a student under Prof. S. P. Thompson, at Finsbury. In the early months of the war he responded to the circular issued by the President of the Institution of Electrical Engineers.

Private Jas. Henry Gardner, of the King's Own Rifles, formerly a motorman in the employ of the Blackburn Corporation Tramways Department, died last week at Manchester, after the amputation of a foot. He was 30 years of age, and was wounded in France. He was buried with military honours, and the funeral was attended by about forty tramwaymen.

Personal.—"London Gazette" announcement:—Territorial Force: Electric Lights Company, Renfrewshire (Fortress) Engineers; Cadet William MacNicol Adam, from Inns of Court Officers Training Corps, to be Second Lieutenant. March 27th.

The Ilford Urban Council has declined to grant leave of absence to Mr. A. Glazier, engineer-in-charge for the Electricity Works, who has been offered a post as electrician in the Mechanical Transport Service Corps for the duration of the war, as the staff is already short-handed, 20 having joined the forces.

Mr. Thos. Cooke, electrician, Cambridge, and Mr. John Herbert Merry, electrician, Cherryton, have joined Kitchener's second army, being recruited at Cambridge.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Power and Lighting Rates.

I think it will certainly interest many of your readers to have the following information on the subject of electricity charges for photo-printing purposes, and I agree to your making what use you desire of such information.

The Ilkeston Town Council at its last meeting, held on March 2nd, passed the following resolution:—

"Resolved that the Town Clerk be, and he is hereby, instructed to prepare a case for the opinion of counsel as to the power of the Corporation to supply electricity to photographers for photo-printing purposes at power rates; and that such case be submitted to Mr. W. E. Tyldesley Jones, the editor of 'Will on Electric Lighting, Power and Traction,' for his opinion."

Mr. W. E. Tyldesley Jones's opinion is not yet to hand, but the circumstances relating to the position at Ilkeston have also been laid before the Local Government Board.

I might explain that I was Chairman of the Ilkeston Corporation Electricity Committee, and the following five questions of mine were put to the Board:—

1. "Is it illegal to supply current for photo-printing at power rates?"
2. "If we supply at power rates are we liable to be surcharged?"
3. "Can you quote any test cases bearing on the point?"
4. "Can you give me the names of a few towns where they have L.G.B. auditors?"
5. "Can you tell me where I can get a complete list of the towns who have L.G.B. auditors?"

The last paragraph of the letter to the Board was a request that instructions be given to the auditors that no surcharge be made in cases where power rates were being charged for photo-printing purposes.

The following is a copy of the Local Government Board's reply:—

[*Copy.*]

Local Government Board,
Whitehall, S.W.

Sir,

Photo Printing and Auditors, etc.

I am directed by the Local Government Board to advert to your letter respecting the cost of electrical energy supplied for the purpose of photographic printing.

In reply to the questions numbered 4 and 5 in your letter, I am directed to forward to you the accompanying list of councils of municipal boroughs whose accounts are audited by district auditors, and to state that the accounts of all urban district and rural district councils also are subject to such audit.

In reply to the questions numbered 1 and 2, I am to state that these matters seem to depend upon the terms of the special Act or Provisional Order under which the supply is given. The Board are not aware of any provision in the general law upon the subject.

In further reply to these questions and to question 3, I am to state that the Board are not aware of any decision of the Courts upon the point, and that they do not find that it has arisen on an appeal made to them from a decision of a district auditor. Apart from such an appeal they would have no power to decide the point.

The Board are not empowered to give any such instructions as are suggested in the last paragraph of your letter.

I am, Sir,
Your obedient servant,
(Signed) D. Dolton,
Assistant Secretary.

I think the above sentence which reads "The Board are not aware of any provision in the general law upon the subject" is very significant.

(Coun.) William Smith.

Ilkeston, *March 27th*, 1915.

BUSINESS NOTES.

Bankruptcy Proceedings.—George Driver & Son, electrical and mechanical engineers, Hythe Road, Willesden Junction.—The first meeting of creditors was held on March 23rd at the London Bankruptcy Court. Mr. E. Leadam Hough, Senior Official Receiver, reported that the business was commenced in 1891 by Mr. G. H. Driver at Euston Buildings, Euston Road, and two years later that gentleman was joined in partnership by Mr. E. W. Fladgate. In 1895 the present debtor, James Proctor Kyd Clark, became a partner, and put in £500 for a third share of the business, which was removed to Hythe Road in 1899. Mr. Fladgate retired during the ensuing year, under terms that he was to receive 5 per cent. per annum on his capital of £1,500 which he left in the business. It was further arranged that he was to receive that interest during his life, with succession to his sister. The business was continued by the debtor and Mr. Driver under the old style as equal partners until 1903, when the latter died, and the debtor arranged to pay out his late partner's capital of £1,600 to his executors by instalments. He subsequently continued the business alone, and at that time arranged to pay Mr. Fladgate £750 of his capital by instalments, and of that he had paid £250. The business was solvent at that time, and was continued by the debtor till last September, when he agreed to sell the goodwill and all the properties connected with the business for £200 to a Mr. W. J. Thomas, who also agreed to take over the trade debts and the liability to Mr. Fladgate. He obtained the £200 in October, and had used the money for living expenses. In 1901 the debtor and Mr. Driver formed the Driver Automatic Weighers, Ltd., to take over from the firm the goodwill of a patent weighing machine business. The capital of the company was £10,000, in 5,000 preference and 5,000 ordinary shares of £1 each. In 1905, in consequence of competition, it was decided to realise the bulk of the assets of the company, and from the proceeds of sale the claims of the creditors and preference shareholders were discharged. No statement of affairs had been lodged, but the debtor roughly estimated his liabilities at £1,850, of which £1,700 was due to the petitioning creditor in respect of a disputed claim, and he had no assets of any kind. It was a question, added the chairman, whether the debtor intended by the sale of his business to Mr. Thomas to defeat the claim of the petitioning creditor. In the absence of any offer the case was left in the hands of the Official Receiver, to be wound up in the ordinary course of bankruptcy.

Catalogues and Lists.—Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—Illustrated and priced leaflet (No. 60) describing their liquid starting switches for polyphase slip-ring motors.

Messrs. Gillespie & Beales, Norfolk Street, Strand, London.—Illustrated descriptive list relating to the "Nilfisk" electric suction cleaner; also a leaflet giving special points for the trade concerning it.

The County of London Electric Supply Co., Ltd., has issued a wall telephone card for the use of its consumers.

Messrs. Arnold, Goodwin & Son, Ltd., Sumner Street, Southwark, London.—List No. 160 containing tabulated particulars and illustrations of the firm's belt-driven air compressors.

Messrs. Ercole, Marelli & Co., of Milan.—Eight-page illustrated list describing in Italian their small electric motors, transformers, pumps, electric fans, &c.

The "Lowa" Electrical Co., 86-90, Chancery Lane, London, W.C.—Circulars giving particulars of the "Lowa" dimming switch and the "Grip" shade carrier.

Book Notice.—"Motor Cycles." By B. E. Jones. London: Cassell & Co. Price 1s. net.

Private Arrangements.—The British Prometheus Co., Ltd., Salop Street, Highgate, Birmingham, Warwick.—In pursuance of Sec. 188 of the Companies' (Consolidation) Act, 1908, a meeting of the creditors interested herein was held on March 25th at the offices of Messrs. Poppleton & Appleby, chartered accountants, 26, Corporation Street, Birmingham, when an approximate statement of affairs was presented showing the position as at January 23rd last. According to this the liabilities totalled £1,590, of which £1,490 was due to the trade, the balance being in respect of a liability under lease as to repairs. The assets were estimated to produce £9,164, and comprised stock in trade £3,832; patent rights, £300; book debts, £1,700; plant and machinery, £1,286; tools and patterns, £211; office furniture, £250; and cash in bank, £1,585. After allowing £6,943 for the claims of the preferential creditors and debentures, the net assets were reduced to £2,221, the estate showing an apparent surplus of £631. It was stated that the company had been adversely affected by the war. The accumulated losses between 1902 and 1914 had amounted to £5,700, while £9,200 had been written off the assets. The loss from July 14th last to date was £1,800. The matter was left in the hands of Mr. C. T. Appleby, as liquidator, with a committee consisting of Messrs. E. Pugh & Co., Mr. Robert Rigby and Mr. Cripwell representing creditors.

Sydney Contracts.—The Sydney Municipal Council has adopted the following motion, viz., "That in view of slight informalities in tenders having caused lowest tenders to be rejected, entailing loss to the citizens, it is desirable that a clause in conditions of tendering be inserted to admit of such informalities being waived and the tender being considered, provided the Council is satisfied that such informality is *bonâ fide* and not prejudicial to the true interest and meaning of the specification and conditions as to tendering."—*Tenders.*

Composition.—G. Braulik, 8, Lambeth Hill, E.C.—Mr. G. E. Corfield, the trustee, reports that the business under his supervision has been continued upon a satisfactory basis. He has now declared the fourth and final instalment of 2s. 6d. in the £, making 10s. in all. In regard to new goods which have been or may be ordered in future, Mr. Braulik will take all responsibility.

Trade Announcements.—Mr. T. J. Read, electrical engineer, of 94, Victoria Road, Swindon, announces that owing to his departure from the town he is giving up the business.

Mr. Fred Edmonds, electrical engineer, has commenced business at Highworth, Swindon.

Owing to heavy demands which have been made upon them for cables and flexible cords since German supplies were cut off, Messrs. Cave & Higgin, Ltd., have removed to larger premises at 19, Hardman Street, Manchester. They will forward particulars on application.

LIGHTING and POWER NOTES.

Aberdeen.—During February 1,118,630 units were generated at the municipal power station, an increase over the corresponding month last year of 104,750 units.

Australia.—The Launceston (Tas.) City Council has decided to ask the Government to submit terms and conditions for a supply of energy from the Great Lake plant. It is estimated that, at a cost of £60,000 for transmission, 10,000 H.P. could be brought to Launceston. Unless satisfactory terms can be obtained, an auxiliary steam plant will have to be installed.

The Maldon (Vic.) Shire Council has, owing to the prospect of an increased price for gas, decided to obtain particulars from other municipalities as to the cost of electric lighting.

The Dalby (Q.) Council has been granted an order authorising the installation of the electric light within the municipality.

The Table Bay (Tas.) Municipal Council is considering the question of borrowing £6,000 for the Wynyard electric lighting scheme.

The North Illawarra (N.S.W.) Council has decided to light the municipality by electricity, the work to be carried out when funds are available. It was also resolved that the various townships should be lighted on a ratepaying basis.—*Tenders.*

Aylesbury.—Public Lighting, &c.—The U.D.C. has decided to apply for a loan of £400 for street lighting by electricity. It is proposed to provide 62 new lamps and convert 31 existing gas lamps. A contract has been made with Messrs. Hazell, Watson & Viney, who have guaranteed to take not less than £200 worth of energy per annum. A loan of £250 is also to be applied for to cover the cost of wiring the Town Hall and adjoining premises; current for power will be available by the end of April.

Ballymena.—The B. of G. was recently informed by the L.G.B. that the provision made by Parliament for local loans was fully allocated, but if the Guardians were unable to obtain the £3,500 required for heating and electrically lighting the Workhouse and new hospital, they might renew their application to the L.G.B. in a month's time.

Barking.—Proposed Loan.—The U.D.C. has applied to the L.G.B. for a loan of £18,000 for extensions and additional plant at the electricity works.

Barnet.—Workhouse Lighting.—The B. of G. has decided to defer the acceptance of a tender for the electrical installation at the Workhouse for the present, those received being so much above the estimate. The North Metropolitan Electrical Supply Co. is to be asked to quote terms for a supply of current for lighting and power for seven or ten years.

Blackpool.—The output of the electricity works for February showed an increase of 27,985 units on February last year; this advance has been made despite the falling-off in the supply of 16,908 units for public arc lamps, and 8,700 units to the tramways. For the 11 months the total increase has been 353,356 units, although the public arc lamps show a decreased supply of 40,041 units.

Bolton.—Public Lighting.—The B. of T. has sanctioned the erection of overhead wires for the lighting of Long Lane, Breightmet, by electricity.

Boston.—L.G.B. Inquiry.—At an inquiry held on March 24th into the application of the T.C. for a loan of £3,600 for a refuse destructor, the inspector (Mr. R. H. Bicknell), intimated that the Council would not be able to get the money, because the Local Loans Commissioners would not grant it, and it would be very difficult to get it elsewhere until the Treasury had withdrawn its circular.

Broadstairs.—Public Lighting.—The U.D.C. has asked the Thanet Tramway and E.L. Co. to install a sample electric lamp in connection with its offer for public lighting where the mains run.

Easebourne.—Public Lighting.—The P.C. has received an offer from the Midhurst and District E.L. Co. to light the streets by electricity.

Eccles.—The terms on which the Manchester Ship Canal Co. is prepared to allow the Corporation to take water from the Bridgewater Canal for condensing purposes have been before the Public Lighting and Electricity Supply Committee, and the latter has decided to intimate that it cannot agree to the terms.

Finchley.—Coal *v.* Oil Fuel.—Messrs. Blackmore and Co., the District Council's contractors for the supply of coal to the electricity department, have intimated that they are unable to comply with the terms of their contract.

The electrical engineer reports that the deliveries of oil fuel were being satisfactorily maintained, and that this, together with the oil engine, was of the greatest assistance in the present situation.

Haslingden.—Loan Proposals.—The L.G.B. has notified the Corporation, in reply to an application for sanction to a loan of £12,000 for electricity extensions, that only work absolutely necessary should be proceeded with, and that capital expenditure should be limited as much as possible. The Electricity Committee has agreed to act in accordance with the communication.

Heston and Isleworth.—The Electricity Committee has decided to charge for current supplied to rifle ranges on the same basis as that fixed for power supply.

Hull.—Plant Extensions.—In connection with the proposed extensions of the electricity works, we understand from Mr. Magoris, deputy city electrical engineer, that the E.L. Committee was recommended to install the 5,000-KW. turbine set, one boiler and feed pump, and to defer for the present, a second boiler, cooling plant, coal-handling gear, &c. This modifies the information contained in our note published last week, which was derived from local sources.

Ilford.—The Electricity Committee has given instructions for all agreements in respect of wiring, fittings and apparatus on hire, agreements for maintenance, &c., to be terminated. In view of the great increase in the cost of coal, the electrical engineer recommends fitting two dry-back boilers with mechanical stokers.

India.—Cauvery Falls.—The chairman of the Nundydroog Co., Ltd., speaking at the annual meeting in London last week, referred to the slight increase in costs, which was attributable to a protracted drought occasioning a shortage of water in the Cauvery River during March, April, May and June, necessitating the use of steam power in place of electricity. Years ago, when they first discussed the question of introducing electric power, they told shareholders that the steam plant would be kept in repair, properly cleaned, so as to be used in any emergency. They, therefore, fell back upon it for several months. The Mysore Government was now constructing a large storage reservoir, which in due time would ensure a constant supply of power under the Cauvery scheme. It might not be entirely completed this year, but it would afford some additional protection, and under ordinary circumstances they need not look forward to a stoppage again on account of shortage of water.

A licence has been granted to Messrs. Crompton & Co. to supply electricity to the town of Agra.

Ipswich.—Three-Phase Extensions.—Extensions have recently been completed and put into operation whereby the whole of the eastern district of the town, which is largely residential, has been provided with an electric supply from four-wire, three-phase low-tension mains, the pressure being 400 volts between phases and 230 volts from any phase to neutral; 5·2 miles of main have already been laid. The district is supplied from two brick-built static transformer sub-stations, which are fed from duplicate three-phase feeders at 3,000 volts. On their way to the eastern district the duplicate feeders, which are each 2·75 miles long, are looped into a rotary converter sub-station in the foundry district, designed to supplement the existing continuous current supply to the consumers in that neighbourhood. The three-phase supply at the power station is at present provided by a rotary converter, running inverted on the D.C. supply, and having a normal alternating-current output of 312 K.V.A. As a stand-by for this there is a 300-K.V.A. three-phase alternator connected to one of the original Reavell tandem compound three-crank engines running at 375 R.P.M. Automatic voltage regulation is provided for on both the rotary and alternator by means of a Taylor-Scotson regulator, this being the third of that make of regulator installed at Ipswich. The two rotary converters in the foundry district sub-stations are arranged for a normal output of 250 KW. The whole of the generating and converting plant has been supplied by the British Westinghouse Co., and the main switchboards have been supplied by the Switchgear Construction Co. The transformers in the static sub-stations have been supplied by Messrs. Ferranti.

Keighley.—The R.D.C. has given permission to the Corporation to lay a cable to the Keighley Joint Hospital, on the understanding that no supply is given to the East Morton Ward.

Kingston.—Increased Prices.—In accordance with the recent resolution of the Council, raising the prices of electricity for lighting, the E.L. Committee has increased the flat rate to 5½d. per unit, the m.d. rate to 7½d. and 3½d. per unit, the tariff to churches to 5d. per unit, and for public lighting by 10 per cent.

Leeds.—Permission has been granted by the Morley Corporation to the Leeds City Tramways Committee to lay cables giving a temporary supply of electricity to Messrs. A. Marshall and Sons, of Perseverance Mills, the newer portion of which are electrically equipped.

Leyton.—Proposed Loans.—The Electricity Committee of the U.D.C. recommends an application to the L.G.B. for sanction to loans of £17,158 for additional plant at the power station and £1,000 for services.

Llandudno.—New Plant.—The U.D.C. has decided, in view of the L.G.B.'s refusal to sanction a loan of £2,000 for extending the generating plant at the electricity works, to pay for the plant out of the reserve fund.

London.—The directors of the London Electricity Supply Companies have decided to raise the price of energy as from April 1st.

A new lighting order has been issued by the Commissioner of Police for the City, which amends the hours during which the inside lighting of shop fronts must be reduced, to from 7 p.m. till sunrise during the month of March, from 7.30 p.m. till sunrise during the month of April, from 8.30 p.m. till sunrise during the month of May, from 9 p.m. till sunrise during the month of June, and until further orders. This order, which came into force on March 22nd, does not affect the time fixed for the carrying of a red rear light by vehicles.

Poplar.—The Electricity Committee has had under consideration the question of the disposal of the surplus profits of the electricity undertaking, and also a profit-sharing scheme, and recommends that from April 1st the charge for private lighting shall be reduced from 5d. and 4d. to a flat rate of 3d. per unit, and for long-hour consumers from 2½d. to 2d. per unit net; domestic consumers' charge from 12½ per cent. on installation expenditure to 8½ per cent., and from £4 per KW. to £3 per KW. standing charge for general lighting purposes; also that a limited number of fans and radiators of standard type shall be loaned to consumers free of charge, in order to develop this class of supply. The Committee also reports that a reduction in the price of power can be effected in the near future if the policy of writing down capital in respect of obsolete plant is continued, so as to reduce the outstanding capital per KW. installed below £25. The Committee recommends, as a definite system of disposal of future profits, that after providing for all usual maintenance charges, and writing down service and instrument loans, the floating balance of the undertaking as set out in the balance-sheet of the annual report shall be at least equal to 10 per cent. of the total income in any year. Of the remaining balance, 40 per cent. shall be devoted to the relief of the rates, 40 per cent. be placed to the credit of machinery capital account to provide for obsolescence of plant, and 20 per cent. be dividend amongst the workmen and staff of the undertaking up to £1,200 and on further amounts the bonus be reduced one-half. It is proposed to appropriate an amount equal to a 1d. rate from the electricity fund for the relief of rates.

L.C.C.—The Treasury has drawn attention to the action of the Hackney B.C. in obtaining a loan of £10,000 from its bankers, which the Treasury had declined to allow it to borrow from the L.C.C.; although Treasury approval is not necessary in all circumstances before sums are borrowed by B.C.'s from their bankers, it should be understood that if a Council insists upon incurring capital expenditure against the wishes of the Treasury, which is acting with a view to the general interests of the nation in existing circumstances, sanction will not be given by the Treasury or the L.G.B. in the case of any further application for approval of borrowing for any purpose whatever.

The L.C.C. Finance Committee recommends the Council to sanction the borrowing of £4,000 by the Stoke Newington B.C. for mains and meters, providing the Council undertakes not to incur further capital expenditure which is not really necessary.

Stepney.—The B. of T. has approved the supplementary agreement with the Shoreditch B.C. for a limited bulk supply.

Mountain Ash.—Proposed Loan.—The U.D.C. has decided to meet the cost (about £550) for the provision of a substation in connection with the electric supply at Abercynon, out of the rates, and to apply to the L.G.B. for a loan of £2,650 for carrying out the other portion of the scheme.

Penzance.—The Penzance and District Electric Supply Co. announces that it is extending the mains in the town, particularly in the Lescud Jack district, and is wiring premises on the instalment system.

Perth.—New Plant.—The Electricity Committee recommends the purchase of certain generating plant at Loughborough, for £1,835; a deputation recently inspected the plant with a view to purchasing it, and thus avoiding further borrowing.

Portaferry.—E.L. Scheme.—The L.G.B. has granted the application of the Downpatrick R.D.C. for powers to carry out a lighting scheme for Portaferry. The area embraces the three townlands of Ballymurphy, Ballyphilip and Tullyboard.

Shipley.—Owing to the high price of copper, and the high rate of interest on loans, the Electricity Committee has deferred the carrying out of certain extensions for the present.

Upper Beeding.—Proposed E.L.—At a meeting of the P.C. on March 23rd, a letter was received from Mr. C. B. Oxley, of Steyning, offering to supply electricity for public lighting at 1s. per week per lamp, and also for private consumption. The Council decided to discuss the matter with Mr. Oxley at the next meeting.

TRAMWAY and RAILWAY NOTES.

Blackpool.—The total tramway receipts from April 1st last year to March 18th this year amounted to £74,393, a decrease of £8,724.

Chester.—Year's Working.—It is estimated that the gross profits from the tramways for the year just closing will be £5,087, as against £5,045 last year.

Colwyn Bay.—Tramway Extension.—The electric tramway line from Colwyn Bay to Old Colwyn has now been completed and fully equipped. The extension is nearly 2 miles in length, and will serve a considerable population on the route as well as the residential and industrial population at Old Colwyn and Llysfaen.

Continental.—Italy.—The Communal Authorities of Rome have been authorised to construct and work, by electric traction, an extension of the Piazza Colonna—Piazza Santa Croce tramway, and also an extension of the line from the Via Po to the Zoological Gardens. The "Società Elettrica Sarda" has also been authorised to construct and work an electric tramway system in the town of Cagliari.

Edinburgh.—Tramway Inquiry.—An inquiry has been held under the Private Legislation Procedure (Scotland) Act, into the prov. order promoted by the Corporation. A proposed tramway branch to Colinton Village and Redford Barracks was opposed by the Colinton Tramways Co. and the County Council. Mr. Cooper, K.C., explained the Corporation proposal to use self-propelled cars, and Mr. A. H. Campbell, the burgh engineer, gave evidence in support of the scheme. Mr. Stephen Sellon said he did not think the Corporation scheme would affect the company's scheme very much, but it would be better for the shareholders if the latter scheme disappeared. Mr. J. B. Hamilton and Mr. Shepherd (Edinburgh Tramways Co.) also gave evidence, while the County Council opposed on account of the narrow roads, and for the company it was pointed out that they hoped to commence construction before February, 1916.

Mr. Macmillan, K.C., for the Colinton Tramways Co., said the company had been authorised by Parliament to construct the line in the full knowledge that it was to be used as a track for the conveyance of material till the population came.

Mr. Cooper, K.C., for the Corporation, said that the T.C. might have been led to consider the purchase of the Colinton Tramways Co.'s undertaking, but it was resolved that under no circumstances would it take over the Colinton tramways along with the company's obligations to the War Office at this time.

The Court eventually decided that the Corporation be granted power to construct a line in the Corstorphine district and in the Colinton area, by Firhill, by circular route to the Braid Hills.

In regard to the portion of the route from Craiglockhart to Colinton, an offer was made by the Colinton Tramways Co. that the Corporation should purchase the rights there at £9,000, but this offer was refused by the Corportion, and that part of the route was withdrawn.

Glasgow.—Female Conductors.—As an experiment, and in view of the shortage of men, women conductors are being tried on the Corporation tramways.

Hull.—The T.C. is applying for powers to construct two additional lines of tramway in the city.

Ilford.—The U.D.C., last week, had a long discussion on a motion to the effect that, in view of the financial condition of the tramway undertaking, the best available expert advice be called in to assist the Council in formulating a scheme by which the undertaking can be placed upon a sound commercial basis. Owing to the lateness of the hour, the discussion was adjourned until the next meeting.

Lancashire.—In our issue of March 19th we stated that owing to recruiting, the number of men carried on the South Lancashire Tramway Co.'s system in the early morning and afternoon was showing a material shrinkage. We understand from Mr. E. H. Edwardes, the manager, that this is incorrect. As a matter of fact, the workmen's receipts happen to be above the average.

London.—The Finance Committee of the L.C.C. has received an intimation from the Treasury that consent will not be given to any municipal expenditure which is not actually necessary in the national interests. The Treasury is not able to approve of the Council's tramway scheme, involving a capital expenditure of £250,000, and suggests the slowing down of any municipal works now in progress.

Oldham.—The Tramways Committee has agreed to a proposal of the manager that Spencer air brakes should be purchased in substitution for the air brakes now in use. The change was recommended on account of the lessened cost of maintenance in the case of the Spencer brakes.

Salford.—FEMALE CONDUCTORS.—Consideration has been given by the Tramways Committee to the question of employing women as car conductors, but it is felt that the scarcity of male labour is not yet so pronounced as to make the change necessary. Alderman G. T. Jackson, general secretary of the Amalgamated Association of Tramway and Vehicle Workers, has stated that his union will not object to the employment of women during the war only, but will insist that they shall be paid the same rates as the men whom they replace.

TELEGRAPH and TELEPHONE NOTES.

Japan.—The Japanese Government has been inquiring into the submarine cables laid by Germany in the Far East, which amount to a length of about 4,000 miles. The main cable extends from Kiaochau to Yap, Celebes and Guam *via* Shanghai. From Shanghai the lines are worked by the German-Dutch Telegraph Co., and cannot be confiscated by Japan. The line between Tsingtao and Chefoo, which extends for about 400 miles, and was operated by the German Government, was seized by Japan as a trophy of war on the fall of Tsingtao, and is now being used for official communications. The Japanese Government is considering the question of connecting the line with the newly-laid line between Shanghai and Nagasaki, with the view of facilitating telegraphic communication between Japan and China.

New telephone exchanges are being established by the Japanese Post and Telegraph Departments in the towns of Kitaku, Osaka, Rosokucho, Kanda and Tokio.

Wireless Telegraphists Wanted.—Wireless telegraphists between the ages of eighteen and thirty are wanted for the Royal Naval Air Service. Pay ranges from 4s. to 6s. a day, with all found. Applications should be made to the Recruiting Officer, Royal Naval Air Service, London Aerodrome, Hendon.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—April 6th. U.D.C. Motor-generators or converters, one H.T. switchboard and L.T. panels, and one H.T. feeder pillar. See "Official Notices" March 19th.

Aldershot.—April 20th. U.D.C. One 400-KW. D.C. turbine set, complete with surface condenser and circulating pumps, &c. One water-tube boiler with chain-grate stoker. See "Official Notices" March 26th.

May 4th. Steam and other pipework. Water-softening plant. See "Official Notices" March 26th.

Australia.—MELBOURNE.—April 19th. 13,560 yards of lead-covered cable, for the City Council. See "Official Notices" March 26th.

April 19th. 13 tons of bare hard-drawn copper cable for the City Council. See "Official Notices" March 26th.

May 19th. Electric signals and spare parts (Contract 28,591), track transformers (Contract 28,359), electric train stops (Contract 28,590), all for a period of five years. Particulars at Contractors' Room, Spencer Street.

June 2nd. Electric lighting material for cars (Contract 28,187). Tender box, Railway Offices, Melbourne. Particulars at Contractors' Room, Spencer Street. Deposit ½ per cent. of amount of tender.

June 15th. Four mechanically-fired boilers, for the City Council. Specifications (£1 1s.) from the City Electrical Engineer.

QUEENSLAND.—June 1st (instead of March 16th). P.M.G. Switchboard for Warwick. See "Official Notices" March 26th.

Batley.—April 6th. Electric light installation at Batley Carr Wesleyan Sunday School. Mr. E. P. Lobley, Jesmond Dene, Birkdale, Dewsbury.

April 7th. Twelve months' supply of stores for the electricity works. Mr. D. Jones, Manager.

Bray.—April 6th. U.D.C. Stores for electric light works. See "Official Notices" March 19th.

Bridgend.—April 8th. U.D.C. 400-KW. steam alternator. See "Official Notices" March 19th.

Brighton.—April 12th. Corporation. Surface condenser. See "Official Notices" March 26th.

Bristol.—April 14th. Incandescent electric lamps (from local firms or from firms in a position to supply from local stocks), for the Docks Committee of the T.C., from May 1st to August 31st. Mr. T. A. Peace, Engineer.

London.—SOUTHWARK.—April 14th. Cable and meters, for the Borough Council. See "Official Notices" to-day.

Manchester.—April 14th. Corporation. Three 1,250-K.V.A. static transformers. See "Official Notices" to-day.

Rhondda.—April 17th. U.D.C. Installation, 83 wiring points, 88 lighting points, at the Council Offices, Pentre. See "Official Notices" to-day.

Sheffield.—April 12th. Supply of motor-van (petrol or electric) to carry one ton, for the Corporation. Specification (10s.) from the Cleansing Superintendent, Town Hall.

Whalley.—April 5th. Lathes, vices, electrical instruments, &c., for County Asylum. See "Official Notices" March 26th.

CLOSED.

Australia.—The following contracts have been placed :—

Melbourne City Council.—
  5,000 KW. turbo-alternator, £15,111; spare parts, £1,015. British Westinghouse E. & M. Co., Ltd.
Prahran and Malvern Tramway Trust (Victoria).—
  Booster and switchgear, £920.—Noyes Bros. Pty., Ltd.
Shire of Nunawading (Victoria).—
  Electric light poles, £379.—M. W. Clements.
  Meters, £162.—Edison & Swan U.E.L. Co., Ltd.
  Fuses.—W. T. Henley's Telegraph Works Co., Ltd.
  Cables, £347.—B.I. & Helsby Cables, Ltd. *Tenders.*
Municipal Council of Sydney; annual supplies.—
  Wires and cables, schedule rates.—Henley's Telegraph Works Co., Ltd.
  Fuse-boxes and fuses, £664.—Laurence & Hanson.
—*Aust. Mining Standard.*

Bolton.—The Electricity Committee has accepted contracts for 12 months' supplies as follows :—

Casings and covers.—F. J. Webster.
Jointing material and rings.—N. Isherwood.
Trough covers.—Bolton Brick Co.

Brighton.—The B. of G. has accepted the tender of Mr. H. J. Galliers, of Brighton, for electrical fittings, at £27.

Canterbury.—The B. of G. has accepted the tender of Mr. Terry for electrical work for the ensuing half-year.

Croydon.—The tender of Messrs. Callender's Cable and Construction Co., Ltd., has been accepted by the B.C. for the supply of electric cables to March 31st, 1916. This is subject to a contract providing for payment on a sliding scale based upon the market price of copper (reported to be about £70 per ton).

Ilford.—The following tenders have been accepted for annual supplies to the Electricity Department :—

Cables.—W. T. Henley's Telegraph Works Co., Ltd.
House-service fuse boxes.—J. H. Tucker & Co.; W. Lucy & Co., Ltd.
Joint boxes.—W. Lucy & Co., Ltd.
Incandescent lamps.—Cryselco, Ltd.; Electrical Manufacturing and Supplies; London and Rugby Engineering Co., Ltd.
Meters.—Ferranti, Ltd.; British Thomson-Houston Co., Ltd.; Electrical Apparatus Co., Ltd.

It has been decided not to enter into any contract for network boxes, but to order the boxes as required.

London.—Messrs. Napier & Kimber, Ltd., have obtained the contract for an electric lighting installation at the First Sea Lord's residence, for H.M. Office of Works.

L.C.C.—The Highways Committee recommends that the chairman and the vice-chairman of that Committee be severally authorised during the Easter recess to open any tenders that may be received in connection with the supply of cables required for the extension of the Woolwich sub-station, and to accept the most favourable tender or tenders.

STEPNEY.—The B.C. Electricity Committee reports the purchase of 4,500 tons of coal for the electricity undertaking in various lots, at prices varying from 18s. 5d. to 27s. 6d. per ton; and also recommends that a further offer of 2,500 tons of Barnsley Bed Top hard 1¼-in. nutty slack, at [illegible] per ton be accepted.

WOOLWICH.—The Electricity Committee of the Borough Council has accepted the offer of Messrs. Babcock & Wilcox, Ltd., to supply the additional shafts and uptakes for the two additional steam units, at £990.

Manchester.—Messrs. Chamberlain & Hookham, Ltd., have received a contract for tramcar meters for one year from the Corporation.

FORTHCOMING EVENTS.

Greenock Electrical Society.—Friday, April 2nd. At 7 45 p.m. At 21, West Stewart Street, Greenock. Social meeting.

Salford Technical and Engineering Association.—Saturday, April 3rd. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "Lifting Machinery," by Mr. D. Riley.

Institution of Marine Engineers.—Tuesday, April 6th. At 8 p.m. At Tower Hill, Minories, E.C. Paper on "Solid Fuel, from a Technical and Commercial Standpoint," by Mr. A. E. Battle.

North of England Institute of Mining and Mechanical Engineers.—Saturday, April 10th. At 2 p.m. At Newcastle. General Meeting.

Association of Engineers-in-Charge.—Saturday, April 10th. Social and Dance.

NOTES.

Geneva Water Supply.—Drinking water is raised to the city of Geneva by pumps installed in the Coulouvrenière power station on the Rhone below the city. The water is carried to these pumps by a conduit 4 ft. in diameter and 4 000 yards long terminating in Lake Geneva at a depth of nearly 50 ft. This conduit which is completely submerged, follows at first the bed of the Rhone, crosses the harbour and ends at the intake strainer, 2,200 yards from the jetty. At first water flowed into the conduit in sufficient quantity by gravity alone, but recent increases in the city's water consumption have made it necessary to supplement gravitational intake, at any rate during hot weather when the lake is low. Since suction applied to the delivery end of the conduit would have involved more or less in-leakage of impure Rhone water or even mud, it was decided to force water into the conduit by a pump installed in the lake.

For this purpose an electrically-driven centrifugal pump was erected 50 ft. away from the conduit at a point 1,700 yards from the strainer intake, and where the lake is about 13 ft. deep. The pump suction and delivery pipes are connected in shunt to the conduit at points about 8 ft. apart between which is a valve closing automatically unless there is pressure on its up-stream face. When the pump is working this valve is closed; otherwise, the valve is open and water flows through the conduit by gravity alone. The vertical spindle centrifugal pump is direct coupled to an asynchronous motor above it, the whole being inside a sheet metal caisson 23 ft. in diameter at the base and composed of two truncated conical sections surmounted by a cylindrical section 8 ft. in diameter, which alone emerges at times of high water. Four manholes are provided in the cover, and a signal light indicates the position of the caisson by night. The caisson was assembled on the shores of the lake, towed about 2,000 ft. from the jetty, sunk by cement ballast and anchored by a ring of screw piles.

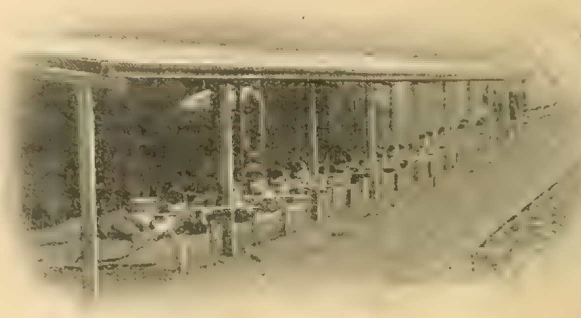
Running at 200 R.P.M. the pump discharges 14,600 gallons per minute against 10-ft. head. The squirrel-cage asynchronous motor mounted above it, in a carcass common to the two machines, develops 65 H.P., and is supplied at 2,000 volts, 40-cycles, from a special alternator in the Coulouvrenière station. This alternator generates at 2,100 volts, at 600 R.P.M., and is direct-coupled to a 105-H.P. Pelton wheel fed from the Geneva high-pressure water mains; a 5-H.P. exciter is driven in the same manner. With this arrangement operation is as simple as possible, the exciter being first started and the alternator and pump motor running up to speed together as the turbine valve is opened. Supply to the pump motor is through a three-phase cable, partly submarine; and automatic lubrication is ensured by a gear-driven pump.

Electricity in U.S. Steel Works.—Prior to 1914 the largest induction furnace used in the States had a capacity of only 2 tons, but last year two 20-ton furnaces were installed for steel refining, and these are the largest of any type now used in America for this purpose. The furnaces are of the two-ring type, and use single-phase current at the exceptionally low frequency of 5 cycles per second. The motor-generator employed has 4 000 K.V.A. output at 5,000 volts, and is direct driven by a three-phase 25-cycle 2,300-volt synchronous motor. The core and coils for each furnace weigh 60 tons, and the refining process, after charging with molten metal, occupies 60 to 90 minutes. The automatic control provided in the latest types of arc furnaces is particularly interesting to practical operators in that, except during a short period after starting the furnace, constant power input is maintained at any predetermined amount. Resistance furnaces utilising heat generated by the passage of current through a resistor of foundry coke, with auxiliary heating from a carborundum arch throwing heat downwards on to the charge, are also provided with relay control, maintaining constant temperature automatically at anything from 1,200 to 2,400° F.

Many modern rolling mills use electric motors exclusively for power purposes. Thus in the new works of the Bethlehem Steel Co., gas-driven alternators supply three-phase 25-cycle 6,600-volt induction motors, ranging from 350 to 3,000 H.P., and aggregating 12,000 H.P. The variable load of rolling mill machinery has proved a difficulty in the past, but the latest speed regulating equipment gives to induction motors the speed characteristics of D.C. shunt-wound machines, permitting them to carry variable load at constant speed, while retaining the mechanical strength and simplicity of the induction motor. Due to the availability of large quantities of power gas in iron and steel works, gas engine drive for electric generators is a specially tempting proposition, but one subject to well-known difficulties. Three 1,400 K.V.A. 2,300-volt 60-cycle units running at 116 R.P.M. were installed last year, and are believed to be the largest 60-cycle generators designed for gas engine drive, though 3,200 K.V.A. 25-cycle sets were previously installed at Bethlehem. The practicability of the large 60-cycle units is due to improved regulation and paralleling characteristics.

Miniature Rifle Ranges.—Few people, other than those who are actually members of Miniature Rifle Clubs, realise the enormous number of these clubs that exist in this country. In practically every village, town and city one or more ranges were to be found before war broke out, particularly in the Midland and Northern Counties, and since then numberless other ranges have sprung into being. That practice on these ranges is of great value when the marksmen take up the more serious work of service rifle shooting has been proved times without number; chiefly it is of value in accustoming the marksman to the handling of the rifle and to taking aim.

The new armies in process of formation have been largely trained on the ranges built by the War Office and on private ranges. One of the Manchester Pals Battalions (the 18th Manchester Service Battalion) has been through a complete course of musketry on the range built by the British Westinghouse Co. in their works grounds at Trafford Park, Manchester. For many years a small range at the Westinghouse Club House has been in operation and well patronised by the members of that organisation, and this no doubt led, when war broke out, to the building of the more ambitious range, the firing point of which is shown in the accompanying illustration. No fewer than 36 men can shoot at one time on this range—10 at 25 yards and 26 at 50 yards. The cost of it, together with that of the rifles, telescopes, &c., was largely covered by the voluntary subscriptions of the employés, and a considerable part was built by them. The Westinghouse Co. gave considerable financial assistance and lent the grounds. In order to prevent any interference with recruiting, passes to shoot on this range were given only to those men who, for one reason or another, were ineligible to join His Majesty's Forces.



Westinghouse Rifle Range.

Legal.—Partners' Liability.—In the City of London Court, on March 26th, before His Honour Judge Atherley-Jones, K.C., a claim was made by Messrs. Rose Bros., 38, Beech Street, E.C., against Mr. Kohlhausen, the Hare and Hounds Hotel, East Sheen, to recover the sum of £8 18s. 4d. for electrical appliances supplied to him. Mr. Clements appeared for the plaintiffs, and Mr. Coupland for the defendant. Mr. Clements said that the plaintiffs were manufacturers of electrical appliances of various kinds, and the defendant owned the Hare and Hounds Hotel at East Sheen. In 1912 defendant combined that occupation with that of an electrical business proprietor. He bought the East Sheen Electrical Co., and plaintiffs supplied all kinds of electrical appliances to him. He told plaintiffs he was the proprietor of the business and gave them bankers' references. They took them up, and they had supplied him with goods for which he had paid. Defendant was known as the East Sheen Electrical Co., and he paid his accounts from time to time with his own cheque. In 1914 the goods now sued for were supplied to the order of the East Sheen Electrical Co. Applications for payment were made, and now defendant said he had ceased to be the company at the time the goods were ordered, and the plaintiffs must look to the present proprietors. Mr. Coupland stated that the defendant had never had the goods sued for. He was not now the East Sheen Electrical Co. Mr. Clements urged that that did not matter. Mr. Coupland said that the defendant was in partnership with one Woodruff. At the outset terms of credit were arranged, and plaintiffs should not have supplied the goods now sued for. Mr. Clements added that the orders were given by someone in the service of the East Sheen Electrical Co. Defendant had held himself out as proprietor of the company and was, therefore, liable by estoppel. Judge Atherley-Jones: You say that if a man disposes of his business he must let his customers know that he is no longer controlling it? Mr. Clements said that was so. Mr. S. J. Leaver, plaintiffs' manager, said he did not know even now that the defendant had ceased to be the East Sheen Electrical Co. Their traveller had gone to the war. Judge Atherley-Jones: Your traveller may have had notice of the change. Mr. Clements: Notice must be sent to the firm. Witness said he never knew that the defendant and Woodruff were in partnership. Defendant brought Woodruff with him, but defendant never said that all orders must be signed by himself. Defendant said he was not an electrician and he took Woodruff into partnership with him because of his expert electrical knowledge. They took over the East Sheen Electrical Co. together, and he carefully told the plaintiffs when he called upon them with Woodruff that his (defendant's) signature was absolutely essential when orders were given for any electrical goods. He did that to safeguard himself. In September, 1913, he sold the business to one Satchwell, and Woodruff had been kept on as manager. He paid all his accounts that were outstanding. The goods sued for were supplied after he left. He did not advertise the dissolution of partnership with Woodruff in the *London Gazette*. Judge Atherley-Jones said it was an unfortunate case in which one of two innocent parties must suffer, and the burden was to be borne by the person who was guilty of the greater negligence. Defendant was a partner with another person, and was an exploiter of electrical goods. Under a trade name he dealt with the plaintiffs. He gave his name as the owner of the business, and therefore plaintiffs must look to him for payment although it might be he had not had the goods. The law was quite clear. Defendant had held himself out as liable, and must pay the plaintiffs. Defendant could easily have relieved himself from liability by intimating to the plaintiffs: "I have ceased to be a member of this firm, and you must not look to me any longer." That was the ordinary course followed by business people, but not by the defendant. He was reluctant to do so, but he must find for the plaintiffs. The affirmative was stronger than the negative. Judgment for the plaintiffs, with costs.

Russia and Municipalisation of Electricity.—Mr. K. Y. Zagorsky, in a report presented to the Imperial Technical Society on the proposed acquisition by the town of Petrograd of the electric concerns now in operation there on the basis of concessions, said that the chief motive for proposing to municipalise electrical energy was the numerous infringements of the concessions on the part of those now holding them; such as, for example, concluding monopolistic agreements with house owners, the limitation of the use of power of other companies, the rare application of the wholesale tariffs, and the failure to return discounts—and many other delinquencies. These and other considerations forced the town to consider the propriety of buying up the private electrical companies so as to centralise them, and thus safeguard the interests of the consumers, whilst at the same time securing an important source of revenue to the town. He held that the electrical business, like water and gas distribution, &c., stood apart from such businesses as might be the object of common industrial competition, which, in the cases mentioned, necessarily involved colossal outlays of capital to little useful purpose, when competition was allowed; whilst, on the other hand, the interests of the consumers were never consulted on their merits. He maintained that municipalisation meant cheaper current for subscribers and satisfactory financial returns to the town; and he believed that the existing tariffs to consumers could be reduced by 40 or 50 per cent., and the returns to the town be double those received from the companies now holding concessions. His report was directed chiefly to combatting the idea that the "1886 company" might be bought up, and the other companies allowed to operate independently; for, he said, these would become irritating competitors with the town.

L.C.C. Tramway Employés.—The Chief Industrial Commissioner on 17th ult. expressed the opinion that, in view of the terms of the Council's standing order, and of the facts of the case, the rate of pay for wiremen was correctly stated in the Council's list of rates of wages and hours of labour; also that the employés in the rolling-stock section, who were employed in workshops or the wiring of cars, were not entitled, under the Council's list of wages and hours, to the rate of 10½d. an hour. It was reported at Tuesday's Council meeting that the employés' representatives on the Conciliation Board had decided to abide by the Commissioner's award.

Educational.—UNIVERSITY COLLEGE, LONDON.—The annual report of the University College Committee was received by the University Senate at their session on Wednesday last. The total number of students for the session 1913-14 was 2,206, including in the Faculty of Engineering, 134. For the current session, 1914-15, owing to the war, there has been a decline in the total number of 335; there has been an increase in the number of part-time and special students, the decline in full-time students up to the present date being 462. This decline is due to the large number of students who are taking an active part in the war. The Faculty of Engineering has been most affected, nearly all the second and third-year men having either taken commissions or enlisted. The fall in numbers will involve a decrease in fees of not less than £10,000. The report contains a summary of the work of last session, and also some particulars of the war activities of the College. The "Pro Patria" List already issued contains 665 names. A large number of Belgian Refugee Students has been received at the College, each student paying a merely nominal fee. The college staff, with the help of its friends, has provided hospitality, either partial or complete, for about 48 persons, and has raised a sum of nearly £300 to aid the students by providing money for their general expenses. All football has been suspended, and the Union Society's Athletic Ground at Perivale has been given over entirely to the purposes of a training camp, at which both students and members of the staff can receive military training. One former student, Capt. Martin Leake, who gained the Victoria Cross in the Boer War, has gained the Cross a second time "for most conspicuous bravery and devotion to duty throughout the campaign." Another student, Lieut. L. T. Despicht, has received the Military Cross "for conspicuous gallantry at Givencby." The revenue of the College in 1913-14 was £71,567, and the expenditure £71,260. Members of the College have already indicated their willingness to assist in meeting the deficit created by the war. The completion of the new buildings has been delayed by the war. A special effort on the part of the Equipment and Endowment Fund Committee, of which H.R.H. Prince Arthur of Connaught is president, is to be made to raise the remainder of the sum necessary for the completion of the chemical laboratories. The sum still needed for this purpose is £13,650, the greater part of which (£10,000) is required for the special equipment of a physical and electrical chemistry laboratory. The national need of improved facilities for chemical education emphasises the desirability of completing the equipment of these new laboratories.

Institution and Lecture Notes.—Sheffield Electrical Social Union.—A new society of those engaged in the electrical trade in Sheffield has been formed with the above title. Its objects will be educational as well as social, and it will be open to electrical manufacturers and contractors, members of their staffs, Corporation and works engineers and assistants. Mr. B. E. Nicholson is secretary, and Mr. A. W. Gadsby, treasurer.

Diesel Engine Users' Association.—At the March meeting the question of the insurance of Diesel engines against breakdown, and the rates charged for this class of risk, was discussed. Particulars obtained in connection with a large number of Diesel engine plants showed that in many cases no insurance had been effected in consequence of the high rates charged by the insurance offices. The proportion of the amount insured to the total value of the plant concerned varied from about 18 per cent. to 66 per cent., the average being 35 per cent. of the total value of the engine. The ratio of the annual premium paid to the total value of the engine insured varied from about 1 per cent. to 3 per cent., and the ratio of the annual premium to the actual amount insured varied from about 3 per cent. to 7½ per cent. A scheme of insurance against breakdown was outlined under which members of the Association would be able to obtain advantageous terms, with a probability of a further reduction in the insurance rates later on after some experience had been obtained of the working of the scheme. One important advantage mentioned in connection with this proposal was that arrangements would be made for periodical inspections of the plant and for advice and reports by a fully qualified Diesel engine expert. At the present time the inspectors sent to make examinations by insurance companies, though thoroughly qualified as steam engineers, were usually not acquainted with the peculiarities of Diesel engines. After some discussion the proposal was referred to the Committee of the Association for further consideration. It was understood that a standard Diesel engine policy would be submitted, as well as more definite particulars as to the rates which it was proposed to charge. The next meeting of the Association is to be held on Wednesday, April 21st, when a discussion will take place on the lubrication of Diesel engines. Information and particulars concerning the Association can be obtained from the acting hon. secretary, Mr. Percy Still, at 19, Cadogan Gardens, S.W.

Royal Institution.—The day lectures after Easter include Prof. Fredrick Soddy, two lectures: "Advances in the Study of Radio active Bodies." Prof. J. O. Arnold, two lectures: "The Evolution of Steel: Influence on Civilisation." Dr. A. W. Porter, two lectures: "Advances in General Physics." Prof. J. A. Fleming, two lectures: "Photo-Electricity" (The Tyndall Lectures).

Institution of Electrical Engineers.—The following are the Council's nominations for election to the Council for the year commencing October 1st, 1915:—

President (one vacancy).—C. P. Sparks.

Vice-Presidents (two vacancies).—

Dr. A. Russell.
R. T. Smith.

Honorary Treasurer (one vacancy).—R. Hammond.

Ordinary Members of Council.—Members (five vacancies).—

W. A. Chamen.
H. Dickinson.
H. W. Firth.
Prof. T. Mather, F.R.S.
H. F. Proctor.
G. S. Ram.
W. Slingo.
A. H. Walton.

Associates (one vacancy).—J. Hunter Gray.

The following members remain in office:—

Vice-Presidents—

J. S. Highfield.
C. H. Wordingham.

Ordinary Members of Council—

F. E. Berry.
R. A. Chattock.
J. Christie.
E. Russell Clarke.
Major E. O. Henrici, R.E.
Prof. B. Hopkinson, F.R.S.
A. W. Martin.
A. M. Ogilvie, C.B.
G. W. Partridge.
W. H. Patchell.
R. J. Wallis-Jones.
W. B. Woodhouse.

It was the unanimous desire of the Council to nominate the President, Sir John Snell, for a second year of office; but the President, while thanking the Council for the honour, expressed his regret that for reasons of health, and on account of the claims of his professional work, he would be unable to accept nomination

Electrical Heating and Cooking Apparatus.—In a paper which Mr. Stanley M. Hills, A.M.I.E.E., is reading before the Junior Institution of Engineers on Monday, April 12th, he proposes to give a description of the various radiators, convectors, &c., the heating of rooms and offices, hotplates, grills, ovens, energy consumption of a cooker, utensils, and running costs. Tickets can be had from Mr. A. Clifford Swales, secretary, 39, Victoria Street Westminster.

Delays and Discounts.—At Church Police Court (Lancs.) last week, James Clayton, landlord of the Queen's Hotel, Church, was summoned by the Accrington electricity department for non-payment of an account for electricity. It was stated that the amount in question was 13s. 9d., the balance of an account for electricity, for the quarter ending September last. Defendant had deducted this amount for discount to which he was not entitled. The last date for discount was November 23rd, and the cheque was received on the afternoon of November 24th, and plaintiffs contended that it was evident that the cheque had not been posted until the morning of the 24th. Defendant admitted that he could not prove that he posted the cheque on the 23rd. An order for payment was made, with costs.

Municipal Competition.—Mr. R. C. Walsham, speaking as president of the National Chamber of Trade at Lancaster, said the sale of electrical fittings by municipalities was interfering with the rights of private traders.

1st London Engineers.—New Field and Signal Companies (212 and 240 men respectively) are again being raised by the 1st London Divisional Engineers (T.F.), as three of their units have already gone abroad on active service. Smart intelligent men are wanted—for the field companies, men connected with the building and constructional iron trades, all-round electricians, &c., and for the signal companies, young men of good education, especially telegraphists, electricians, instrument makers and telephone operators, all of whom are taught to ride. The work is very interesting, and the pay is considerably higher than in most other arms of the service. Application should be made to the headquarters, 10, Victoria Park Square, Bethnal Green, or to the branch recruiting office, Labour Exchange, Edgware Road.—*Standard.*

A Siemens Social.—The Siemens Dalston Miniature Rifle Club has been well supported during the past four years, and the present season's membership forms the record since its inception. Some 23 past members of the Club are now serving with the Forces, which makes the present membership of the Club all the more satisfactory. A Social Evening was held at Mozart House on Friday, March 26th, under the auspices of the Club, and a party of about 150 club members and their friends experienced a very enjoyable evening. Mr. A. B. Holmes distributed the medals and spoons won during the current half-season. Vocal and instrumental items were interlarded with dancing, and an extremely long programme was put through between 7.30 and 12 p.m. The arrangements were in the hands of the Club Committee, and Mr. F. S. Dennison acted as hon. M.C.

Private Arrangement.—W. A. Boissier, electrical engineer, East Street, Derby.—The creditors interested herein were called together recently, when a statement of affairs was presented showing liabilities of £1,956, of which £751 was due to the trade, and £1,205 to cash creditors. The assets were estimated to realise £456, from which had to be deducted £6 5s. for preferential claims, leaving net assets of £450, or a deficiency of £1,506. The debtor, who was only 24 years old, commenced business in April, 1910. He had little or no capital of his own, but his father-in-law advanced him various amounts. The debtor had prepared rough trading accounts at various dates, and they showed that a profit was made in the business. An offer was made of a cash composition of 6s. 8d. in the £. An increased offer was pressed for, and eventually 7s. 6d. in the £ was offered, and was accepted by the creditors.

Appointments Vacant.—Electrician (£80 +), for Clonmel District Lunatic Asylum ; switchboard attendant (27s. 6d.), for Borough of Lancaster. Particulars are given in our advertisement pages to-day.

The I.M.E.A. Development Committee. — At the meeting of this Committee held on March 12th, reports were received from the several Sub-Committees, whose operations have to a considerable extent been interfered with by the difficult conditions existing at the present time. The question of the production of printed publicity matter received attention.

The possibilities and limitations under which municipal electric supply undertakings work to-day were dealt with at some length for the benefit of the considerable number of co-opted members who were present, and who offered suggestions and assistance which were much appreciated.

It is anticipated that some more or less workable scheme for carrying on publicity work by means of printed matter, Press advertisements, &c., will shortly be brought before the full Committee.

Mr. H. C. Palmer (of the General Electric Co.) and Mr. L. G. Tate were co-opted members of the Publicity Sub-Committee.

Further discussion arose around the work of the Sub-Committees on "Domestic Appliances" and "Electrical Installations" (Hon. Secs. Messrs. Roles and Allen) ; and proposals from these gentlemen were considered.

It was understood that these and other similar Sub-Committees would probably be able to carry on a very considerable amount of valuable work of a definite character in the direction of collating and analysing the mass of information at present existing amongst engineers and manufacturers on the subjects dealt with by the Committees, and that the results of such investigations would be available to the full Committee, and also would form useful matter for the guidance of the operations of the Publicity Committee. A further question of making such information generally available for manufacturers and the electricity-using public received consideration, and will be referred to again later.

A Question of Means.—In Croydon Police Court on Monday the question of the means of Norman D. Frost, a canvasser in the employment of a London electrical supply company, was being discussed so as to enable the Bench to arrive at a sum to be allowed his wife under a separation order, he being the defendant. He said he received £2 2s. weekly and travelling expenses, the maximum being 6s. weekly. There was no commission. His duty was to advise people about electric light installations. Complainant's solicitor : Have you borrowed money from electricians ? Defendant : Yes. The solicitor : And you have never paid it back ? Defendant : No, because I have not been requested to. The solicitor : But you know perfectly well this money is lent ? Defendant : Yes, but they never ask it back. Pressed further, defendant said the last sum of the kind received was about £2. He could not give the exact date of the transaction ; it was sometime before Christmas. The clerk : Did you give an I.O.U. for it ? Defendant : I gave nothing for it. The solicitor : How much a year did you get in loans of this sort ? Defendant : At the outside, taking the year right through, I should say £6 ; that is the best I have done. Defendant admitted having borrowed from other tradesmen not electricians, but denied that it was within his power to give them work. The Solicitor : Do you say, "Go to Mr. So-and-So for your work ; he is the finest electrician in the town ?" and then go yourself to Mr. So-and-So and say, "Lend me a fiver ?" Defendant : I do nothing of the kind. The Solicitor : Is it a fact that you are able to put work in the way of electricians ? Defendant : If I cared I could put work in the way of a great many people. Defendant was ordered to pay his wife 15s. a week, and the solicitor hoped his employers would come to hear of his statements.

Fatality.—Langley.—On March 24th, at the works of Messrs. Albright & Wilson, at Langley, James Wilcox (19), who was engaged on a railway siding which runs into the works, was found lying on the floor and clutching a "live" electric wire which passed over the spot into an adjoining factory. Dr. Broughton was summoned, and attempts were made to restore animation, but without success. Another man who released deceased from the wire experienced a shock, but quickly recovered. It is surmised that while deceased was throwing a cover over the truck on which he was standing he slipped, and in falling clutched the wire to save himself.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The York Corporation has granted increases of salary to the following employés in the electricity department :—Mr. S. Spofforth, Mr. Peterkin (draughtsman), Mr. E. M. Pearson (mains superintendent).

Mr. E. W. Martin, assistant distribution engineer in the Woolwich electricity department, has been promoted to the second class of the engineering staff in that department, and his salary has been increased to the maximum of such class, viz., £150 per annum.

The Ilford Council has been recommended to increase the salaries of Mr. R. F. Windett, meter superintendent, and Mr. E. W. Foweraker, fourth charge engineer.

Mr. William Chamberlain, mains superintendent engineer in the Oldham Corporation electricity department, was married last week to Miss Lilian Hood, daughter of the late Ald. Hood, a former Mayor of the borough.

Mr F. Spink, Works Superintendent of the Worksop Electricity Works, has recently resigned his appointment, and has entered the Navy, as an Electrical Artificer, for the period of hostilities.

Tramway Officials.—Mr. Dugdale, the general manager of the Oldham Corporation tramways, who has been ill for some time, is now very much improved in health.

Dover Tramways Committee has appointed Mr. Bond, of the Colchester tramway staff, as depôt foreman.

General.—The marriage took place at St. Bartholomew's Church, Ruswarp, on March 22nd, of Mr. William Henry Atkin, electrical engineer, of South Bank, and Miss Edith Porritt youngest daughter of Mr. William Porritt, of Ruswarp.

The Special Committee of the L.C.C. on London Electricity Committee recommends that Mr. G. M. Gillett, Mr. H. H. Gordon and the Hon. Gilbert Johnstone be appointed members of that Committee.

Obituary.—We regret to learn that Mr. Matthew Thomas Medway, founder and head of the Medway's Safety Lift Co., Deptford, S.E., died at Brockley on March 22nd. He was 65 years of age.

Prof. Henry Robinson.—We regret to learn that Prof. Henry Robinson, M.Inst C.E., Emeritus Professor of Civil Engineering at King's College, London, passed away in London on March 24th. In the earlier days of electricity supply the late Professor was prominently associated with the design and installation of a number of undertakings in London and the provinces.

Wills.—The late Dr. Anthony Traill, Provost of Trinity College, Dublin, left £6,779.

The late Mr. J. F. Albright left £32,601 net and £33,854 gross personalty.

NEW COMPANIES REGISTERED.

Hubert D. Carter, Ltd. (139,734).—This company was registered on March 23rd, with a capital of £5,000 in £1 shares (2,000 7 per cent. cum. pref.) to carry on the business of gas, electrical, motor and hot water engineers and fitters, lighting contractors, plumbers, manufacturers of wire, screws, nails, rivets, nuts, bolts and electrical equipment of all kinds, etc., to acquire the business carried on by H. D. Carter at Colwyn Bay. The subscribers (with one share each) are: H. D. Carter, Crosley House, Colwyn Bay, electrical engineer; C. L. Williams, Bolton Villa, Colwyn Bay, secretary; W. E. Buckley, Beech House, Colwyn Bay, gent. Private company. The number of directors is not to be less than two or more than five; the first are H. D. Carter (permanent managing director, special qualification 500 shares) and others to be appointed by the subscribers. Qualification of directors 10 shares. Remuneration of managing director; £150 per annum and a percentage of the profits. Solicitor, E. A. Crabbe, Cronhaulog Chambers, Abergele Road, Colwyn Bay. Secretary, H. D. Carter. Registered Office: Sea View Terrace, Colwyn Bay.

Cark and District Electric Supply Co., Ltd. (139,728).—This company was registered on March 23rd, with a capital of £2,000 in £1 shares (1,500 6 per cent. cum. pref.), to carry on at Cark, Flookburgh, Allithwaite and adjoining district the business of an electric light supply company in all its branches. The subscribers (with one share each) are: C. H. Best, 72, Market Street, Bradford, incorporated accountant; G. Dickinson, Cark Mills, Cark-in-Cartmel, corn merchant; F. Wilkinson, Bankfield, Allithwaite, colliery agent. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first. When there are only three directors, two shall be holders of ordinary and one the holder of preference shares; when there are five, three shall be holders of ordinary and two the holders of preference shares. Qualification £25. Remuneration as fixed by the company. Solicitor, F. W. Poole, Ulverston, Lancs.

Roto Engineering Co. (Bradford), Ltd. (139,737).—This company was registered on March 23rd, with a capital of £1,000 in £1 shares, to carry on the business of electrical, mechanical and ventilating engineers, merchants, manufacturers of rotary pumps, oil cabinets, filters and other appliances, steam, hydraulic, pneumatic or other engines, etc. The subscribers (with one share each) are: H. Hornby, 2, Clarendon Street, Bradford, iron merchant; F. Laycock, 92, Beech Grove, Lidget Green, Bradford, managing clerk. Private company. The number of directors is not to be less than two or more than 5; the subscribers are to appoint the first. Qualification, 50 shares. Remuneration as fixed by the company. Solicitor, A. V. Hammond, Dale Street Chambers, Bradford. Registered office: Borough Mills, Bradford.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rhondda Tramways Co., Ltd.—Particulars of £250,000 debentures, created by resolutions of March 13th, 1911, November 8th, 1912, and February 4th, 1915, and secured by trust deeds dated March 24th, 1911, November 13th, 1912, and March 11th, 1915, filed pursuant to Section 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £10,000. Property charged: The company's undertaking and property, present and future, including uncalled capital and tramways and right of user or same, and lands with generating station and other premises thereon, together with equipment of tramways, and all purchase moneys to be received from Rhondda Urban District Council, etc. Trustees: Law Debenture Corporation, Ltd., 41, Threadneedle Street, E.C.

Corona Lamp Works, Ltd.—Issue on 27th February, 1915, of £4,350 debentures, part of a series of which particulars have already been filed.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Charge, as substituted security, dated March 4th, 1915 (supplemental to trust deed dated October 16th, 1913, and acknowledgment of indebtedness dated November 10th, 1914, securing £500,000 deb. stock). Property charged: All shares in capital of Carville Site and Power Co., Ltd., which may during the continuance of the security constituted by the trust deed be acquired by the company. Trustees: Law Debenture Corporation, Ltd., 41, Threadneedle Street, E.C.

Naylorgraph, Ltd.—Two debentures, dated 13th March, 1915, to secure £576 and £100 respectively charged on the company's undertaking and property, present and future, including uncalled capital, if any, subject to prior debs. Holders: J. M. Hunt, Fairlawn, Park Road, Southborough, and J. P. Naylor, 57, Croxted Road, Dulwich, S.E.

CITY NOTES.

North Metropolitan Electric Power Supply Co., Ltd.

Mr. E. Garcke presided on March 25th over the annual meeting, held at Electrical Federation Offices, Kingsway. He said that last year they sold 36,800,000 units of electricity, an increase of 2,400,000, or about 7 per cent. The increase would have been much larger but for the outbreak of war, for in the first half of the year the increase was 2,800,000 units, but in the second half there was a diminution of over 400,000 units, and that notwithstanding that the second half of the year was usually better for the electricity supply business than the first half, especially where current was supplied for working tramways. The North Metropolitan Electric Tramways, for which they supplied current, ran fewer car miles and consequently consumed less energy, and the various power users in the district also reduced their consumption. Although the increase in the volume of business was less than the normal increase in previous years, they had obtained a revenue of £173,000 compared with £164,000 for 1913, and had made over £3,000 more profit. He thought that, having regard to all the circumstances, the result of the year's working must be considered satisfactory, especially as several items of expenditure had increased owing to rises in prices. They had had to spend over £50,000 on coal, compared with about £47,000 in 1913. The balance to net revenue was £92,791. After providing for mortgage, loan and debenture interest and transferring £2,000 to the reserve to secure the redemption of the debentures, and placing £1,624 to the depreciation account—raising it to £100,000, writing off the whole of the preliminary expenses, amounting to £14,941, there was sufficient to pay the 6 per cent. cumulative preference dividend for the year, the same dividend on the ordinary shares as a year ago, leaving £4,676 to be carried forward, compared with only £1,054 brought in from the preceding year. They had thought it wise to write off the whole of the preliminary expenses instead of further increasing the depreciation reserve, seeing that the depreciation fund now amounted to £100,000, which they considered an adequate reserve for the time. They had also thought it wise to carry forward a larger amount of undivided profit in view of the general uncertainty as regarded the profit which might be earned during the current year. The dividend on the preference shares had absorbed £5,000 more than in 1913, which arose in consequence of their having issued £100,000 additional preference share capital during the past year in order to provide for capital expenditure rendered necessary by the extension of their power houses and the laying of a main trunk cable from their Willesden power house, through Wembley and Pinner, where they were now supplying electricity in bulk for lighting purposes. The capital expenditure during the year had amounted to £83,295. The shareholders would be interested to know that the company's business continued to develop satisfactorily. They had recently made several contracts with new power users, and the general manager was in communication with several other factories for the supply of electricity. The electricity distribution business of their subsidiary company was also progressing satisfactorily, and they had received dividends of 6 per cent. for the year upon their investments therein. At the last meeting he referred to the subject of the London electricity supply situation and stated that fortunately they were outside that controversy, and that therefore it was not necessary for them to discuss it. Soon afterwards, however, a Bill was promoted by the L.C.C. which proposed to deal not only with the situation in London, but which also proposed to take powers to enter the area which they now served outside London. The Bill was not proceeded with owing to the Council being unable to obtain the necessary approval required by the Borough Funds Acts. They were assured, however, that if the Bill had been proceeded with there was no reason to anticipate that they would have failed to obtain a clause fully protecting their interests; and, considering that they were working under statutory powers, which placed them under heavy obligations, and that they were serving the public satisfactorily, the directors felt that the company was not only entitled, but was bound to be prepared, to take all necessary steps for the safeguarding of its rights and interests. Having referred to the retirement of Mr. George Richardson, who had been a director of the company since 1903, the Chairman said that the directors and shareholders were indebted to the staff for the admirable way in which they had performed their duties during the very trying period since the outbreak of the war. 23 per cent. of the staff of their own company and of its subsidiary company —the North Metropolitan Electrical Power Distribution Co. were now serving in either the Army or the Navy, and included among the officers was Mr. Boyes, their secretary. Those remaining at home were subscribing to a joint fund which the associated tube and tramway companies had inaugurated for the purpose of providing assistance for the dependents of those employés who had joined the Colours. The company had also joined in the contributions made to the various war funds by the British Electrical Federation.

Sir Ernest Spencer seconded the resolution and the report was adopted.

London and Suburban Traction Co., Ltd.

The Rt. Hon. C. B. Stuart Wortley, K.C., M.P., presided on Friday last over the annual meeting held at the Holborn Restaurant. The Chairman said that in the case of the tramway and omnibus companies in which they were interested, their total traffic receipts amounted to £1,303,900 odd, against £1,152,494 in 1913. The passengers carried were 246,800,000, against 218,900,000. The electricity supply companies in which they were interested sold a total of 39,510,000 units in 1914, as compared with 36,904,000 in 1913. Their total income from their holdings in the various subsidiary companies was £107,884, plus £10,593 for interest on money which they had lent to the companies. That compared with £98,825 and £5,309 respectively in the previous year. Including sundry receipts the total revenue was £118,579, against £105,370 in 1913. On the other hand, the administrative and general expenses had amounted to £2,077, against £1,880. They had had to find for interest on debenture stocks, original and new, £18,695, against £5,094, and for interest and other moneys borrowed £5,555, against £7,013. Including the item of £6,200 put aside as a sinking fund for the redemption of the 5 per cent. debenture stock, the total expenses for 1914 amounted to £34,953, against £17,018 for 1913. The result was that they had been able to pay the full dividend on the cumulative preference shares amounting to £80,110, as well as £9,226 for dividend on the ordinary shares for the first half of the year at the rate of 1 per cent. per annum, and carrying forward £2,886, against £8,597 last year. The shareholders would see that in the first half of 1914 they had a fair prospect of realising the hopeful anticipations in which he indulged at the last meeting. It was in the early days of July and before the outbreak of war that they declared the interim dividend. The final results for the year showed that though the effect of war on the various subsidiary companies had undoubtedly been adverse, it might well have been worse than it was. It had certainly removed from the streets a large number of omnibuses which competed with the tramways of many of their subsidiary companies, and to that extent it had helped them. It was, of course, impossible to say what their experiences would be during the remainder of the war, but he thought they were justified in hoping that a return to peace conditions would mean for them a return to the modest kind of prosperity which the first half of 1914 seemed to promise. Out of 4,186 employés in the associated companies no less than 1,110 had joined the Forces, which was 24 per cent. of the whole. The company was throwing in its lot with the T.O.T. Mutual Aid Fund, which was looking after the dependents not only of the underground railway and tramway men but of the men in power houses as well who had joined the Colours.

Mr. E. Garcke seconded the motion.

Replying to a shareholder, the Chairman said he was given to understand that the chairmen of subsidiary companies were satisfied that a sufficient amount had been set aside for depreciation in regard to each concern.

The report was adopted.

Liverpool District Lighting Co., Ltd.

The annual meeting was held on March 24th, Mr. W. A. Cookson presiding. The Secretary read a statement from Mr. Charles McLaren (the Chairman, who was indisposed) which said that the war had retarded business during the second half of the year, and instead of an estimated increase of 50,000 units sold they had increased the sale by only 31,279 units, which, considering all things, was a very creditable result. The profits, which had increased by £744, amounted to £5,422, which, after deducting the interest paid on bank overdraft, was exactly equal to 8 per cent. of the ordinary capital. They had had to pay a higher rate of interest, more income tax, and they had also paid the wages of their employés who had joined the Colours, who numbered one-third of the staff. They did not anticipate any serious capital expenditure during the present year. By an agreement with the Hightown Gas & Electricity Co. they were now supplying them in bulk for distribution and sale in their own district of Hightown, and in this way they were supplying a large military camp at Sniggery Woods, and also the battery at Hightown. They were also supplying by arrangement electricity to another camp situated at Thornton, about 220 yds. beyond their boundary. That would make up for the economies practised by their existing consumers, but they could not look forward to any substantial increase of business during 1915. They had always been handicapped by want of coal storage bunkers capable of holding 500 or 600 tons, and consequently were apt to be hit by strikes of workmen, and now by the war. Their engineer was preparing a report and plans suitable for coal storage bunkers, and if they found it was in any way possible to erect them at a reasonable cost they intended to make themselves independent of the fluctuations in the coal trade. Doubtless many shareholders would think that having made profits equal to 8 per cent. of the capital a dividend of 5 per cent. might be paid, but the directors after due consideration decided that this time of national crisis was not the time to increase dividends.

Cleveland and Durham Electric Power, Ltd.—The directors report that during 1914 the capital expenditure on works was £14,915. The gross profits, which have been adversely affected by the war, amounted to £36,839. After providing for debenture interest the net profit is £16,826, plus £8,799, brought forward. The directors propose a dividend of 4 per cent. on the preference shares, transferring to depreciation and renewals account £3,000, reducing expenses of issue of debentures by £1,000, and carrying forward £8,277.

Wm. Beardmore & Co., Ltd.—The *Times* states that the profit for 1914 amounted to £219,142 (against £164 236), and £186,947 was brought forward. The directors place £50,000 to special preference dividend reserve, and, after paying the year's dividend on the preference shares, recommend a 5 per cent. dividend on the ordinary shares, leaving £193,089 to carry forward. For the preceding year the dividend was the same.

Vickers, Ltd.—In consequence of the great pressure due to the war, it has been found impossible to complete the yearly accounts for presentation at the usual date. In the meantime, the final dividend of 5 per cent. on the preferred 5 per cent. stock and on the 5 per cent. preference shares have been paid.

Altrincham Electric Supply, Ltd.—We have now received a copy of the report which was adopted at the annual meeting held last week. There were 88 new installations connected to the mains during 1914. The accounts showed a profit of £8,349. Including £2,776 brought forward the amount available for distribution was £9,612. Balance of preferred dividend required £1,059, there was put to general reserve £500, and to depreciation of machinery account £1,500, leaving £5,503, out of which a dividend of 10s. per share upon the deferred shares. Mr. F. O. Arnold has been elected a director. We understand that the progress of the company was arrested by the war. For the first month or so of war the power loads showed a diminution owing to short time in the factories, and when Government work was freely given out towards the end of the year there was a lack of men in the workshops, and this fact then and still prevented the company from reaping the benefit that would have ensued from overtime. The actual output was less than in 1913 owing to consumers' household economies and the shorter hours on power loads. Working expenses were, however, reduced in spite of an increase of 11 per cent. in price of coal. It is interesting to learn from Mr. G. H. Fawcus, the engineer and manager, that he has one large farm on the mains for both power and lighting, and one more at least is coming on within the next few weeks.

Newmarket Electric Light Co., Ltd.—The annual meeting was held recently, Mr. F. E. Gripper presiding. The directors' report stated that during 1914 the equivalent of 1,015 33-watt lamps had been connected, making the total 30,744 lamps. The profit on the year's working, with £146 brought forward, amounted to £2,464, and after deducting £733, debenture and other interest, £1,731 remained available. The directors recommended a dividend of 3½ per cent., £650 being carried to reserve for renewal of plant, leaving £151 to be carried forward. Mr. Gripper said that the dividend recommended was ½ per cent. less than last year. But for the war they would have had a record year. Receipts from sales of current had fallen off; also receipts from wiring account by £145. Expenditure had increased by £40, this being mainly due to rates and taxes. The balance available for distribution was less by £228 than last year. The report was adopted.

American Telephone and Telegraph Co.—The report states that the net earnings were $40,557,977, or approximately the same as in the previous year. The interest charges were $8,223,163 and the dividends at the regular rate of 3 per cent. per annum were $27,572,674. Of the resulting balance there was carried to reserves $2,500,000 and to surplus $2,262,139. At the end of the year the number of stations which constituted the system in the United States was 8,648,993, an increase of 515,976, including 168,177 connecting stations; 2,885,985 of these were operated by local, co-operative and rural independent companies or associations having sub-licence or connection contracts, so-called connecting companies. The Bell telephone toll lines of the United States now reach 70,000 places, from substantially all of which messages can be telephoned to the nearest telegraph office.—*Financial Times.*

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

British Tungsten Metals Syndicate.
Electrical Regulators and Economisers.
Frank Suter & Co.
Gorwitz & Co. Aluminium Fabrik Weilar (Rhon) Aktiengesellschaft.
Indestructible Accumulators
Indicating Fuse and General Manufacturing Co.
International Electric Transport and Enterprise Co., of Alsace Lorraine.
Kellogg Manufacturing Co. (Europe).
Leeds and Bradford District Electric Railways.
Reis Oil Fuel, Gas Producer and Burner.
Scientific Illumination.
Telephone Disinfecting Co.

Clyde Valley Electrical Power Co.—The report for the half-year ended December 31st last states that the profit amounts to £37,662, plus £37,662 brought forward. After payment of the dividends on preference shares to October 31st, 1914, amounting to £9,000, and after adjusting interest and transferring £12,500 to contingency fund for depreciation, &c., there remains £33,826. The directors recommend that £3,290 be transferred to special reserve, £10,000 applied in writing down cost of Acts, 1901, 1904 and 1912, and £9,000 provided for the dividend on preference shares to April 30th, 1915, leaving £11,535 to be carried forward.

Gateshead and District Tramways Co., Ltd.—A dividend at the rate of 6 per cent. per annum, and a bonus of 6s. per share (together 12s. per share), on the ordinary shares, making 9 per cent. for the year, are announced.

Stock Exchange Notice.—The Treasury has authorised dealings in the following securities:—

Bombay Electric Supply and Tramways Co., Ltd.—12,000 "new" ordinary shares of £10 each.

Howard & Bullough, Ltd.—An interim dividend at the rate of 10 per cent. per annum, less income-tax, on the ordinary shares is announced for the past quarter.

Company Meetings.—The annual meetings of the British Westinghouse Electric and Manufacturing Co., Ltd., and the Brush Electrical Engineering Co., Ltd., were held on Monday in London. We shall report the proceedings in our next issue.

United Tramways, Ltd.

Mr. W. M. Acworth presided, on Friday last, over the annual meeting held at Electrical Federation Offices, Kingsway. The Chairman said that the shareholders outside the London and Suburban Traction Co. only held about 3 per cent. of the stock. The work of the reconstruction of the Hammersmith lines had been completed, bringing up the expenditure to £62,000. Pending the completion and sale of those lines to the L.C.C., they were paying interest and sinking fund charges upon the amount advanced for the reconstruction, £12,500 had been appropriated to reserve for reconstruction and renewals out of profits, while £29,000 had been charged against that fund. That amount was almost wholly represented by the reconstruction of the line from Brentford to Hounslow, which was originally opened in 1901. After allowing for that appropriation there remained a balance of £8,142, of which £6,250 had been distributed in payment of a dividend at the rate of ½ per cent. on the preference shares last July. The traffic receipts, amounting to £316,000, showed a decrease of over £11,700; the car mileage run was some 410,000 miles less than the previous year, and the receipts per car mile showed a decrease of .08d. In the first seven months of the year the passenger receipts were £2,243 in excess of those for the corresponding period, and the receipts per car mile showed an increase of .17d. At the end of the year, however, that increase in receipts had been turned into a decrease of £11,793. At the commencement of August they were compelled to reduce their services very considerably owing to the number of motormen and conductors who were called up as Reservists. Over 24 per cent. of the staff were now serving with the Army or Navy. In addition, a considerable number had since the war enlisted in the new forces, and, although new men had been taken on, they were still considerably below their normal number. Originally they had 835 motormen and conductors; now they only had 668. Apart from the reduced services, the receipts decreased owing to the earlier closing of the public-houses and the decreased street lighting. He said last year that he thought their affairs had touched bottom, and their traffics for the first half of 1914 showed that but for the war the year would have compared favourably with 1913. Unfortunately, the working expenses in 1914 did not decrease in proportion to the car mileage. With the exception of the item of running expenses, the working expenses remained more or less constant, although the car mileage had considerably decreased. The company had joined in the T O T Mutual Aid Fund for the purpose of giving help to the dependents of those of the staff who had joined the Colours. They had done what they could to encourage increased traffic by issuing cheap fares for children, and they had obtained powers to run trailer cars and carry passengers in excess of the authorised number at times when there was a rush of traffic.

Lord Knutsford seconded the motion and the report was adopted.

Metropolitan Electric Tramways, Ltd.

Mr. E. Garcke presided on Friday last week over the annual meeting, held at Electrical Federation Offices, Kingsway. The Chairman said that in the early part of last year they had reason to hope that the results of the year's working would be materially better than was shown by the accounts. Up to the 1st of August the traffic receipts were £7,000 greater than those for the corresponding period of 1913, and the receipts per car mile showed an increase of .22d. By the end of 1914, however, this increase in the receipts had been turned into a decrease of £8,500. At the commencement of August the company was compelled to reduce the services very considerably, owing to the number of motormen and conductors who, as Reservists, were recalled to the Colours, and 25 per cent. of the total staff were now serving with the Army and Navy. Apart from the reduced services, the receipts decreased owing to the earlier closing of shops, and because of the restricted street lighting. There was now but little traffic after about 10 o'clock at night in the districts served by the company's tramways. Unfortunately, the working expenses did not decrease in direct proportion to the reduction of the receipts, for, with the exception of the expenditure on electrical power and on wages account, the item of working expenses remained more or less constant irrespective of the car mileage, and even the wages bill had not been reduced in proportion to the reduced services, because during the past year they conceded the men an increase in the rate of pay. A matter of some interest to the public in connection with the traffic arrangements of the company was the extension of through services between the tramways operated by the company and the tramways of the London County Council. Since September last through services of cars had been operated between Barnet and Euston and Moorgate Street *via* the Archway Road. Passengers on the Barnet line could also now book through to Charing Cross from North Finchley *via* the Highgate Tube Railway. At Stamford Hill the company and the L.C.C. had agreed to issue 1d. transfer tickets between each other's systems. Through booking arrangements were also about to be established at Golders Green between the company's Finchley Road line and the Hampstead Tube Railway as far as Charing Cross, and at Scrubbs Lane between the company's line from Harlesden and the L.C.C. tramways as far as Hammersmith. Cheap tickets were now issued to children under fourteen years of age on week-days between the hours of 8.30 a.m. and 5.30 p.m. It afforded the directors much satisfaction to be able to give the public these improved travelling facilities, although that company did not derive much pecuniary benefit from them. The accounts did not call for much explanation. They had expended on capital account during the year £13,263. They had had to increase the suspense account by about £2,000 in respect of interest and expenses in connection with the Watford and Bushey undertaking, which had not been proceeded with, because they decided that the district could be better serve by omnibuses. They had increased the reconstruction and renewals fund investment by about £30,000, and a full list of the investments in which the fund of £138,893 was invested was now appended to the report. It was very nearly eleven years since the first of their lines was opened for electrical working. During that period they had built up large reserves for the purpose of providing for the renewal of the lines, as they were worn out, and it was a very satisfactory feature that the lines had all been maintained in excellent condition, so far, almost entirely out of revenue, and that the large fund which they had accumulated was available to meet any abnormally heavy expenditure on track renewals which might be necessary in future. About 95 per cent. of the whole of the share capital of this company was now held by the London and Suburban Traction Co., Ltd., and only about 8 per cent. of the preference and about 2 per cent. of the ordinary shares were in the hands of other shareholders. The policy of the company was, therefore, now directed by the board of the London and Suburban Traction Co., Ltd. On former occasions he had explained that since the control of this company had passed over to the London and Suburban Co. efforts had been made to minimise the competition between the omnibuses and the tramways, and considerable progress had been made in that direction, but a complete elimination of competition was not possible, and they could not hope to do more than establish such co-ordinated working arrangements as would secure to each company its fair share of the combined revenues, and further negotiations were proceeding with a view to adjusting the divergent interests on that basis. The company and the staff contributed to a fund formed by the allied London traction undertakings for the purpose of assisting the dependents of those employés who had joined the Colours, and he asked the shareholders to sanction the contributions which the company was making to that and other war relief funds.

Mr. C. G. Tegetmeier seconded the motion, which was carried.

South Metropolitan Electric Tramways and Lighting Co., Ltd.

The annual meeting was held on Friday last at Electrical Federation Offices, Kingsway. Mr. C. G. Tegetmeier, who presided, said that the working account of the traction section showed a balance of £22,385, or an increase of £1,112. The traffic receipts from the tramways were adversely affected by war conditions, and in place of a very considerable increase which was indicated during the first seven months of the year there was a decrease at the end of £571. On the other hand, the net profit on the working of their motor 'buses was £1,352 more, owing to their having had the benefit of their running for the whole of the year, instead of for only five months during the previous year. The electricity supply section of the business was still more adversely affected by the war conditions than the traction section. Although there was an increase of 271 in the number of consumers connected, which was a larger increase than they had ever had previously in any one year, the revenue from the sale of current to private consumers was only £654 more than in the preceding year. That comparatively small increase was attributable solely to the restrictions upon lighting imposed by the authorities since the outbreak of war, and the fact that they were able to show even a small increase under the conditions that had prevailed must be regarded as satisfactory evidence of the progressive character of the business. With a return to normal conditions there could be little doubt as to its continuous and profitable development. The capital expenditure during the year amounted to £4,960, practically the whole of which was spent upon the lighting undertaking, £3,947 being expended on the extension of the mains. Expenditure of that nature became necessary as the districts comprised within their large area of supply became settled, and it was likely to be increasingly remunerative. The net profit for the year, after setting aside £3,000 to the renewals fund, the same as in the previous year, amounted to £15,966. With the amount brought forward they had £16,721 available for distribution. They proposed to place £1,500 to the reserve fund, to pay a dividend on the 6 per cent. preference shares in respect of the year 1913, and an instalment of 1 per cent. in respect of the year 1914. That would leave £651 to be carried forward. 30 per cent. of the company's staff—in fact nearly the whole of those eligible—had joined the Forces, and the whole of the present staff were contributing to the fund which had been organised by the companies with whom they were associated, for the assistance of the dependents of those of their employés who had enlisted. The companies themselves subscribed an equal amount to that contributed by the men.

Mr. E. Garcke seconded the resolution, which was carried unanimously.

Guildford Electricity Supply Co., Ltd.

During 1914 the company made satisfactory progress, the gross receipts being £12,356, showing an increased revenue of £571. There was a balance on the revenue account of £3,947 (after crediting depreciation fund account with £1,000) as compared with £4,044 for 1913. After making provision for debenture interest, dividend on preference shares, etc., and placing £250 to the credit of reserve fund account, they had £1,149 available for distribution, out of which they recommended the payment of a dividend at the rate of 5 per cent., less tax, on the ordinary shares, absorbing £760, thereby leaving £390 to be carried forward.

Year.	Connections.	Total Revenue.	Total Costs	Gross Profit.
1912	969	£10,069	£5,114	£4,955
1913	1,090	£11,786	£6,492	£5,294
1914	1,195	£12,356	£7,409	£4,947

This company, in common with most companies of a like nature, has suffered during the latter portion of last year by the diminution in the sale of electricity, and also in the increased cost of production of same, in consequence of the war. Mr. J. A. C. Younger resigned his position as a director of the company in September, and Mr. E. E. Pullman, who had previously acted as a director, was elected to the vacancy.

	1914.	1913
Units sold Lighting	389,811	370,125
Power and Heating	696,660	672,475
Totals	1,086,471	1,042,600
H.P. of Motors Connected	899	810
Total Number of Connections	1,195	1,090

South London Electric Supply Corporation, Ltd.

The annual meeting was held on March 23rd, at the Cannon Street Hotel, E.C. Mr. J. Atherton, who presided, said that during the first half of the year excellent results had been obtained in respect to additional lamps connected, revenue obtained, and gross profit earned. The increase in units sold was 431,567, or 16½ per cent. for the half-year, and they had every reason to hope that this rate of progress would have been continued in the second half-year, but the outbreak of war had the immediate effect of reducing their output, which, however, was gradually recovering to normal in September, when in the latter part of that month the regulations in respect to the disuse of outside lighting were put into force, thus instantaneously forcing down their output for lighting purposes. They had especially felt this, as the shopping districts in their area of supply depended largely upon electricity for outside illumination. These restrictions still remained in force, but, notwithstanding, the total units sold during the year amounted to 6,153,241, and showed an increase over the previous year of 412,015, or 7.2 per cent. for the full year. The extended use of electricity for power purposes had largely contributed to this satisfactory result, for during the year 98 motors of 933 h.p. had been connected to the mains, making a total of 6,304 h.p. on consumers' premises. Further, the additional connections amounted to 1,355 kw., or the equivalent of 38,742 35-watt lamps, and nearly 10,000 in excess of any previous year. This constituted a record for any one year since the commencement of their operations. The gross revenue had increased by £3,385, and the working costs from £23,475 to £25,431. The profit had thus increased £1,429, which was satisfactory, as the period under review included five months of war; and notwithstanding increased costs for labour, coal, and in fact for all commodities used in their business, the total cost per unit sold worked out at the satisfactory figure of .99d. per unit sold, as compared with .98d. in 1913. The capital expenditure during the year amounted to £11,487, of which £1,081 was for buildings, machinery and plant; £1,331 for coal elevating and mechanical stoker plant; mains £5,382, and transformers and meters £1,946, and on special items, including construction of show-rooms and for plant on hire, etc., £1,493 net, after writing off £978 for depreciation. They were satisfied that the expenditure incurred on the show-rooms would well repay them. After referring to the withdrawal of the London electric supply Bills, the Chairman said that at the last meeting they took powers to create £50,000 new capital, divided into 10,000 6 per cent. cumulative preference shares of £5 each, and of these 6,000 were offered for subscription to the existing shareholders and debenture stockholders of the company and were fully subscribed. In view of the momentous events which had taken place since the date of issue, he thought they might congratulate themselves upon having made the issue when they did, thus providing the company with funds so that it might actively prosecute its business. During the latter part of the year they co-opted as directors Mr. J. B. Braithwaite and Mr. H. B. Renwick, of the County of London Electric Supply Co., Ltd., that company having acquired a considerable financial interest in the company with a view to their closer relationship and for mutual assistance, their areas of supply being contiguous. They were fortunate in securing the assistance of these two gentlemen, whose presence on the board would add considerable strength to the directorate. They had had unrivalled experience in dealing with electric supply problems, particularly in connection with the development of electric supply in London, and this should prove of great benefit to the company, not only in developing their own business, but also in dealing with the broader question of the London electric supply problem and the many troublesome and complicated points arising from it. About 25 per cent. of their normal establishment having joined the Colours, this representing nearly 50 per cent. of the eligible men in the company's employ, a point had now been reached making it inadvisable for any more employés to leave the company's service for the Colours, as the principal departments would then become under-manned, a condition of affairs which would be serious in view of the public service which was being given, and of the fact that a large number of factories in Lambeth were working directly or indirectly on Government work and depended almost wholly upon their supply for driving their machinery and lighting their premises. Much as they congratulated those men who had left to serve their King and country, it must not be forgotten that those who were compelled to remain behind on this public work and its maintenance carried serious responsibility, much of which could only be entrusted to specially-trained men possessing the necessary skill and experience. They were making money allowances to all those who had enlisted, and although this would be a heavy burden, the board felt sure they would think it only right that their dependents and others should be well looked after in the breadwinner's absence; and to those men who were still in the company's service, war bonuses on a graduated scale were being given to assist them in the extra cost of living. There had been, and were still, many difficulties to contend with in the proper maintenance of their supply, and coal bulked largely. At times there had been serious difficulty in obtaining adequate supplies, principally owing to congestion on the railways due to the movement of troops and military stores, and to the great shortage of railway wagons, and to the lessened output from the collieries owing to so many of the miners having enlisted. They were having to pay considerably in excess of their contract prices for some of their coal, and although they raised their charge for supply to some of their consumers early last year, it might again be necessary to further increase the rates to compensate them for the considerably greater expenses to which they were committed under the prevailing conditions. The available balance was sufficient to pay a dividend of 5½ per cent. on the ordinary shares, as in 1913, and still leave sufficient to pay a further 1 per cent. on the ordinary share capital, but having regard to the unknown conditions through which they might have to pass during the present year, they considered that the interests of all concerned would be better served by paying a dividend of 5 per cent. for the past year, which would enable them to strengthen their cash resources by carrying forward £2,898, against £727, thus making it possible, if circumstances were favourable, to initiate the payment of interim dividends on the ordinary shares.

Mr. A. Madge (a shareholder) seconded the motion, which was adopted without discussion.

British Insulated and Helsby Cables, Ltd.

Dr. E. K. Muspratt presided at the annual meeting, held at Liverpool, on March 22nd. He said the profit for 1914 was £277,428, an increase of £30,077. The results were very satisfactory considering that the profits were greater than the company had made in any previous year, and that for about half the year the working had been under war conditions. The extra profits were not due to orders for war supplies. Work had been done both for the War Office and the Admiralty, but the total was not large enough to materially affect the earnings as a whole. The war had affected business with many of the company's best customers, such as municipal corporations and large electric light and power companies, who had ordered less than they would have done in normal times. On the other hand, the company had done a much larger business than before the war with neutral countries. No consignment of manufactures on the prohibited list had been despatched to any neutral country without the knowledge and consent of the British Government or without care to prevent them reaching an alien enemy. The general result had been that the company's factories had been very busy throughout the whole of the year, and the unexecuted orders in hand at the present time were more than ever before. A considerable number of the company's staff had joined the forces, and both they and their dependents had been liberally dealt with by the board. The staff and workpeople had also on their part, by voluntary weekly subscription, contributed to relief funds to the extent of over £1,000. The company was now paying a war bonus to its employés to meet the enhanced cost of living. Having regard to the good results of the year's trading the directors had felt justified in setting aside £25,000 towards the formation of a pension fund, which had been under consideration for several years past. They felt they could hardly expect to retain in their service the very best men without some such provision, and they felt that the formation of such a fund was in the best interests of the company and the shareholders, and that in making it they were following the example of the Government and many large and successful companies. The extinguishing of the item of patents and goodwill had much strengthened the balance sheet. Alluding to the investments of the company, the Chairman said they now stood at £531,423, as compared with £525,828 in the previous year; a valuation of the investments had been made, with the result that the figure came out at some thousands more than the amount appearing in the balance sheet. The two companies, namely, the Midland Electric Corporation for Power Distribution, Ltd., and the Electric Supply Co. of Victoria, Ltd., in which the British Insulated held considerable interests, were making satisfactory progress, and the Automatic Telephone Mfg. Co., Ltd., in which the British Insulated also had a large shareholding, was now for the first time paying a dividend of 3 per cent. on its ordinary shares, the profits having risen from £24,166 to £38,263, an increase of £14,097. The cash resources of the British Insulated Co. now amounted to no less a sum than £270,862, and the directors considered, especially under present war conditions, that this strengthened the position of the company very much indeed and brought many contracts which it would otherwise be impossible to deal with. One such contract at present in hand was for the Australian Government, amounting to about £600,000.

The report was adopted.

Automatic Telephone Manufacturing Co., Ltd.

At the third annual meeting, held in Liverpool on March 22nd, Mr. James Taylor (Chairman) said the profit for the year amounted to £38,248, an increase of £14,081, which indicated satisfactory progress. In recommending a 3 per cent. dividend they felt that in present times, if able to pay a small dividend they should do so, as investors had so many calls on their incomes, which were already in many cases reduced. There had been a substantial increase in the company's turnover during the year, and this increase was chiefly due to the fact that a good start had been made in executing the orders for automatic exchanges referred to in his report of last year. The present position of the automatic section of the business was as follows:—The four exchanges at Epsom, the General Post Office, Simla in India, and Cordoba in Argentina, continued to work well, and to the satisfaction of the purchasers. The traffic on these exchanges had increased at a greater rate than was usual with exchanges worked on the manual system, and in consequence extensions of the plant had already been called for. The exchange at Rosario referred to last year had been completed, and was working satisfactorily. Quite recently the automatic exchange at Accrington had successfully been brought into service. The company had also in hand exchanges for Leeds, Newport, Blackburn, Chepstow, Paisley and Portsmouth, on all of which good progress had been made, and all of which the company was prepared to complete this year, but some delay might arise in bringing them into use on account of circumstances beyond the control of the company. From the reports of those working, both here and abroad, they felt every confidence in the future of automatic telephones. During the year the company had continued to receive assistance from the Automatic Electric Co. of Chicago, but it was satisfactory to know that they were now able to manufacture in this country all except a small percentage of the equipment of an automatic exchange. The general business of the company during the year in ordinary telephone and telegraph instruments had been satisfactory, and at considerable inconvenience they had undertaken work for the Admiralty and the War Office.

The report was adopted.

Madras Electric Tramways (1904), Ltd.

The annual meeting was held on March 23rd at Dashwood House, E.C., Mr. A. M. Quill presiding.

In proposing the adoption of the report, the Chairman said the accounts for 1914 showed a balance from running account of £21,356 as compared with £20,975, an increase of £381, or, say, 1¾ per cent. The gross receipts amounted to Rs. 6,66,633, compared with Rs. 6,44,201 in 1913. An increase of 8.7 per cent. was shown for the first seven months of 1914, but after war was declared business in Madras suffered in common with that of all other places, and during the last five months of the year the traffic receipts steadily fell. The increase for the whole year, therefore, was only 3.5 per cent. They were still suffering from the depression, the receipts this year to the middle of March being 2.2 per cent. less than the corresponding period of 1914, but perhaps they had reason to be thankful that things were no worse. The number of passengers carried in 1914 was 17,622,219, an increase of 5.22 per cent. The cost of running had shown an increase, due chiefly to repairs rendered necessary by the monsoon (which was unusually severe last year), and the net increase from running was accordingly only 1¾ per cent. At the last meeting he informed them that Government had suggested a scheme of road widening in Chintadripet, which would have enabled another line of rails to be laid in that district. As these negotiations had been proceeding for some years the board decided that Mr. Gray should visit Madras and endeavour to effect a settlement, because until a diversion of the line was made it was impossible to proceed with any extensions, or, indeed, to develop the existing lines further. As neither the Corporation of Madras nor the company could contribute towards the cost of street widening, another route had to be considered, and the diversion which they had all along advocated, viz., along Mount Road, over Government House Bridge and along Body Guard Road to the Central Station, had now been sanctioned by the Corporation. This route would necessitate the widening of Government House Bridge and Penitentiary Bridge, and plans had been submitted for the approval of Government. He trusted that these would be passed without undue delay and so permit the development of the undertaking to proceed. A scheme for providing accommodation for the natives in the suburbs of Madras was now being considered by Government and the Corporation, and he was glad to say that the routes for extensions which they themselves had in contemplation coincided in a large measure with those recommended by the authorities, but the distance which these extensions were to be carried would require further consideration. Meantime, they had indicated their willingness to proceed with the extensions gradually as soon as the diversion along Mount Road had been completed. The arrangements made for the joint management of the Madras Electric Supply Corporation, Ltd., and this company had proved satisfactory, and would effect savings in the management of both companies. He thought it right to mention that the company had a contingent liability in respect of a bank loan to the Madras Electric Supply Corporation, Ltd.

Mr. James Gray, in seconding the motion, referred to his recent visit to Madras, and said he fully concurred in the opinion of the company's representatives there that the diversion of the lines should be *via* Mount Road and Body Guard Road, as that was the direct route between the northern and the southern parts of the city. The new route would constitute, really, a trunk line, enabling them to provide a more rapid through service, and it would also permit of extensions to various parts of the city which they did not at present touch. Speaking generally, he was pleased with the condition of the undertaking. The permanent way, with the exception of two small sections, had now been laid with 90-lb. rails, which were in very good condition. The buildings were of a substantial character and the workshops were equipped with all the tools necessary for building tramcar bodies and for executing repairs to the rolling stock. A petition was presented to him praying for an increase in the rates of wages and the creation of a provident fund. As a regular system of advancement was already in operation, it was not necessary to grant the former, but the creation of a contributory provident fund would, he thought, be a good thing for the company and the matter was now under the consideration of the board.

The report was adopted.

A French Investment Co.

The report for 1914 of the Société Centrale pour l'Industrie Electrique, of Paris, whose board includes representatives of various large banks in Paris and leading experts in the electrical industry, records on a paid-up capital of £800,000 net profits of £43,000, which sum has been placed to a special reserve fund in consequence of the effects of the war, whilst the balance of £5,200 from 1913 has again been carried forward. It appears that the war effects were perceptible in the working of the Compagnie Centrale d'Energiè Electrique in Algiers, Oran, Rouen and Chateauroux, and a reaction is apprehended in the receipts of the Société des Tramways et Electricité, of Constantinople. The capital increase of the Compagnies Réunies Gazet Electricité, of Lisbon, was carried out, and the year 1913-14 yielded a dividend of 7½ per cent., as in 1912-13. The report refers hopefully to the capacity of development of this particular company. In addition, a further example—the Société Force Electrique, of Baku—paid for 1913 a dividend of 9 per cent. on the preference shares and 6 per cent. on the ordinary capital, and although working in 1914 was interrupted owing to a lengthy strike movement, the gross profits materially increased. It is added that despite the situation of war, the petroleum industry in the region of Baku seems to be in full activity.

Italian Supply Companies.

Notwithstanding the mobilisation of the Italian Armies which has been proceeding for several months past, the course of the war has not detrimentally affected any of the supply companies if we may judge from the accounts which have so far been published for 1914, although when we speak of Italian supply concerns it has to be remembered that various German and Swiss companies hold large interests in many of them, and these may be mentioned in parenthesis. The Società Adriatica di Elettricità (Zurich Bank for Electrical Enterprises), of Venice, for instance, has decided to pay 7 per cent. for 1914 on capital of £800,000, as compared with the same rate on less capital in 1913; the Società Idroelettrica Ligure, of Milan (Zurich Bank), 8 per cent. on £[illegible], as against the same rate in 1913 on less capital; the Società per le Forze Idrauliche dell' Alto Po, of Milan (Zurich Bank), 8½ per cent. on £184,000, as contrasted with 8 per cent; the Società Elettrica Riviera di Ponente Ing. R. Negri, of Milan (Zurich Bank and Swiss Electrical Industry Co.), 6 per cent., as in 1913, on £800,000; and the Società Lombarda per Distribuziona di Energia Elettrica, of Milan, 9 per cent. on £750,000, as compared with 10 per cent., the reduction being due to the necessity for writing down paper securities. In addition to these instances the German Schuckert group controls five subsidiary companies in Italy, four of which are distributing the same rates for 1914 as for the preceding year. These are the Società Sicula per Imprese Elettriche, of Palermo, 8 per cent. on capital of £320,000; the Società Toscana per Imprese Elettriche, of Florence, 10 per cent. on £100,000; the Società Bergomasca per Distribuzione di Energia Elettrica, of Bergamo, 4 per cent. on £161,000; and the Società Torinese di Tramways e Ferrovie Economiche, of Turin, 5 per cent. on £240,000. On the other hand, the fifth company—the Società Industriale Elettro-chimica di Pont St. Martin—has been compelled to refrain from paying any dividend for 1914, this result comparing with 5 per cent. on £140,000 in 1913. The explanation is to be found in the fact that the company's Bard power station was put out of service last July in consequence of damages caused by high water, and it was only possible to proceed with repair works on low-water conditions which prevailed in February of the current year. The examples given show the fair degree of prosperity which applies to a number of supply works in Italy, but they by no means exhaust the list of undertakings, including manufacturing, in which foreign capital is largely interested, and which have greatly contributed towards the industrial development of Italy.

British Aluminium Co., Ltd.

Mr. A. W. Tait (Chairman) presided on Friday, at Winchester House, E.C., over the annual meeting. He said that trading profit and other income for the year was £272,256, as compared with £268,720, or an increase of £3,535. These results showed some slight improvement over the previous year, which up to that time was the best result obtained since the company was originally incorporated in the year 1894. In last year's report, and in his remarks at the annual meeting, he mentioned that, although the results were good, no progress could be made in an absolutely straight line, and, in March last, in common with other industries, there was a temporary set-back in the demand. This set-back continued for several months, but about the middle of the year there was a gradual improvement in the position. The prospects were, however, considerably upset on the outbreak of the war. When this occurred, there was naturally a period of considerable anxiety, because the company sold its production practically all over the world, and a large portion of that production had usually been sold in Germany, which had been the largest user of aluminium in Europe. The war, therefore, involved the cancellation of a considerable number of orders and contracts which were upon the company's books; but he was pleased to say that, so far as the year under review was concerned, this had been offset by the increased demand of the British Government and its Allies and contractors working for them. The result of the year had, therefore, been that the output and sales showed an increase over the previous year, and the prices realised were approximately on the same level as the previous year. The costs of production were, however, affected—specially in the closing months of the year—by the increased prices of certain materials, freight, insurance, and other expenses. He thought, therefore, considering the slackness in the demand at the beginning of the year and the abnormal conditions suddenly created by the war, the results were on the whole satisfactory. With regard to the demand for aluminium, this, in their opinion, still continued to increase, although it was a little difficult to forecast what the position would be after the war. There was, however, ample scope for development in the various uses of the metal. At the present time, there was a good demand for the metal for war material, equipment and stores; but how far this exceptional and unusual demand would be taken up by general commercial development afterwards it was somewhat difficult to forecast. There was every reason to believe, however, that as regarded the year 1915 the company would be able to market the larger part, if not the whole, of its production at reasonable prices. The question of the company's production for the current year was dependent very largely on two factors, viz., (1) labour, (2) ability to obtain and maintain the necessary stocks of raw material and coal. Owing to the splendid response which had been made by the young men of this country to the call for service to the Empire, and owing to the Government call on the labour that remained being a paramount one, it was extremely difficult for other employers of labour to maintain adequate forces. So far as their company was concerned, the response to the country's call had been extraordinarily good. The number of members of the staff and employés who had joined the Colours was about 550, which was approximately 22 per cent. of their total forces. Two of their directors were serving also, namely, Captain Pollen and Captain Cooper. In accordance with the general custom which had been adopted by the various manufacturers in this country, they had made provision for the dependents of the members of their staff and the families of their employés who had joined the forces. Their industry, which was very largely a specialised one, required a considerable period of training on the part of the men before they were able to give efficient labour, and, for some time past, it had been increasingly difficult to supply the gradual wastage which had occurred due to causes which he had mentioned. They were employing a certain number of Belgians, but the supply of those who were capable and willing to work was very far below the demand of the labour market at the present time. Their staff and men, however, had been working in an excellent way and had responded exceedingly well to the additional strain put upon them, and they hoped that they might be able to keep the whole of their works going during the year nearly up to their full capacity. With regard to the second difficulty, namely, that of obtaining and maintaining the necessary supplies of raw material and coal at the various works, their chief difficulty was with regard to their principal raw material—bauxite. This was obtained from their mines and from stocks in the South of France. Immediately after the outbreak of war, the French Government declared bauxite contraband and placed an absolute bar upon its exportation. They were able, however, with the help of the Foreign Office, to convince the French Government of the absolute necessity for this raw material to enable the company to supply Government contracts, and a special permit was given for export, although it was still necessary to obtain a special permit for each cargo, which very often involved delay and demurrage. Apart from that, it was becoming increasingly difficult to obtain the necessary freighting facilities to their works. In order that the shareholders might appreciate to what extent this disturbance and increase in prices affected the company's costs of production, he might mention that, in the course of a year, they had to deal with approximately 200,000 tons of seaborne freight. The market for coal had also been affected, and there was also a heavy burden in connection with insurance to cover marine and war risks on raw materials and metal. It was not possible in any considerable measure to raise the price of the metal to compensate for these increases in expenditure, as a large quantity was contracted for before these troubles became manifest, and it had also been the desire to prevent any great fluctuation in prices in order to protect and encourage the users of the metal. In a business of this magnitude, a certain amount of capital expenditure must always be going on. The preliminary work for the erection of the new alumina works at Burntisland was in progress, but, owing to difficulties in obtaining labour and material, it was not expected that these works could be in operation until next year. The power plant required for the rolling mills at Warrington had been completed, and these mills were now operating satisfactorily to their full capacity. The final balance of the purchase price for the acquisition of the works at Vigelands, Norway, from the Anglo-Norwegian Aluminium Co., was completed in June last. This purchase was an advantageous one for the company, and had largely increased their productive capacity. The acquisition of those works necessitated the increases in their carbon-electrode works at Kinlochleven and the erection of the new alumina works at Burntisland in order to supply adequately their increased requirements of those materials. They hoped and expected that the whole programme would be completed in the course of next year, and, as all the capital necessary for the acquisition of those works and for the extensions at other works which he had mentioned, together with the necessary working capital for their operation, had been found out of the resources of the company, the shareholders were to be congratulated on the increased capacity which had been obtained without the necessity of an increase in capital, and they would agree that the building up of reserves, which had been the policy of the board since the incorporation of the new company, had been more than justified. The company's rolling mills at Milton and Warrington had been kept employed up to their full capacity during the year, and the demand for manufactured aluminium continued to grow in a satisfactory manner. With regard to their interests in Switzerland, there had been no change since the position was last reported. The Martigny-Orsières Railway continued in operation for general traffic, and the Orsières power scheme was being properly maintained and supervised, but no new work was being carried out. In the balance sheet the stocks of metal, raw materials and stores, amounted to £187,266, or an increase of, approximately, £14,000, as compared with the previous year. This increase was largely to be accounted for by the increase in the working stocks at their various factories. Sundry debtors and bills receivable stood at £119,561, as compared with £91,400, or an increase of approximately £28,000. This amount was after making provision for all bad and doubtful debts, and in this connection he might mention that all debts due by parties in Germany, which he was pleased to say were not of very large amount at the outbreak of the war, had been written down to a nominal sum. Cash in hand and at bankers stood at £163,308, as compared with £140,092, or an increase of approximately £23,200 over the previous year. It was necessary for a company of their magnitude to keep a large cash reserve, and more particularly so in the present times. The allocations to reserve account for the last two years, amounting to £100,000, had not been invested in securities outside the company's business owing to the necessity of making provision for capital expenditure. The dividend recommended by the board on the ordinary share capital was at the same rate as the previous year, and, in view of the difficulties which he had mentioned, the board considered it was prudent that the dividend on the ordinary shares of the company should not be increased. They felt that in these somewhat uncertain and difficult times the interests of the shareholders would be best served by maintaining the dividend on the ordinary share capital for the year 1914 at the same rate as the previous year. It was evident from Press cuttings that there had been an idea in the minds of several persons that the company had benefited largely by the war, but this was not the case. In the minds of others, there seemed to be an extraordinary ignorance of the company's manufactures, because in one paper it was quoted with all seriousness that the company was doing extraordinarily well, working night and day for the Government in the manufacture of aeroplane engines.. The company were producers of aluminium in crude and manufactured form, but they did not undertake complicated questions of mechanical engineering such as those which had been attributed to them.

Mr. J. Taylor seconded the motion.

Mr. C. Hacking asked what were the prospects of the company recovering its trade with Germany after the war?

The Chairman said that Germany had been the largest users of aluminium in Europe, and it was difficult to forecast what would happen. Germany manufactured a very small amount of aluminium and must come into the markets of the world to purchase. He did not anticipate that there would be the slightest difficulty in doing trade with Germany if they desired to do it.

The motion was carried, as was also a resolution of thanks to the board and staff.

Marconi's Wireless Telegraph Co., Ltd.

The directors have declared a dividend of 7 per cent., less income tax, upon the 250,000 7 per cent. cum. participating pref. shares in respect of the year 1914, payable on April 19th. In making this announcement the directors say that the company has continued since the outbreak of war in full control of its business, but its stations have been largely devoted to Government work. For this reason the new direct public service with New York, which it had been contemplated would have been opened in the summer of last year, has had to be postponed. In other respects the company's business has been necessarily disturbed, and considerable business which was pending in many foreign countries has been delayed or deferred. This, however, has been substantially compensated for by Government and other business directly resulting from the war; the works and all the company's staff have been working under the highest pressure throughout the whole period. A number of matters, including the question of compensation and payment for services, being still in abeyance, the directors are as yet unable to estimate with sufficient reliability the results of the business of last year to warrant them at this moment in declaring an interim dividend upon the ordinary shares. They are, however, of opinion that there is no reason for deferring the dividend upon the preference shares. The directors say that they contemplated being in a position to give shareholders information with regard to other matters of importance concerning the company's business, but as these still remain under negotiation, it has been resolved not to delay further this announcement and the payment of the dividend.

STOCKS AND SHARES.

Tuesday Evening.

At this season of the year, the coming of the Easter Holidays always necessitates earlier preparation of matter, as well as advertisements, for the Electrical Review, and this is the reason why the financial section has to be made up earlier than usual. The approach of Easter in the ordinary way is a signal for Stock Exchange business to slack off, but in this year of surprises it is not so astonishing to find that the House is developing a good deal of activity. Possibly this may be because most people are compelled, for one reason or another, to curtail their Easter holidays. Some are too busy to go away; others are too idle. The position may be illustrated by the traditional Stock Exchange complaint that when members are making a lot of money, they have no time to spend it; and when they have plenty of time to spend money, it means that they are not making any. The withdrawal of the usual railway facilities, which presses so hardly upon thousands of the workers in the Metropolis, offers another excuse for staying in town by those to whom a holiday flight to golfing grounds or the seaside has been in previous years a matter of course.

As was foreshadowed here last week, the price of electricity is to be put up; and this will come as no surprise to those who have any acquaintance with the conditions under which concerns connected with the industry, or with gas, are labouring at the present time. When gas companies raise the price of their product they are obliged to lower their dividends. Electric lighting companies, however, are not confined by any such sliding scale as that which operates in the case of the gas companies; but it would be too much to expect that the former will maintain their dividends if the raising of the price of current has any pronounced effect upon consumption. These are, however, too early days to discuss the matter with any degree of certainty; and it is mentioned merely as a hint to shareholders that they may be called upon to make some further sacrifice, in addition to whatever disabilities they have already suffered in consequence of the war.

The leading article in last week's issue dealt with the serious aspect presented to many electricity undertakers through the Treasury limitations of capital expenditure. The subject is one closely concerning the companies, as well as local authorities, and it has been already discussed earnestly in certain board-rooms. Fortunately, the charge of extravagance in capital expenditure is one that has been rarely levelled at electricity supply companies—at any rate, within the past half-decade; and this has been due largely to the fact that the continual discussion of schemes for taking over the companies, with a view to the constitution of one central authority for the supply of London as a whole, has been ever-present to the minds of those charged with the control of the business.

So it comes about that the spending departments have lived in an atmosphere of wholesome economy; and that further capital expenditure may be prohibited by the Treasury is a threat which will probably convey less terror to directors in the electrical world than to most other branches of domestic industry. Still, those companies which are well buttressed with reserves have additional cause for congratulation at this time. It is understood in the Stock Exchange—to whose Committee are forwarded copies of applications made by companies for new capital issues—that the Treasury interprets its prohibitory powers with a reasonable amount of elasticity, and that, where definite cause of national interest can be shown, the applicant for permission to raise more money can reckon upon his proposals meeting with at least favourable consideration.

This week a large number of ex-dividend markings have been made, and already in some cases deductions have been recovered, either wholly or in part. County ordinary, for instance, at 11⅜ have regained the full amount of the dividend. South Londons are up to 3 xd. The fall in Westminsters has been checked, the price recovering ⅛ to 7½. Cities at 14½ are ex their dividend, and in several of the leading shares this re-arrangement of prices has resulted in investment purchases.

The rumour linking the South London and the South Metropolitan Companies with the County of London Electric Supply Co. has gained ground since we referred to it—with intentional vagueness. On the face of it, there is a good deal to make one hesitate about accepting it as even probable; and so we mention it for what it may be worth. South Metropolitan ordinary shares have been wanted just lately, some people having given as much as 11s., although a month or so ago the nominal quotation was about half as much as this. South Londons have been a good market for some time past; therefore it can scarcely be inferred from their present strength that developments must have taken place quite recently to account for the way in which the shares have been sought after.

We append our usual list of representative stocks and shares in the markets connected with electricity:—

Home Electricity Companies.

	Mean price. July 27, 1914.	March 27, 1915.	Rise or fall this week.
Brompton Ordinary	9⅜	8¼ xd	— ¼
do. 7 per cent. Pref.	8⅜	7¾ xd	— ¼
Charing Cross Ordinary	5¼	4½	—
do. do. do. 4½ Pref.	4¾	4⅛	—
do. do. City Pref.	4⅝	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅞	4⅜ xd	—
do. 4½ Deb.	96½	92	—
City of London	16	14½ xd	—
do. do. 6 per cent. Pref... ..	18½	12½ xd	—
do. do. 5 Deb.	116½	112	—
do. do. 4½ Deb.	100½	98	—
County of London	12	11⅜ xd	+ ¼
do. do. 6 per cent. Pref. ..	12	11⅛ xd	+ 1/16
do. do. 1st Deb...	102½	100	+1
do. do. 2nd Deb.	100½	97	—
Kensington Ordinary	7½	7	—
London Electric	1 7/16	1½	+ 1/16
do. do. 6 per cent. Pref... ..	5 1/16	4 15/16	—
do. do. 4 Deb.	92½	87	—
Metropolitan	8½	8 xd	—
do. 4½ per cent. Pref.	4 7/16	4	—
do. 4½ Deb...	97½	96	—
do. 3½ Deb...	88	80	—
St. James' and Pall Mall	9⅝	8½	+ ¼
do. do. do. 7 per cent. Pref.	7	6⅝	—
do. do. do. 3½ Deb.	84½	80	—
South London	8 1/16	8 xd	+ 1/16
South Metropolitan Pref.	1¼	1⅛	—
Westminster Ordinary	8⅜	7½	+ ⅛
do. 4½ Pref...	5⅛	4⅛	+ ⅛

Telegraphs and Telephones.

	Mean price. July 27, 1914.	March 27, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108½	103½	—
do. Def.	23	21⅜	+ ⅛
Chile Telephone	7⅜	6⅜	—
Cuba Sub. Ord.	8½	8½	—
do. Pf.	16½	15	—
Eastern Extension	12¾	12¼	—
do. 4 Deb.	97½	92	—
Eastern Tel. Ord.	130½	131	+ 2½
do. 3½ Pf.	77½	73½	— ½
do. 4 Deb.	96½	93	— 1
Globe Tel. and T. Ord.	11¼	11	—
do. Pf.	12⅝	12	+ ⅛
Gt. Northern Tel.	82½	29	—
Indo-European	69	61	—
Marconi	1⅜	1¼	— ⅛
New York Tel. 4½	101	98	+ 1
Oriental Telephone Ord.	2 3/16	2	—
do. Pf.	1 5/16	1 3/16	—
Tel. Egypt Deb.	98	88½	—
United R. Plate Tel...	6⅜	6	—
do. Pf.	5¾	6	—
West India and Pan.	1½	1 1/16	— 1/16
Western Telegraph	18⅜	18	—
do. 4 Deb.	96½	93	— 1

Home Rails.

	Mean price. July 27, 1914.	March 27, 1915.	Rise or fall this week.
Central London, Ord. Assented	88	76½	+ ⅛
Metropolitan	87½	29	— 1
do. District	91¾	17½	— ⅛
Underground Electric Ordinary ..	2½	1¼	— ⅛
do. "A"	7/6	5/6	— 6d.
Income	88	81 xd	—

FOREIGN TRAMS, &c.

	Mean price. July 27, 1914.	March 27, 1915.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅞	4¼	—
do. 2nd Pf.	4¼	3⅞	—
do. 4 Deb.	91	84	—
do. 4½ Deb.	98½	91	—1
do. 5 Deb.	96	88	—
Brazil Tractions	66	52½	— ½
Bombay Electric Pf...	11⅜	10⅜	—
do. 4½ Deb.	96	91	—
Mexico Trams..	70	80	—5
do. 5 per cent. Bonds ..	84	45	—
do. 6 per cent. Bonds ..	76	80	—
Adelaide Sup. 6 per cent. Pf.	5½	5½	+ ⅛
do. 5 Deb.	104	103	—

MANUFACTURING COMPANIES.

	Mean price. July 27, 1914.	March 27, 1915.	Rise or fall this week.
British Westinghouse Pref.	1¾	2	+ ¼
do. 4 Deb.	74½	72	—
do. 6 p. lien	102½	99	—
Callenders	11⅛	12	+ ¼
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2⅝	3$\frac{3}{16}$	
Edison & Swan, £3 pd.	$\frac{3}{32}$	14/6	—
do. do. fully paid	1¼	2⅛	— ⅛
do. do. 4 Deb.	59	63	—2
do. do. 5 % Deb.	63½	60	—
Electric Construction	$\frac{17}{32}$	13/9	+ 3d.
do. do. Pf.	$\frac{1}{16}$	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	14¾	+ ⅛
do. 4½ Pref.	5	4⅞	— ⅛
do. 4½ Deb.	100½	97	—
India-Rubber	9	9	+ ¼
Telegraph Con.	38½	37	— ½

Marconi shares have gone back a little to 35s. sellers—not because the company has just lost an action for damages in which a comparatively small sum was involved, but because the directors announce that they cannot declare an interim dividend upon the ordinary shares at the moment. A number of matters, they say, including the question of compensation and payment for services being still in abeyance, they are as yet unable to estimate with sufficient reliability the results of the business of last year, but they are of opinion that there is no reason for deferring the dividend upon the preference shares. Matters of importance concerning the company's business are still under negotiation, but the directors state that some of the disturbance caused by the war has been sufficiently compensated; and they add that the works and all the company's staff have been working under the highest pressure throughout the whole period covered by the war. The preference are steady at 33s., and, in the subsidiaries, small falls lowered American Marconis to 9s. 3d., and Canadians to 5s. 3d.

The outstanding feature in the telegraph market is the strength of Easterns, the stock having risen 2½ to 131½, thus passing its end-July, 1914, level. "China" shares now stand the same as they did at that time, and Easterns at 13½ are but 7s. 6d. lower. The market shows decided strength, but, oddly enough, a few of the prior-charge stocks are on offer, for which the reason probably must be sought in the fact that new gilt-edged issues are being made at prices so tempting that they encourage holders of existing stocks to sell these, and to apply for the newcomers.

Mexico Trams are 5 points lower. Brazil Tractions, on a decline in the Rio rate of exchange to 13 7/32d., continued to droop. The Anglo-Argentine Tramways division is fairly steady, and likely to improve, since the suspicion with which most Argentine things have been regarded is now wearing off; and the railway market especially exhibits new signs of vitality.

Callenders, Henleys, and India-Rubber shares are all better. British Insulateds have hardened to 11, ex the dividend of 11s. Electric Constructions rose a few pence. Telegraph Constructions are 10s. easier, heavy shares such as these being vulnerable to the offering of any small amount. Edison and Swan have eased off a little, and the first debenture is 2 points lower at 63. Armament shares rallied a little, and the rubber market is one of the best in the Stock Exchange. Renewed attention has been called to the excellent position of most of the well-managed concerns; and since proprietors are in no mood for selling, the demand which has sprung up from investors has had a bracing effect upon the market, although at the same time it has been difficult to satisfy.

Midland Electric Corporation for Power Distribution, Ltd.—The report states that the revenue was adversely affected during the first two months of the war, but, apart from the supply of energy for light, has since improved. The balance to the credit of the net revenue account, after payment of debenture interest, is £17 859, plus £3 572 brought forward, making £21,431, of which the directors have appropriated to depreciation of plant and machinery, £8,582; depreciation of stores, £500; writing off of commission and expenses of issues of debentures and shares, and expenses during construction, £4,275; payment of a dividend of 6 per cent. on 13,079 preference shares, £3,923; transfer to a debenture premium redemption account, £500; carrying forward £3 650.—*Financier.*

Lancashire Dynamo and Motor Co., Ltd.—The *Times* states that the ordinary share dividend is [illegible] per cent. for the year, free of tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Monday, March 29th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	4/6	..
a	„ Nitric	„	19/-	..
a	„ Oxalic	per lb.	10½d.	..
a	„ Sulphuric	per cwt.	5/-	..
a	Ammoniac Sal	„	£49	..
a	Ammonia, Muriate (large crystal)	per ton	£49	..
a	Bleaching powder	„	£9	..
a	Bisulphide of Carbon	„	£21	..
a	Borax	„	£20	..
a	Copper Sulphate	„	£28 10	..
a	Lead, Nitrate	„	£35	..
a	„ White Sugar	„	..	..
a	„ Peroxide	„	..	..
e	Methylated Spirit	per gal.	..	..
a	Potassium, Bichromate, in casks	per lb.	6d.	..
a	Potash, Caustic (88/90 %) ..	per ton	£75 to £80	..
a	„ Chlorate	per lb.	1/6	..
a	„ Perchlorate	„	1/6	..
a	Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	Nom.	..
a	Shellac	per cwt.	65/-	..
a	Sulphate of Magnesia	per ton	£5 10	..
a	Sulphur, Sublimed Flowers ..	„	£11 10	..
a	„ Recovered	„	£8	..
a	„ Lump	„	£8 10	..
a	Soda, Caustic (white 70/72 %) ..	„	£10 2 6	..
a	„ Chlorate	per lb.	9¼d.	..
a	„ Crystals	per ton	45/-	..
a	Sodium Bichromate, casks ..	per lb.	8¼d.	..
	METALS, &c.			
	Aluminium Ingots, in ton lots ..	per ton	£90	..
	„ Wire, in ton lots (1 to 14 S.W.G.)	„	£120	..
b	„ Sheet, in ton lots ..	„	£120	..
p	Babbitt's metal ingots	„	£50 to £221	..
c	Brass (rolled metal 2" to 12" basis)	per lb.	9⅜d.	½d. inc.
c	„ Tube (brazed)	„	11d.	½d. inc.
c	„ „ (solid drawn) ..	„	10½d.	½d. inc.
c	„ Wire, basis	„	10d.	½d. inc.
	Copper Tubes (brazed)	„	1/-	½d. inc.
c	„ „ (solid drawn) ..	„	1/-	½d. inc.
g	„ Bars (best selected) ..	per ton	£90	£4 inc.
g	„ Sheet	„	£90	£4 inc.
g	„ Rod	„	£90	£4 inc.
d	„ (Electrolytic) Bars ..	„	£77	£6 inc.
d	„ „ Sheets ..	„	£95	£6 inc.
d	„ „ Rods ..	„	£83	£3 inc.
d	„ „ H.C. Wire	per lb.	10⅜d.	⅜d. inc.
f	Ebonite Rod	„	3/-	..
f	„ Sheet	„	2/6	..
n	German Silver Wire	„	1/8	..
h	Gutta-percha, fine	„	6/10	..
h	India-rubber, Para fine	„	2/5½	..
l	Iron Pig (Cleveland warrants) ..	per ton	63/7	2/7 inc.
l	„ Wire, galv. No. 8, P.O. qual.	„	£18	..
g	Lead, English Pig	„	£24	..
m	Manganin Wire No. 28	per lb.	..	..
g	Mercury	per bot.	£12 5 to £12 10	..
e	Mica (in original cases) small ..	per lb.	4d. to 2/6	..
e	„ „ „ medium	„	3/- to 5/	..
e	„ „ „ large ..	„	6/6 to 10/6 & up.	..
o	Nickel, sheet, wire, &c.	„	Nom.	..
p	Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p	„ „ rolled bars & rods	„	1/2 to 1/3½	..
p	„ „ rolled strip & sheet	„	1/3½ to 1/5½	..
o	Platinum	per oz.	195/-	..
d	Silicium Bronze Wire	per lb.	10½d.	..
r	Steel, Magnet, in bars	per ton	£70	..
g	Tin, Block (English)	„	£174	..
n	„ Wire, Nos. 1 to 16	per lb.	2/6	..
p	White Anti-friction Metals ..	per ton	£52 to £194	..
k	Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

P. R. Jackson & Co., Ltd.—The *Financial Times* states that for 1914 the gross profit was £13,475, and after payment of interest on debentures, depreciation, &c., there is a balance of £8 948. The directors recommend a dividend of 6 per cent. on the ordinary shares, writing off goodwill account £2,000 and leaving to be carried forward £1,756.

Winnipeg Electric Railway Co.—For 1914 the net earnings amounted to $1,685,093, and after providing for fixed charges and four quarterly dividends of 3 per cent. each, a credit to profit and loss of $901,697 brought forward was reduced to $816,309. A dividend of 2½ per cent. has been declared for the quarter ending March 31st.—*Financial Times.*

Huelva Gas and Electricity Co., Ltd.—The net report for 1914 was £2,051, plus £245 brought forward. Deducting the dividend on the preference shares, the directors recommend that £1,400 be written off for depreciation of gas and electric plant, leaving £574 to be carried forward.

ELECTRICITY IN MINES.

[The Report of H.M. Electrical Inspector of Mines.]

The report for the year 1913 of Mr. Nelson, H.M. Electrical Inspector of Mines, is included in the General Report of the Chief Inspector of Mines, which has just recently been issued.

The report deals first with the growth of the use of electricity in mines, the following being a summary of the returns received on January 21st, 1913:—

	Surface H.P.	Underground H.P.	Total H.P.
Scotland	26 279	93 361	119 640
Northern	64 837	79,422	144,259
York. and North Midland ..	55,954	51,245	104,200
Lancashire, North Wales and Ireland	9,884	20,863	30,747
South Wales	90,581	91,237	181,818
Midland and Southern ...	9,141	35,294	44,434
Totals ...	256,676	371,422	628,098
Total for year 1912 ...	194,088½	316,667½	510,756

These figures show an increase of 32·24 per cent. in the electrical H.P. installed for the surface; 17·29 for underground; and a net total increase of 22·97, which is very satisfactory indeed on a year's working.

A further estimate of the growth of the use of electricity in the different divisions may be made by comparing the number of tons of mineral raised per electrical horse-power employed with the corresponding figure for the year 1912, as shown in the following table:—

		Tons of mineral per electrical H.P. employed.			
Division.	Tons of mineral raised in 1913.	On surface.	Below ground.	Above and below ground together 1913.	Corresponding figure for 1912.
Scotland	47 434,287	1,805	508	395	449
Northern	65,263,291	1,007	822	452	538
York. & North Midland	73,449,759	1 314	1,434	686	744
Lancashire and North Wales	28,480,739	2,881	1,365	926	1,028
South Wales	57,009,050	620	625	314	336
Midland and Southern	29,924,227	3 274	848	673	718
United Kingdom...	301,611,353	1,175	812	480	534

In regard to coal-cutting, the number of electrically-driven machines in 1913 was 1,307, being an increase of 173 over the number in use at the end of 1912.

Fatal Accidents.

There were during the year 1913 15 fatal accidents definitely due to electricity, and causing in all 16 deaths. In addition, a serious fire at the Big Pit of the Blaenavon Iron and Steel Co., at Blaenavon, Monmouth, on April 7th, which resulted ultimately in the loss of three lives, was held by most investigators to have been due to the failure of an electric cable, and the disaster at Senghenydd Colliery on October 14th was held by the Commissioner appointed to investigate the cause to have been possibly, but not certainly, due to sparks from electric signalling wires. The two latter accidents apart, the figures for the year 1912, comparable with those given above for 1913, were 12 accidents causing 14 deaths. In 1913 there was therefore an increase of three accidents and two deaths over the figures for 1912.

The whole of the 15 accidents which occurred in 1913 were electric-shock accidents. Of these, three took place on the surface and 12 below ground. The two classes of accident will be separately considered, so that any conclusions it may be possible to draw shall have application to surface conditions and to underground conditions respectively. The figure for electric-shock accidents below ground, which had begun to show a downward tendency, has risen again, as will be seen below:—

	1907	1908	1909	1910	1911	1912	1913
Number of persons killed by electric shock below ground in coal mines ...	10	12	13	15	9	7	13

The figure for 1913 is disappointing in comparison with 1912, although the horse-power of electric plant in use below ground increased by 17 per cent. during the year. For the first time it is possible, from the data available, to determine the rate of increase of the horse-power of electric plant in use below ground. On the assumption that that rate of increase is normal, and not exceptional (and there is no reason to think that it is other than normal), the horse-power of electric plant in use below ground has increased by 95 per cent. since the end of the year 1909, whereas the number of persons killed by electric shock, as will be seen, was the same in 1909 as in 1913. It is also of interest to note that of the 79 persons killed by electric shock below ground, in seven years between January 1st, 1907, and January 1st, 1914, 45 were killed in the first half of that period, and 34 in the second half; figures which, taken in conjunction with the increase of electrical horse-power in the second half period over the first half period, seem to show that the risk of fatal electric shock below ground is decidedly a diminishing risk. It is, on the other hand, unsatisfactory to note that of the 12 fatal electric-shock accidents that occurred below ground in 1913 (one of the accidents was responsible for the deaths of two persons), at least *nine might have been avoided by greater care in the maintenance of apparatus and stricter regard to the regulations.*

Surface Accidents.—Of the three electric-shock accidents, one occurred on a high-pressure alternating-current system, one on a medium-pressure alternating-current system, and one on a low-pressure alternating-current system. In the case first mentioned the victim of the accident touched some part of the winding of a three-phase motor supplied with current at 3,000 volts. Though the insulation appeared externally to be perfect, it was, in fact, insufficient, and a fatal electric shock followed. The accident on a medium-pressure system was of an unusual character. A derrick-pole was being erected by means of steel wire guy ropes, when one of the latter made contact with an unprotected fuse in the neighbourhood belonging to a 5-H.P. motor supplied with three-phase current at 400 volts. The ground was wet, and the man who had hold of the guy rope that made contact with the fuse was killed. The fuse which caused the accident should clearly have been protected. The accident on the low-pressure system was the result of an act by the victim himself (a boy of 13), and his death may fairly be classed as a misadventure. The evidence given at the inquest showed that the boy who was killed challenged one of his mates to climb a railing, and from this position to touch some electric wires which would then be within his reach. His mate refused, so the victim himself climbed the railing and touched the wires. He was killed instantly, though the pressure was not high (220 volts alternating).

Underground Accidents.—Out of the 12 underground electric shock accidents, nine occurred on medium-pressure three-phase alternating-current systems, two on medium-pressure continuous-current systems, and one on a low-pressure two-phase alternating-current system. The circumstances of each of these accidents have been considered, with the result given by the following table:—

Due to:—	Accidents.	Deaths.
1. Faults as regards the earthing of metallic outer coverings of apparatus:—		
(a) Total absence of any connection to earth	1	1
(b) Break in continuity of earth connection	2	[illegible]
(c) Outer covering earthed but connection with earth insufficient	3	[illegible]
2. Contact, direct or indirect, with live parts of cables:—		
(a) Direct contact with a live cable exposed through abrasion of the insulation ...	3	3
(b) Contact with a conductor (a girder) made live by its contact with a live cable exposed through abrasion of the insulation	1	1
3. Accidental contact with uninsulated live parts of apparatus ...	[illegible]	[illegible]
	12	13

The above table may be summarised thus:—

	Accidents.	Deaths.
1. Contact with outer coverings of apparatus live through the absence of, or an inefficient, earth connection	6	7
2. Defective insulation of cable systems ...	4	4
3. Contact with uninsulated live parts ...	2	2
	12	13

For the period between January 1st, 1905, and December 31st, 1913, that is to say, in nine years, electric shock below ground has been responsible for 83 recorded accidents and 86 deaths. Mr. Nelson has carefully considered the available information in regard to all of these accidents (a large portion were personally investigated by him), and they may, he thinks, justly be analysed as follows :—

	Accidents.	Deaths.
1. Contact with outer coverings of apparatus live through the absence of an efficient earth connection	37	40
2. Defective insulation of cable systems ...	32	32
3. Contact with insulated live parts	12	12
4. Other causes (misadventure)	2	2
	83	86

Defective earthing has, therefore, been responsible for very nearly 50 per cent. of the deaths due to electric shock below ground. Imperfect insulation of cables has been responsible for 37 per cent. of such deaths.

SUMMARY OF FATAL ELECTRIC SHOCK ACCIDENTS IN 1913.

	Accidents.	Deaths.
Surface Accidents —		
(a) On three-phase systems :—		
Low pressure	1	1
Medium pressure	1	1
High pressure	1	1
(b) On continuous-current systems :—		
Low pressure	—	—
Medium pressure	—	—
Underground Accidents :—		
(a) On three-phase systems :—		
Low pressure	1	1
Medium pressure	9	10
High pressure	—	—
(b) On continuous-current systems :—		
Low pressure	—	—
Medium pressure	2	2
	15	16

Of the accidents on the three-phase systems, 13 in all, 10 were on completely insulated systems and 3 on systems with the neutral point connected to earth.

Of the 16 persons killed by electric shock in 1913, 3 were coal-cutter attendants, 2 were surface labourers, 2 were underground road repairers, 2 were motor attendants, 1 was a haulage hand, 1 a pony driver, 1 a foreman, 1 a coal conveyor attendant, 1 a drawer, 1 a surface screen boy, and 1 a trained electrician.

NON-FATAL ACCIDENTS.

During the year 1913, 53 separate non-fatal accidents, or dangerous occurrences, were reported. There were no non-fatal ignitions of firedamp reported as having been due to electricity, as against 1 in 1912. There were, however, 3 underground fires as against 2, and 50 electric shock accidents causing injury to 51 persons, against 36 accidents causing injury to 36 persons in 1912. All the electric-shock accidents were in mines under the Coal Mines Act, as also were all the underground fires.

Underground Fires Caused by Electricity.—Three underground fires were reported as having been due definitely to electricity in 1913.

The first occurred on January 16th at Leven Colliery, Fife, Scotland. It was caused by the breakdown of two cables which were carried through the woodwork of a trapdoor, and in contact therewith without effective insulation, and without armouring. The fire burnt for about an hour, and the woodwork of the door and some props were destroyed. No one was injured.

The second fire occurred in a haulage motor house at the Duffryn Rhondda Colliery, Port Talbot, South Wales, on March 11th. In order to shield the motor-man from the cold intake-air, a piece of brattice cloth was hung behind him, and in the neighbourhood of the cables running from the motor-controller to the resistances. The fire was caused by a short circuit in the base of the controller, which set fire to the cables referred to. The fire travelled *via* their outer coverings to the brattice cloth, which, in turn, caught fire, and some of the neighbouring props were scorched, but help was close at hand and the fire was quickly extinguished.

The last was the least serious of the three. It occurred in a pump room at Markham Colliery, Hollybush, near Newport, Mon., on May 2nd. A short-circuit due to a breakdown of insulation at a cable dividing box caused an arc, which ignited the rubber insulation of some neighbouring cables. The fire spread to a rubber mat on the floor of the pump room, but it was readily extinguished by the application of a little sand.

Electric Shock Accidents.—Of the 50 electric shock accidents causing injury to 51 persons which were reported during 1913, 30, causing injury to 30 persons, took place below ground, and 20, causing injury to 21 persons, took place at the surface. Of the 51 persons injured, 43 were disabled for more than seven days. In three cases the victim was unconscious for some time, artificial respiration being successfully applied in each case. In four other cases the victims were very seriously injured by burns.

The first of these four cases occurred in the generating station at the surface of Silverwood Colliery, Rotherham, Yorkshire, on February 9th. Two men were working behind a live 500-volt alternating-current switchboard, when one of them dropped a spanner across some live parts. The short-circuit caused an arc, which badly burned both men about the head and face. It is said that the men were working with current on, in disobedience to instructions.

The second of the accidents above referred to occurred in the generating station at Littleburn Colliery, Durham, on May 29th. The victim, a contractor's foreman, was explaining to a member of his firm how he intended to fix some conductors which were about to be erected behind the switchboard. He had a pair of pliers in his hand, and with these he made accidental contact with some live metal. The shock caused him to fall against three bare conductors carrying 2,750-volt alternating current. He was very seriously burnt, losing his left arm. After the accident the bare conductors were effectively protected.

The third accident occurred at Greenrigg Colliery, Fauldhouse, Linlithgow, Scotland, on August 19th, and resulted in severe burns to the victim's left arm and hand due to the failure of the insulation of a trailing cable which he was handling. The system in this case was continuous current and the pressure 500 volts.

The fourth accident occurred at Bargoed Colliery, Monmouthshire, on December 29th. In this case the victim was a switchboard attendant, and he committed the error of attempting to examine a switch which was live at the time, and which he knew to be live. He short-circuited the conductors in the neighbourhood of the switch, which was carrying 3,300-volt alternating current, and was badly burnt on the left hand, face, and neck as a result.

Unclassified Non-Fatal Accidents.—An accident of an unusual character occurred at the Prince of Wales (Haigh Moor) Colliery, near Pontefract, Yorkshire, on August 25th. The glass forming the peephole on a coal-cutter frame was blown out with such force that it caused incised wounds in the back of the attendant, who was at the time 10 yards from his machine. As the result of investigation and experiment it was agreed that there had been an explosion in the coal-cutter frame caused by the volatilisation of some insulating varnish, unduly heated by a short circuit in the motor armature. This short circuit also ignited the gas which formed inside the frame of the coal-cutter, and which proved to be explosive.

The chief point to be noticed in the report is the importance of having an efficient earth, and as we have on several occasions pointed out, shortcoming in this respect, in our opinion, is due not so much to neglect on the part of the management as to incompetence of the electricians in charge. It is sometimes difficult to get a really efficient "earth" in a mine, and unless the electrician in charge has a little more knowledge than a merely practical one, it is very possible he does not clearly understand how to obtain, much less maintain, an "efficient earth" as defined in the Special Rules regulating the use of electricity in mines.

It is also a little disconcerting to have three fires reported due to electricity, and shows how much care is necessary in installing and maintaining electrical cable and plant in mines. If the colliery company cannot afford the services of a really competent engineer, then at least it would pay them to have a monthly or quarterly report made by an outside engineer. Accidents are expensive, and prevention is much better than cure.

REVIEWS.

Samuel F. B. Morse: His Letters and Journals. Two volumes. By E. L. Morse. London: Constable and Co. Price 31s. 6d. net.

In these two volumes, which are written by his son for the purpose of giving to the world "through characteristic letters and contemporary opinions an accurate portrait of the man and a succinct history of his life and labours," we have the story of Morse the artist and inventor. With the "artist" part of the biography we do not propose to concern ourselves here, interesting though it be, and teeming with material that enables us to appreciate the man from many different aspects. Here we shall confine ourselves to the period beginning with the dinner-table conversation on board the s.s. *Sully* in 1832, and terminating with Morse's death 40 years later—a period of stress and trial, of buoyant hopes and crushing disappointments, ending at last in success and world-wide celebrity.

During the dinner-table conversation just alluded to the subject of electromagnetism was discussed, and Morse rose from the table with the idea that there was "no reason why intelligence might not be transmitted instantaneously by electricity," quite ignorant of the fact that the same thought had occurred to the minds of others long before his day.

That Morse first conceived the idea, or was the inventor, of the telegraph, no one to-day who knows anything of the subject would seriously maintain. The distinction of having first published the idea of applying electricity to the telegraph belongs to the historic Scotsman, "C. M.," who ennunciated his views in the Scot's Magazine in 1753, and the invention attained its practical realisation in the hands of Le Sage, of Geneva, in 1774. Hence the need for the reader to guard himself against the acceptance of such expressions as "the inventor of the telegraph," which are sprinkled freely throughout the book in reference to Morse.

In our desire to do justice to Morse we must not allow ourselves to forget the work of those who had laboured at the problem before him, as well as those who were contemporary with him.

Forty-two years after the invention of Le Sage, and 16 years before Morse embarked on the *Sully*, our own countryman, Ronalds, of Hammersmith, had telegraphed over eight miles of wire, with such success that he presumed to suggest its adoption by the British Admiralty for coast communication purposes, only to meet with a refusal on the ground that the existing system of telegraphing (semaphore) was sufficient for their purpose.

In 1820 Ampère constructed a telegraph, using a magnetic needle, wires and a battery; in 1828 Dyer erected a telegraph line on poles, with glass insulators, on Long Island, New York, and produced signals on prepared paper by means of electricity, and in 1830, in Dublin, Booth showed how electromagnetism could be used to telegraph to a distance and cause marks to be made by the fall of the armature of a magnet when the current was broken. Now these were all antecedent to the year 1832, when Morse claimed to have had his inspiration. They not only embodied the idea of a telegraph, but actually were practical methods of telegraphing, although crude ones. Morse's ignorance of what had already been done—an ignorance admitted by his biographer—need hardly be wondered at when we find two Judges, who tried one of the cases in which he was involved, giving it as their opinion that "Mr. Morse was the first to devise and practise the art of recording language at telegraphic distances by the dynamic force of the electromagnet, *or, indeed, by any agency whatever*" (the italics are ours).

That Morse did not continue in this state of ignorance is shown by the following significant interrogatories and answers, which appear in the records of a litigation with Bain, the inventor of the electrochemical recorder:—

"Nineteenth interrogatory. Do you mean to say that you were the first to discover that when an electromagnet is connected with, and forms a part of, such circuit the magnet becomes attractive and non-attractive, as the current flows or ceases to flow? Answer: I do not.

"Twentieth. Do you mean to say that you were the first inventor of the combining an electromagnet and an armature in a circuit of electric or galvanic conductors? Answer: No, not generally in the abstract; but I do claim to be the first inventor of combining an electromagnet and an armature, *as described in my letters patent*, and of combining this combination with a circuit of electric or galvanic conductors."

So much for Morse being the inventor of *the* telegraph. Let us now see if he can lay claim to having invented the first practical telegraph. In the year 1837 his apparatus, on his own admission, was in such an unfinished state that he was unwilling for it to be seen. In the same year Cooke and Wheatstone, in England, patented the first practical (needle) telegraph—practical in the sense of being a commercial undertaking. On June 10th, 1840, the first American patent for an electric telegraph was granted to these two inventors, and ten days *later*, on the 20th of the same month, Morse was granted his *first* patent for "a new and useful *improvement* in the mode of communicating information by signals by the application of electromagnetism."

These facts speak for themselves, and need no comment.

Again, in order to show that Morse was not ignorant of electrical principles when he conceived the idea of a telegraph, it is contended by his biographer that he (Morse) "was familiar with much that had been discovered with regard to that mysterious force (electricity) through his studies under Profs. Day and Silliman, of Yale, and through the lectures and conversations of Profs. Dana and Renwick in New York, so that the charge which was brought against him that he knew absolutely nothing of the subject, can be dismissed as proving the ignorance of his critics" (vol. 2, page 3). In a deposition made in March, 1850, Prof. Henry (the man after whom we name our practical unit of inductance) said of Morse:—"He appeared to be an unassuming and prepossessing gentleman with very little knowledge of the general principles of electricity, magnetism, or electromagnetism, &c."; and again, in giving evidence in the Bain case already referred to, the same high authority stated:—"I am not aware that Mr. Morse has ever made a single original discovery in electricity, magnetism, or electromagnetism applicable to the invention of the telegraph. I have considered his merit to consist in combining and applying the discoveries of others *in the invention of a particular instrument* and process for telegraphic purposes."

When reading through these pages, if we are to prevent our judgment from becoming obscured by the admiration which this fine tribute of a son to the memory of his father evokes within us, we must bear the facts in mind; for there is much, apart from the vexed question of priority, that we should like to dwell upon in this story of a man who voluntarily relinquished a remunerative profession, in which he had attained to a place of high distinction, to tread the rough and thorny path of the inventor, wherein he was to suffer penury and want, obloquy and insult, and be looked upon as an eccentric and a visionary.

We do not admit his claims, which in this book are reaffirmed, because in the truer perspective, with which the lapse of years has furnished us, we are enabled to estimate his position and work more dispassionately and impartially than was possible for his contemporaries; but in doing so, we recognise his right to a conspicuous place amongst the many workers who have contributed to the progress of electromagnetic telegraphy.

Much has been achieved since the days of Morse; and the advent of fast-speed printing telegraphs and multiplex telegraphs is threatening to displace whatever remains of the more modern form of his recorder in the shape of the Wheatstone receiver. But when we contemplate the long evolutionary process which has resulted in the marvellous systems at our disposal to-day, and try to single out any one name as that of the "inventor of the telegraph," we the more consciously recognise the truth of Sabine's remark that the arrogance of any individual claim to the title cannot be recognised; and those men who deserve the most credit happen to be those who advance the least claim to it.*
—A. F.

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* "Telegraph History and Progress," by Robert Sabine, C.E.

Dynamo and Electric Motor Building. By A. H. Avery. London: Cassell & Co., Ltd. Price 1s. net.

In this volume the author has done justice to his long experience in the art of building small dynamo-electric machines, by providing at a purely nominal price a fully illustrated and thoroughly practical treatment of the alternative constructions available, and the materials and methods of construction and assembly best suited to the needs of the amateur with limited resources. Chapter I presents a simple and clear explanation of the fundamental principles of dynamo-electric current generation, and is followed by an equally clear explanation of the function of the commutator, the effect of brush width, angular lead, and auxiliary poles. The author is to be complimented on dealing with these topics without introducing theoretical matter so tempting to the expert and so confusing to the amateur; the explanations given are clear, simple, and quite concordant with the practical nature of the work.

The general requirements and materials of field magnets are outlined in Chapter III, and the relative merits of different types of field systems are discussed briefly. The desirability of laminating armature cores is explained in the next chapter and the practical merits of different forms of stampings are discussed; means for ventilating the core might be described a little more fully and the use of wedging strips instead of binding wires deserves mention. In dealing with commutator construction the author becomes rather general in his remarks; more definite and practical information is here required by amateurs. Brushes and brush gear are dealt with in considerable detail; the relative merits of various brush materials and the reasons for and applicability of different mounting methods are discussed, but here again a little more definite practical information might be included. Next follow three chapters on insulation and windings to which the author rightly attaches great importance, for defects in the material or arrangement of field and armature windings are responsible for most troubles in home-built machines. The instructions and illustrations here presented are admirable and should meet all requirements. Both hand and former wound armature coils are considered.

Chapter IX presents full working instructions for the building of a 120-watt motor-dynamo converter, it being assumed that the reader buys the main castings ready made. The principle of working of the converter is first explained, then follow detailed and fully-illustrated instructions as to the sequence and manner in which machining and erecting are to be performed. This chapter is beyond criticism, and the notes concerning commutator and brush gear construction rectify the slight deficiencies noted in the chapters relating specifically to these topics. Chapter X includes general notes, and outline working instructions for the building of a number of small dynamos and motors, besides giving more detailed treatment of the construction of a 1-h.p. motor. The working drawings are clear and to scale, and include only essential dimensions. Suitable winding quantities and speeds are merely stated, and one wonders whether a simple explanation could not be given of means of calculating, at least approximately, the relation between winding, size and weight, horse-power and speed. The average amateur is, perforce, content to adopt instructions given by the makers of the castings, or advised in the query columns of journals devoted to model building; or else to depend on chance. If he could be shown how to design his windings, the interest and value of building and testing the machine would be much increased.

A few tables showing the weight of various sizes of wire accommodated in various spaces, the number of laminations of various thicknesses per inch, and so on, would be a valuable addition. Chapter XI, dealing with motor-starters, is cursory: the author explains how to calculate the total starting resistance, but then recommends that it be divided into equal sections; personally, we should not consider this advisable in a 2-h.p. starter, and, in any case, the advantage and method of proper grading should be explained. The final chapter on testing dynamos and motors for faults is thoroughly good. The book is well indexed, well produced, and to be recommended as an excellent investment to all readers, whether amateur or professional, interested in building small dynamo-electric machines.

Clock Repairing and Making. By F. J. Garrard. London: Crosby Lockwood & Son. Price 4s. 6d. net.

As a thoroughly practical treatise, of value to the amateur as well as to those in the trade, this book deserves high praise. Difficulties which are likely to be met with in the repair of clocks of various kinds are clearly pointed out, and the methods of overcoming the same are equally clearly explained. The writer is one who has had practical experience of the whole subject he deals with, and the numerous "wrinkles" which are so useful in mechanical work of the kind are freely given. Here and there, however, there are indications that the writer accepts common practices without questioning their correctness. On page 2, for example, he states that the bob of a pendulum is lens-shaped for the purpose of enabling it to cut the air easily. That this is the intention is doubtless true, but that that particular shape actually accomplishes the desired result is, we think, rather doubtful; probably no one has thought it worth while to question the correctness of the supposition, which, after all, is of negligible importance.

On page 126 the statement is made, in reference to turret clocks, that "steel lines if put on wooden barrels cut the wood to pieces." To this statement we can, from practical experience, give an unqualified denial, for the lines merely dig slightly into the wood and form a spiral groove; such a practice is, it is true, not one to be recommended, but it certainly is not a disastrous one.

In regard to the dissertation on page 3 in reference to "Pallets and Crutch," it is much to be desired that the most unsatisfactory arrangement of providing practically no adjustment for setting the pallets in the position to give a correct beat has not been got rid of; a few better-class clocks have two adjusting screws (page 149), but in the great majority of cases the crutch (of springy wire) has either to be bent by means of a pair of pliers, or the pallets twisted round on their axle, to which they are secured spring tight, or rather spring loose, in many cases. Again, anything more absurd than the way in which clock cases are made it is difficult to imagine; they seem to be designed with the express purpose of making it impossible to get at any part of the works for cleaning or adjustment. Clock makers or clock repairers seem to have resigned themselves to the stereotyped designs, or rather want of design, and in explaining how to take a clock apart and put it together again, point out difficulties which will be met with, but do not state that these difficulties arise from absurdities in the construction of the clocks. Mr. Garrard treats of clocks as they are, and anyone reading through Chapter II, which deals with "cleaning a skeleton clock," cannot but be struck with the completeness with which he treats the subject. Chapter III, on "Clock repairing," is full of useful information. In Chapter IV, in referring to "drills," Mr. Garrard states that "a drill is not a difficult thing to make," but such information as he gives as to how this is to be accomplished is most incomplete, and anyone desiring definite information is hardly likely to be satisfied with being told that the drill "may then be filed up to the correct shape," no information whatever being given as to what thiss hape shall be. The statement on page 127 that turret clocks should be "boxed in free from damp" is entirely wrong; what is wanted is the freest possible circulation of air through louvres, and no "boxing in": this was pointed out by Lord Grimthorpe many years ago. We are pleased to note that Mr. Garrard considers that electric clocks have a large future before them, though he does not go into the subject at any length, this being beyond the scope of the book. In spite of the occasional incompleteness of information, the work, as a whole, is one strongly to be recommended to all those who are interested in clock making and repairing; it may be studied with very great profit, especially by country clockmakers, whose knowledge of their trade is, in a multitude of cases, deplorably incomplete, to say the least.—H. R. K.

Dinner.—The employés in the switch works of Messrs. Ferranti, Ltd., of Hollinwood, have just held their first annual dinner at the Star Hotel, Failsworth. Mr. Torrance, works manager, presided.

ELECTRICITY APPLIED TO MINING.

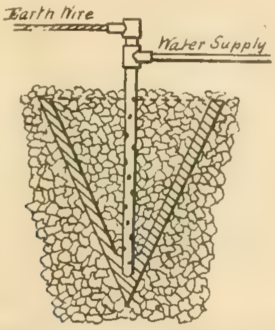
[*The following discussions took place on the paper read by* Mr. C. P. Sparks *before the* Institution of Electrical Engineers; *see page* 454.]

Discussion at Newcastle.

Mr. J. **Leggat** said that even where local collieries had their own generating plant it very frequently paid them to arrange for a stand-by supply from the local supply companies, and they were thus able to dispose of surplus energy if they produced any. He assumed that the Ilgner sets were installed on account of the comparatively small size of the generating plant, and that had the generating plant been of much larger capacity, ordinary induction motors would have been used, either coupled direct to the winding drums or geared.

Dr. W. M. **Thornton** said that he noticed that the disposal of the small coal was given as the reason for installing gas engines, and he would be glad to know if the "Bettington" boiler had been considered, as this was giving wonderful results elsewhere. He regretted that no costs were given in the paper, as the inclusion of these would have strengthened the case for electrical driving very considerably. He had come across several cases of protective devices acting without any fault being discoverable on the cable, and assumed that faults occasionally sealed themselves up. The duration of such faults was comparable with the duration of surges. For earth plates, he suggested a design consisting of an inverted hollow cone, as shown in the accompanying sketch; if provision were made to run water into this cone it would provide a continuous source of moisture for the surrounding coke. Due attention had not been paid to the effects of the comparatively large inductance of the ordinary mining electric bell. With the amount of inductance due to an electric bell in the circuit, the ordinary currents in use could undoubtedly cause explosions. He did not consider the figures at the end of the paper accurate enough to be put forward as authoritative. There was no doubt whatever that mixtures of pit gas could be ignited when using present-day voltages. With alternating currents, a higher percentage of gas was necessary to obtain the maximum explosive effect. The only way out of the difficulty was to shunt the actual coil of the bell by means of a high non-inductive resistance. This could be added to any bell cheaply, and only increased the ringing current by about 10 per cent.

Mr. W. **Baxter** said that even if the costs had not been stated in pounds, shillings and pence, it would have been interesting to have comparative figures for the gas and steam stations. In order to reduce the width of single-reduction haulages, he suggested the introduction of an idle wheel between the motor pinion and the spur-wheel on the haulage; this would lengthen the bed-plate somewhat, but would obviate the somewhat unmechanical extension bed-plate for the motor where it had to be placed alongside of the haulage. Turning to the generating plant, he noted that the nine turbo-generators were made by no fewer than four firms, the alternators by four firms, and there were six different combinations of complete sets. Reading between the lines, it appeared that the gas engines had not been much of a success, and he asked why it was that these large gas engines were so successful abroad, and so unsuccessful, as a rule, in this country. He considered that a weak point in the Coal Mines Act, 1911 (General Regulations of July, 1913) was in insisting upon a surface earthplate without at the same time insisting upon earthplates at each level, as it had been shown conclusively by Mr. W. W. Wood that very dangerous conditions might arise with a surface earthplate only, due to insulating strata intervening between the surface and the various levels. Mr. Sparks's recommendation to earth the neutral point in every case was decidedly too sweeping; colliery managers and electricians held that an earthed neutral was not necessarily better than an insulated neutral. It was highly dangerous to make it possible for an automatic protective device to plunge a whole pit into darkness, and where separate lighting cables were installed, to be consistent, these should also have automatic leakage protection, with possibly disastrous results in the event of an earth occurring. With regard to underground lighting, he did not consider that rubber-insulated cables run in screwed tubing made a satisfactory job. He suggested the use of cab tire-sheathed cable for this work. With regard to the cost of running miners' electric lamps, the cost of lamp bulbs averaged 0.12d. per lamp per shift, whereas no lead cell on the market could be run for much less than .3d. per lamp per shift. It was, however, a fact that when using alkaline cells the cost of battery maintenance just equalled the cost of lamp-bulb maintenance.



Method of Earthing suggested by Dr. Thornton.

Mr. H. W. **Clothier** thought that it was better to eliminate lightning arresters altogether. With regard to the objection that automatic leakage protective devices might cause danger by plunging a pit into darkness, he suggested the use of a number of these devices at different parts of the system, so graded as to cut out the defective part only. He suggested that relays might be used in connection with signalling systems, as these could be made to work with very minute currents; in one case he had in mind the power required did not exceed 0.08 volt-ampere. He did not agree with Dr. Thornton that the figures given at the end of the paper were unsatisfactory, because they formed a faithful record of something which was not known before.

Mr. P. V. **Hunter** said that in considering the results of a colliery electrification one could generally state whether or not the advice had been good by noting the power factor, and from the excellent results shown in the paper it was apparent that the Powell Duffryn scheme was a well-designed one, with motors properly proportioned for their work. He quite agreed that for the installation under consideration fifty cycles was much better than twenty-five cycles. He joined issue with Mr. Sparks on the question of burying the earth plates at a great depth; a much better arrangement would be to have a multiplicity of earth plates. To provide an efficient earth for static sub-stations it had been found necessary to provide no fewer than eight plates placed 40 ft. apart and carefully bonded together.

Mr. C. P. **Sparks**, in reply, said that the special ventilating arrangement shown in connection with the Elliot Pit pumping station had been found necessary owing to the high temperatures attained by the atmosphere in the pump-room and to guard against accumulations of coal dust. He took exception to Dr. Thornton's remarks that the tests on ignition by signalling wire were not scientific, as an elaborate series of tests had been very carefully made. The gas engine installation had not been a failure, and the company were increasing the number of gas engines. The variety of types of machinery was accounted for by their trying to eliminate faults discovered in existing plants.

Discussion at Birmingham.

Mr. R. A. **Chattock** said that it was interesting to find that the gas-driven generators required 18 B.TH.U. per watt-hour against 36.5 for the live steam turbines. This difference was largely accounted for by the difference in the load factor governing each type of generating plant, the gas plant having a load factor of 72 per cent., whilst the steam only had 47 per cent. Even better figures than those given should have been obtained with such load factors. It was certainly very necessary to keep the load factor on the gas-driven plant at the highest possible point, and it was interesting to see that in mining work it was possible to adjust the load by carrying out the pumping during the night time and supplying the general colliery demands during the day, and thus to obtain an annual load factor of 72 per cent. Some years ago he went into the question of using gas plant compared with steam turbines for ordinary electric power supply from a central station, and he was satisfied that an annual load factor of at least 35 per cent. would be required before the gas plant could compete with the steam turbine. The ordinary central station, working on light, power and traction load, had only a load factor of about 25 per cent., and the adoption of gas-driven plant was therefore not justified. These conclusions were based not only on the actual cost of generation by the two methods, but also on the capital cost of the plant and buildings required; in addition, he considered that turbine-driven plant was more reliable than large gas engines, experience with which had not, up to the present, been entirely satisfactory.

Mr. N. **Shuttleworth** said that the Ilgner motor-generator sets described in the paper were probably the second largest in the Kingdom. As with all other sets of a similar kind, it was necessary to arrange for a considerable drop in speed between no load and full load on the induction motor, so that excessive demands made on the c.c. generators could be provided by the flywheel at the expense of its stored energy. The methods in use for enabling this speed drop to take place as the load increased were as uneconomical as it was possible to imagine. In the present instance a resistance was inserted in the secondary circuit of the induction motor which absorbed at maximum slip or minimum speed some 15 per cent. of the total input to the motor. The average slip in the absence of further particulars might be assumed as 8 per cent., which meant that 8 per cent. of the continuous input to the induction motor was wasted. The liquid slip regulators which consumed this energy required considerable attention and were expensive to keep in good repair. He would suggest the use of a rotary slip regulator, which took the form of a commutator motor inserted in the slip-ring circuit of the induction motor to be regulated. Making allowances for the losses in the rotary regulator, some 7.5 per cent. of the present input to the induction motor would be saved. Moreover, the power factor of the induction motor would be improved at the same time practically to unity, so that on the whole the supply current would show a reduction of approximately 20 per cent. Incidentally this also improved the efficiency of the system, because the colliery plant was fed by transmission lines of considerable length in which the losses inclusive of step-up and step-down transformers would not be less than 7 per cent., and by reducing the line current by 20 per cent. the transmission losses were reduced to 4.5 per cent. The rotary regulator could, therefore, be said to save no less than 10 per cent. of the present input and at the same time increase the carrying capacity of the transmission system. On the basis of cost of power of one penny per ton of coal raised to the surface, the saving for both winders amounted to 6s. per working hour, or probably £5 per day. It would seem, therefore, that the direct benefits to be obtained from the use of a rotary type regulator amply justified further capital expenditure in this direction.

Mr. C. **Jones** gave particulars of electrical apparatus which he had installed at Cannock Chase Colliery, and emphasised the large field which was open to electrical engineers for electric haulage to perform the work now done by pit ponies.

Dr. C. C. **Garrard**, in speaking of flame-tight boxes for electrical apparatus, pointed out the advisability of always carrying out the tests with coal gas, as this was a more highly explosive gas than the gas found in mines, and consequently if the boxes were safe with coal gas they could be relied upon to give complete protection in service under mining conditions.

Discussion at Manchester.

Mr. **Seaton** stated that Lancashire would very shortly possess a thoroughly up-to-date colliery electrically equipped throughout and with steam turbines as prime movers.

Mr. W. T. **Anderson** said it was remarkable that all fatal accidents in connection with electricity below ground were due, not to unearthed systems, but invariably to high resistance in the earth circuit. It was most difficult to convince colliery managers and engineers of the importance of earthing. Generally speaking, earthing consisted of putting an 18 in. earth plate into the ground, and if a bell rang through it all was considered well. Heavy earth plates buried in made ground were invariably used, and in his opinion were a source of considerable danger. He described a system of earthing adopted at the Clifton and Kearsley coal mines in which cast-iron pipes 9 ft. long by 9 in. diameter, were buried vertically in a pit which was constantly supplied with water. Recent tests showed a resistance of 3.8 ohms between duplicate sets of pipes and 1.48 ohms between pipes and sets in parallel. The 50 per cent. conductivity in metallic sheathing demanded by the Rules was, in his experience, almost impossible with joints. Earthing of neutrals was very necessary.

Mr. G. M. **Brown** said that the Powell Duffryn property was ideal for complete electrification. The greatest drawback was the low average power factor, due largely to the enforced use of low-speed motors of great overload capacity. In the case of the Aberdare Valley the average was between .7 and .85, probably nearer .7 in cost cases. This was inevitable in colliery work, owing to the necessity of having haulage motors of ample capacity for their work. These motors usually represented a large proportion of the total load. Static condensers could be used in the case of small motors to keep the power factor at its maximum value at practically all loads and speeds, and in the case of large motors running under very steady load, the phase advancer could be used. The disadvantages of the phase advancer were that it could not be kept in circuit on starting or reversing, and that the amount of leading wattless current was unduly large in proportion to the motor load. These disadvantages effectually barred its use in connection with haulage motors, and the best method appeared to be the installation of a synchronous condenser. A simple calculation would show that the so-called wattless load of the Powell Duffryn Co. represented a capital value of several thousand pounds, and if to this was added the probable cost of generator and transformer capacity to deal with this load, the total would be astounding and would demonstrate the fact that an investment in plant for improving the power factor on transmission lines would be a sound financial proposition.

Mr. H. W. **Edmondson** said, referring to portable lamps, that half-watt lamps would probably be used, but not in the near future. The exact voltage conditions under which portable lamps would be used should be ascertained in order to ensure efficient working.

Mr. S. J. **Watson** said that as far as electrification of collieries in Lancashire was concerned, practically the whole field had got to be attacked. Gas engines were a thoroughly good proposition at a centre where coke ovens were installed. It would be of interest to know why on a transmission line only nine miles long, it had been necessary to step up from 10,000 to 20,000 volts.

Dr. G. W. **Worrall** referred to earth resistance tests which he had superintended at a large group of collieries. The conductivity of the earth return varied from about 1 to 2½ times the conductivity of the cable. The result depended upon the size of cable, and also took account of joint boxes and switchgear which were installed. Regarding the resistance of earth plates, some tests carried out by him using two auxiliary earth plates showed a resistance slightly under one ohm. Colliery managers seemed to think that when installing a 20 or 30-H.P. haulage motor, it was simply necessary to cut a hole in the side of the shaft and put the motor there. Open fuses and switchgear which did not conform to Home Office regulations were frequently met. The engineer of a very large group of collieries advocated the abolition of all starting gear underground; specially designed motors of about 40 H.P. were switched direct on the mains, and the results were stated to be very satisfactory. He suggested that miners' lamps should be fitted with reflectors instead of leaving the lamps open; this would enable anyone following the bearer of the lamp to see ahead much better. Leather thongs for suspending cables were usually eaten away by rats and had to be replaced by zinc thongs.

Mr. C. **Day** said the utilisation of exhaust steam had grown enormously, one company having supplied over one hundred plants for this purpose. The problem of condensing plant in collieries was a difficult one; corrosion and sediment problems were common, and it seemed quite the thing that jet condensing plant rather than surface plant with tubes should prevail. Taking 100 cases in his experience, only one-fourth were surface condensing, the remainder being of the jet type. Corrosion was more prevalent with the very high speeds of rotation than with the lower speeds; it was a distinct fact that a centrifugal pump run at 3,000 revs. would be more likely to show corrosion than if run at 1,000 revs. Therefore, if small steam turbines were used for driving these pumps it would seem better to drive through gears and keep the speed of the pump down.

Mr. **Nelson** considered the question of colliery staff very important. Colliery plant was installed and when running all right was handed over to a man who, in view of the small size of the colliery, could not be adequately paid and therefore could not have the experience to deal with such a valuable collection of machinery. This point alone warranted the supply being taken from a company. Regarding motors, he advocated the specification of a certain air gap, as in many cases very high efficiencies and high power factors were demanded necessitating small air gaps, with consequent trouble due to slight wear of bearings. There was considerable room for improvement in the arrangements for easily and speedily removing connecting cables from portable haulage motors and the operating gear.

Mr. E. C. **McKinnon** said regarding positive battery plates it was stated that the original lead type lasted about nine months; assuming six charges per week this would work out at about 200-250 charges. The life of the plate was affected by too much charging, but the deterioration could be decreased by the use of celluloid separators between plates. Care of the positive plate would give at least 600 charges instead of the present maximum of 250.

Mr. W. **Cramp** said it was difficult to realise how it would pay a colliery to buy its current unless the colliery were very small. Comparative figures would be interesting, even if actual figures were withheld. The author had stated that trouble had arisen due to pre-ignition, and for that reason the powers of the gas engines were reduced; there appeared to be other means of overcoming this trouble. The compression could be reduced, which would enable the gas engine to work again up to its full power. Another arrangement was to draw in with the air a certain amount of the exhaust gases ejected from the cylinder, which reduced the richness of the mixture and prevented pre-ignition. It had always been a puzzle to know why for 1,000 K.V.A. units the low-speed engine was adopted at all. The cost per KW. was particularly greater than that of the high-speed vertical engine; in fact two vertical sets could almost be bought for the price of one horizontal set. Besides the engine cost, there was the enormous cost of low-speed generators compared with the small cost of direct-driven high-speed generators. A third and not altogether negligible factor was that the high-speed vertical engine was a home product and could be built and repaired here. For the air filter a pressure of 4 in. or 6 in. of water produced by the fan was quite unnecessary; an inch at most should be sufficient.

Mr. **Sparks** said that one point in the paper was unanimously approved in London and at the Local Sections, viz., the earthing of the neutral. Mr. Anderson had shown how by careful design and good construction earth resistances of 3.8 and 1.48 ohms could be obtained. He desired to impress upon all members the fact that this earthing matter could not be dealt with haphazard, because, after all, the earth connection was intended to be the main safety point. The sheathing could not be relied upon, and in the paper an actual conductor was advocated. The author advised a number of smaller collieries not so favourably situated as Powell Duffryn, and it appeared simpler for them to purchase from power companies the moderate amount of energy they required. He did not know of a power company which could supply such an undertaking as the Powell Duffryn. Mr. Edmondson's remarks regarding lamp voltage embodied an exceedingly valuable suggestion; it was often overlooked that what appeared in itself a small variation in voltage was a large percentage when dealing with a 2-volt lamp. They had started with a surface condenser, but owing to the large amount of oil, etc., coming from the winding engine, and through the low-pressure system into the condenser, the difficulty of maintaining a good head with surface condensing was very great, and in the latest adaptation a jet condenser had been used. Mr. Day's recommendation of the jet condenser was absolutely right, as surface condensing was too difficult a problem to keep up. When the winder-house was put up it was intended to put in one electric crane, but as it was required to erect the plant quickly, it was arranged to build the workshop exactly the same width as the winder-house, as it only meant altering the building by a foot or two. The original two cranes were therefore available for the winder-house during erection, and subsequently one of the cranes was transferred to the pump-house. The scheme saved an enormous amount of time and money. For many years he had always demanded in specifications to have the air gap dimensions of the motor. There was a reason why vertical gas engines had been ignored. It was desired at the start to go in for a unit of about 1,500 KW., and at that time, eight years ago, it was quite incredible that a firm should consider a high-speed unit delivering anything like 1,500 KW., and although there was some approval of the proposal, no bids could be obtained for a unit of this size. This was the reason for the low speeds. Improvement in power factor was attained by working at a fixed pressure. Motors designed to give good results at 3,000 volts would have a good power factor at 3,000 volts, but if the voltage was 2,900 or appreciably over 3,000, the power factor would be bad.

IMPORTS OF HOLLAND.

The following figures showing the imports of electrical and similar goods, for consumption, into Holland during the year 1913, are taken from the recently-issued official trade statistics; the figures for 1912 are added for purposes of comparison, and notes of any increases or decreases are given.

	1912. Gulden.	1913. Gulden.		Inc. or dec. Gulden.
Machinery, steam, industrial and agricultural.—				
From Belgium	3,342,000	3,690,000	+	348,000
,, Great Britain ...	8,195,000	11,062,000	+	2,867,000
,, Hamburg	176,000	236,000	+	60,000
,, Germany	24,334,000	29,036,000	+	4,702,000
,, United States ...	3,653,000	4,758,000	+	1,105,000
,, Other countries ...	466,000	798,000	+	332,000
Total	40,166,000	49,580,000	+	9,414,000
Gutta-percha, raw.—				
From France	132,000	333,000	+	201,000
,, Great Britain ...	163,000	174,000	+	11,000
,, Dutch Guiana ...	885,000	1,959,000	+	1,074,000
,, Java, etc.	4,772,000	1,650,000	−	3,122,000
,, Other countries ...	230,000	237,000	+	7,000
Total	6,182,000	4,353,000	-	1,829,000
Gutta-percha manufactures.—				
From Belgium	379,000	578,000	+	199,000
,, Great Britain ...	202,000	156,000	-	46,000
,, Germany	372,000	402,000	+	30,000
,, Other countries ...	21,000	1,000	−	20,000
Total	974,000	1,137,000	+	163,000
Iron wire.—				
From Belgium	3,591,000	3,785,000	+	194,000
,, Great Britain ...	25,000	21,000	-	4,000
,, Germany	28,313,000	86,486,000	+	58,173,000
,, Sweden	294,000	546,000	+	252,000
,, Other countries ...	15,000	23,000	+	8,000
Total	32,238,000	90,861,000	+	58,623,000
Instruments, physical, chemical, etc.—				
From Belgium	711,000	810,000	+	99,000
,, Great Britain ...	607,000	547,000	−	60,000
,, Hamburg	53,000	401,000	+	348,000
,, Germany	6,425,000	7,639,000	+	1,214,000
,, Other countries ...	219,000	149,000	−	70,000
Total	8,015,000	9,546,000	+	1,531,000
Copper wire.—				
From Belgium	166,000	211,000	+	45,000
,, Great Britain ...	107,000	152,000	+	45,000
,, Hamburg	205,000	6,000	--	199,000
,, Germany	2,995,000	4,038,000	+	1,043,000
,, Other countries ...	64,000	80,000	+	16,000
Total	3,537,000	4,487,000	+	950,000
Steel wire.—				
From Belgium	474,000	866,000	+	392,000
,, Great Britain ...	801,000	909,000	+	108,000
,, Germany	867,000	5,283,000	+	4,416,000
,, Other countries ...	43,000	118,000	+	75,000
Total	2,185,000	7,176,000	+	4,991,000
India rubber manufactures.—				
From Belgium	1,780,000	2,343,000	+	563,000
,, Great Britain ...	2,139,000	8,548,000	+	3,321,000
,, Java	5,239,000	2,917,000	+	778,000
,, Germany ...	55,000	115,000	+	60,000
,, Russia	634,000	1,273,000	+	639,000
,, United States ...	117,000	91,000	−	26,000
,, Other countries ...	804,000	791,000	−	13,000
Total	10,756,000	16,078,000	+	5,322,000
Glass manufactures.—				
From Belgium	327,000	330,000	+	3,000
,, Great Britain .	115,000	141,000	+	26,000
,, Germany	2,131,000	2,303,000	+	172,000
,, Other countries ...	18,000	18,000		—
Total .. .	2,591,000	2,792,000	+	201,000
Porcelain.—				
From Belgium	188,000	224,000	+	36,000
,, Great Britain ...	107,000	94,000	−	13,000
,, Germany	1,388,000	1,577,000	+	189,000
,, Other countries ...	82,000	112,000	+	30,000
Total	1,765,000	2,007,000	+	242,000

Note.—Gulden = 1s. 8d.

UTILISATION OF WATER-POWER.

In a paper read recently by Mr. Arthur Surveyer, before the Canadian Society of Civil Engineers, the author dealt with the question of making Canadian water-powers valuable, and incidentally touched on electrochemical and metallurgical developments in connection with hydro-electric power. A brief abstract of his paper is as follows:—

The following table has been compiled from various European sources, from the reports of the United States Geological Survey and from the report of the Canadian Commission of Conservation. It shows the total available and developed water-powers in the different countries of Europe, in the United States, and in the various Provinces of Canada: it also indicates the percentage of utilisation for each country and the horse-power per sq. mile.

TABLE I.

—	Hydraulic power available on turbine shafts. Available. Thousand H.P.	Hydraulic power available on turbine shafts. Developed. Thousand H.P.	Percentage of utilisation.	Available power per square mile.
Europe			Per cent.	H.P.
Great Britain ...	963	80	8·3	1·00
Germany	1,425	445	31·2	1·18
Switzerland	1,500	380	25·0	3·71
Spain	5,000	300	6·0	3·86
Italy	5,500	565	10·2	4·22
France	5,857	650	11·1	5·80
Austria-Hungary ...	6,460	515	8·0	7·34
Sweden	6,750	550	8·2	7·72
Norway	7,500	920	12·3	14·12
	40,955	4,405	10·6	5·44
North America				
United States ...	26,736	4,016	15·0	7·49
Canada				
Saskatchewan ...	20		0·2	19
Alberta	71	7	9·8	·69
Nova Scotia	83	15	18·0	3·93
New Brunswick ...	280	10	3·6	10·03
Manitoba	410	48	11·7	6·37
British Columbia ...	1,100	101	10·1	2·81
Ontario	3,400	504	14·8	15·41
Quebec	5,600	328	5·8	16·38
North West Territories	6,800	—	0·0	3·19
	17,764	1,013	8·2	6·55

The data contained in this table refer to conditions in the year 1911, and the provincial areas used to calculate the figures of the last column are taken from the Canadian Atlas of 1906.

It would have been more interesting if complete figures for 1914 had been available. Unfortunately, nothing authentic could be obtained except in a few instances. The inclusion of the new Shawinigan development, the Canadian Light & Power Co.'s plant, and the large development at Cedars would raise the figures for the Province of Quebec to over 500,000 developed horse-power. Switzerland's present figures are about 550,000 H.P., Norway's over

1,000,000 H.P., and those of the United States between 5,500,000 and 6,000,000 H.P.

It is probable that the data concerning Europe and the United States are fairly accurate whilst the Canadian figures are based on doubtful information. The Conservation Commission of Canada in its report of 1911 did not "consider advisable to make an estimate of the total water-power in Canada," adding, "one estimate places it at nearly 17,000,000 H.P.; but it does not, and cannot, rest upon any basis of reliable information."

Table II and Table III refer more closely to the subject of this paper and supplement to a great extent the information given in Table I.

TABLE II

Provinces.	Developed power.	Subdivision of developed power.		
		[illegible]	Pulp and paper.	Various Industries
	H.P.	H.P.	H.P.	H.P.
Ontario	504,000	394,000	46 000	64 000
Quebec	328,000	198,000	88,000	42,000

Table II has been compiled from the report of the Canadian Commission of Conservation, and details the uses made of the developed water-powers in Ontario and Quebec. It should be noted that 74,000 electrical H.P. are exported from Ontario to the United States at Niagara Falls, and this amount is, therefore, not included in Table III.

Table III indicates the uses made of the *hydro-electric* energy generated in Ontario, in Quebec, in France, in Sweden, and in Norway. The data for the Provinces of Ontario and Quebec were taken from a paper by Mr. Watson Bain on the "Electrochemical Industries in Canada." The figures for the other countries refer to conditions previous to 1910, and have been compiled from different statistics. The conclusions resulting from the examination of Table III are that up to the present we have only progressed in the more simple applications of electricity, and that we have practically neglected its utilisation as an electrolytic agent and as a heat generating agent in electrochemistry and electrometallurgy.

TABLE III.

Countries.	Developed hydro-electric power.	Subdivision of developed power.			
		Electrochemistry and electro-metallurgy.		Motive power. Traction and lighting.	
	H.P.	H.P.		H.P.	
France ...	592,000	[illegible]	49·1	301,000	50 9
Norway ...	543,000	[illegible]	[illegible]	268,000	49·4
Sweden ...	370,000	120,000	32 4	250 000	67·6
Ontario ...	320 000	[illegible]	[illegible]	295,000	92·2
Quebec ...	198,000	[illegible]	14·1	170,000	85 9

It is self-evident that the consumption of electricity for lighting or for traction depends on population. Neglecting the Montreal market, which is exceptional, the consumption of electricity *per capita* either for lighting or for traction is too small to be considered as an inducement to the extensive development of our waterfalls. A Western statistician gives the consumption of electricity in small towns as, roughly, one-tenth of a horse-power per inhabitant, so that a plant of 1,000 H.P. would, on this basis, be sufficient to supply the requirements of a town of 10,000 population. On the other hand, the smallest electrochemical or electrometallurgical industry consumes more than 1,000 H.P. Plants of 10,000 H.P. are numerous, and those of over 30,000 H.P. are by no means exceptional.

The pulp and paper industries are also great users of power, but we in Canada are not so very far behind in this phase of development, although Sweden utilises over 120,000 H.P.

An improvement in the situation might be brought about by attracting to Canada more electrochemical and electro-metallurgical industries thereby causing a notable increase in the development of our water-powers. It has been thought advantageous to briefly review some of the industries which, either on account of the abundance of the necessary raw materials, or because of the large neighbouring markets, might be likely to prosper in Canada.

ELECTROCHEMISTRY.

Calcium Carbide.—The calcium carbide industry was started in 1895, with Mr. Wilson, of Ottawa, as one of the pioneers. There are now over 70 plants situated all over the world capable of absorbing 360,000 H.P. in their operation. The world's production for 1910 was 250,000 tons; it was 300,000 tons in 1912, and increased to 340,000 tons in 1913.

One special feature of the carbide industry is that many of the producing countries are not users of the product, and that the centres of consumption are located in places where it is impossible for want of waterfalls to manufacture carbide.

Germany, England, Australia, and the South American Republics are the importing countries; the consumption of Germany has increased five-fold in the last 14 years, having risen from 11,000 to 55,000 tons annually. The exporting countries are Sweden, Norway, Switzerland and the United States. The production of the United States in 1913 was 70,000 tons, with an export trade of 15,000 tons. The American exports go to South and Central America, where the demand for acetylene for house lighting is rapidly increasing.

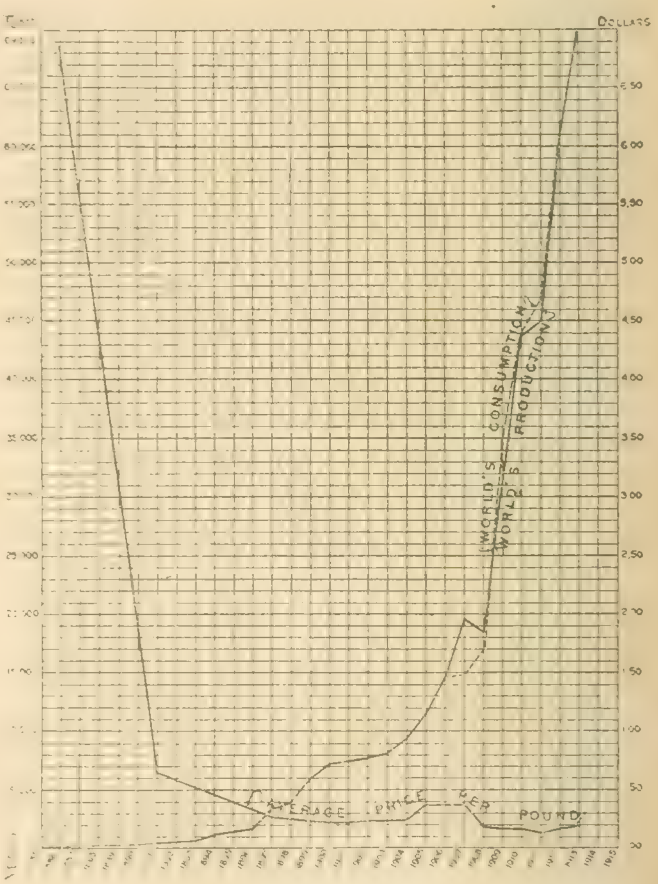
Nitrate of soda, or Chile saltpetre, is the best known of the imported fertilisers; it is found in its natural state in immense deposits situated in Chile, Peru and Bolivia. The curve gives an idea of the phenomenal increase in the world's consumption.

Nitrate of Lime.—Nitrate of lime was not at first received with favour by the farmers on account of its hygroscopic properties which demand the immediate use of the whole contents of a barrel once it has been opened. However, outside of this inconvenience, nitrate of lime has been proved entirely superior to the Chilian nitrate of soda, and its consumption as a fertiliser has increased rapidly.

The manufacture of synthetic nitrate of lime has only been carried out so far in Norway by the Norwegian Nitrogen Co., and its subsidiary companies, grantees of the Birkeland and Eyde and Schonnherr patents.

The chemical fertilisers manufactured at Notodden are nitrates of lime, of potash, of ammonia, of phosphate of ammonia, and of biphosphate of lime; this industry produces also nitric acid and nitrite of soda. The production of nitrate of lime was 9,500 tons in 1909, and it is estimated that the production in 1915 will be about 160,000 tons.

The Norwegian Nitrogen Co. and its subsidiary companies have undertaken, solely for the needs of this industry, the construction of a number of hydro-electric plants, the total capacity of which will reach the enormous figure of 540,000 H.P. There are at present four plants of approximately 180 000 H.P. in operation, with two others totalling 160,000 H.P. in course of construction.



Production, Consumption and Average Price of Aluminium.

The world's yearly consumption of nitrate of soda is approximately 2,500,000 tons; but the Chilian saltpetre is not utilised solely as a fertiliser, it is also employed in the manufacture of powder and nitric acid. It is generally acknowledged that industry does not absorb more than ⅓ or ¼ of the total production of nitrate of soda.

Mr. E. F. Côte, a well-known French economist and engineer, after having analysed the progress of the different Norwegian industries in 1912, expressed the following opinion concerning the future of the manufacture of nitrate of lime:—

"Four hundred thousand horse-power with the efficiency mentioned above would probably produce 250,000 tons of nitrate. But what is this? Chile exports every year 2,000,000 tons of natural nitrate to Europe; in 10 or 15 years the Norwegian nitrate plants will have attained their full development; but their production then will not be sufficient to take care even of the increased consumption. It is certain, on the other hand, that the Chilian beds will not be able to indefinitely supply the rapid and continuous increase of the demand, and it will be necessary for industry to develop its own means of production in order to satisfy the urgent need for nitrogen of the bread-eating nations. This means that the market for nitrogenised fertilisers is practically unlimited and that is why the capitalists have given their backing to the electro-synthetic processes with a spontaneousness which has only been equalled by their boldness."

Limestone is the only raw material required in the manufacture of nitrate of lime, the economical production of which is entirely dependent on the cost of the electrical energy. In Norway, the cost of production of nitrate of lime is very much below the selling price of Chile saltpetre.

Nitric Acid.—Synthetic nitric acid is chiefly obtained by the Pauling process, which is similar in principle to the Birkeland and Eyde, and Schonnherr processes.

The Pauling furnaces are used in Austria-Hungary, at Patsch, near Innsbruck: there are 24 furnaces absorbing 15,000 H.P. Another plant of 8,000 H.P. operates the Pauling process in the north of Italy, whilst in France, the Roche-de-Rame works near Briançon, have utilised 8,000 H.P. since 1908, and will ultimately use 20,000 H.P.

Nitric acid manufactured synthetically is very pure, and is free from nitrous products, and from chlorine and sulphuric acid.

The world's production of nitric acid is from 200,000 to 250,000 tons per year, Germany producing about 100,000 tons, and the United States 70 000 tons per year. The margin between the selling price of ordinary nitric acid and the cost of synthetic azotic acid is large and indicates that this industry can afford to pay more for its electrical energy than the nitrate plants.

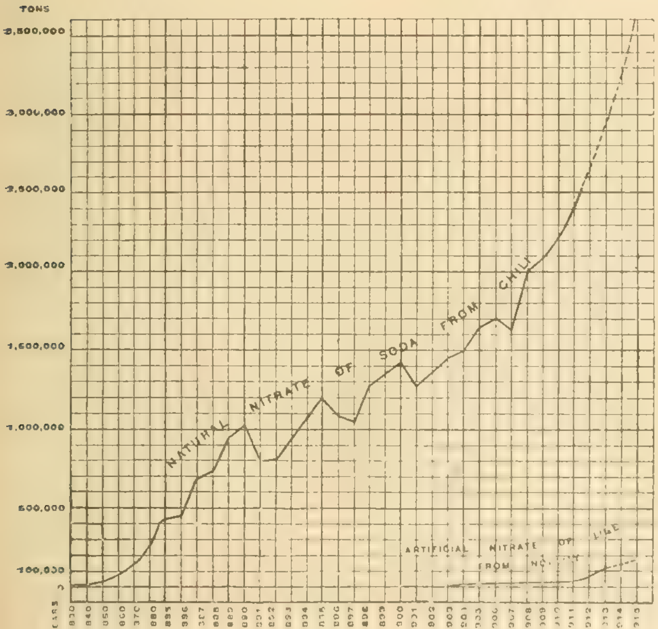
Calcium Cyanamide.—This is an artificial fertiliser containing carbon, nitrogen and calcium.

Electrical energy is used chiefly in the production of calcium cyanamide, which is the raw material, and which is transformed chemically into an azotised compound.

Calcium cyanamide is manufactured in 15 different plants located in France, Switzerland, Norway, Italy, Austria-Hungary and Japan. In addition, the American Cyanamide Co. has important works in the State of Alabama, and a plant at Niagara Falls on the Canadian side.

The world's production in 1911 was 110,000 tons, in 1912 was 153,000 tons and in 1913 reached 226,000 tons.

The Canadian plant began operation in January, 1910, with a yearly capacity of 10,000 tons; in March, 1913, the production of the plant had been increased to 24,000 tons per year.



Production of Nitrates in Chile and Norway.

Aluminium.—This is manufactured by electrolysing alumina dissolved in a molten bath of cryolite, these materials being placed in an iron trough lined with carbon, and connected to the negative pole of a dynamo, while a carbon anode immersed in the charge is connected to the positive pole.

Alumina is obtained by refining bauxite; this ore is composed of impure hydrated alumina, and contains besides ferric oxide, silicon and titanium oxide. France and the United States are the countries rich in bauxite. In 1910 the world's production of bauxite was 271,000 tons, and of this total France had supplied 128,000 tons and the United States 129,000 tons.

In 1912 the United States produced 165 000 tons of bauxite, and imported 27,000 tons from France. They exported in the same year to Canada 10,000 tons of alumina or concentrated bauxite.

The cryolite employed in the metallurgy of aluminium is a double fluoride of aluminium and of sodium. The only known deposit is situated in Greenland, and belongs to the Danish Government. The export of this natural cryolite had reached 8,000 tons in the year 1911. However, the double fluoride of aluminium and sodium is now prepared artificially in France and in Austria; the raw material used in this manufacture is the fluoride of calcium called fluorspar, and the synthetic cryolite is considered a much better product than the natural cryolite of Greenland.

Since 1886 the increase in the world's consumption of aluminium has been phenomenal. The chart shown indicates this rapid rise, and also shows the corresponding drop in the selling price of the metal.

The manufacture of aluminium was towards 1890 in the hands of five companies, who raised the production of aluminium from 175 tons per year to 7,300 tons during the period from 1870 to 1890. In 30 years the average price of aluminium decreased from $1 a lb. to $0.22 a lb. in 1900.

The price of $0.22 per lb. did not leave a very great margin of profit, so that in 1900 the five companies amalgamated into an international syndicate to regulate the production and the selling price of aluminium.

This combine caused an immediate rise in the quotations, but in 1907, the patents for the manufacture of aluminium having become public property and the price of copper having fallen very low, the production of aluminium became much larger than the demand for it. This was followed by a crisis, which brought about the dissolution of the aluminium syndicate in 1908.

In April, 1911, a new alliance was formed between the different manufacturers of aluminium. The object of this combine was to regulate the selling price, to put a stop to the cut-throat competition which had existed since 1908, and to work for the constant enlargement of the market for aluminium.

The extraordinarily low prices of aluminium have resulted in the popularising of the use of the metal and the increase in its consumption in a remarkable manner, so that a return to normal conditions will leave the manufacturers who have been able to face the crisis with a market for their product definitely enlarged and continually increasing.

In 1912 the United States produced 18,000 tons of aluminium, France 13,000 tons and Canada 9,000 tons.

Zinc.—The production of zinc by the electro-thermic process has been undertaken chiefly in Sweden and Norway. At Trollhattan in 1912 11 furnaces produced 3,228 tons; the plant is to be enlarged to 17 furnaces of 1,000 H.P. each and eight of 500 H.P. each, giving a total installed capacity of 21,000 H.P.

Two Norwegian plants produced 8,900 tons in 1912; and at Vancouver the Canada Zinc Co. is supposed to be operating several Snyder furnaces for the electro-thermic treatment of zinc.

Nickel and Copper.—Drs. Haanel and Héroult have experimented at Sault Ste. Marie, and think it would be possible to obtain commercial ferro-nickel pig by the electro-reducing process.

In 1910 the total power used by aluminium works was over 320,000 H.P., of which 140,000 H.P. was developed in France.

The actual capacity of the plants of the Aluminium Co., of America, is 90,000 H.P., and this company has signed a contract for the purchase of 60,000 H.P. for use at its Messena Works on the St. Lawrence.

The Shawinigan Falls plant of the Northern Aluminium Co. has a capacity of 20,000 H.P. A French company, the Southern Aluminium Co., has started at Whitney, N.C., the construction of a 70,000 H.P. hydro-electric plant, with furnaces, &c., which was to be in operation early this year.

The Government of Chile has also been making extensive experiments in France on the industrial production of copper, and hopes to be able to effect a reduction of 75 per cent. in the cost of its production by means of the electric furnace.

Production of Pig-Iron by the Electric Furnace.—In 1906, the Canadian Government authorised Dr. Haanel to experiment on the reduction of ore in the electric furnaces known at the time. The experiments were followed by experiments in Sweden extending over several years. At Domnarfvet, the tests took place between 1907 and 1909, and were made with several small furnaces which had been invented by three Swedish engineers.

The Swedish Association of Iron Masters considered that the results of the operation of the Gronwall furnace were good enough to warrant the construction in 1910 of a complete experimental plant at Trollhattan near the Government's hydro-electric plant. The Trollhattan experiments were continued until September, 1911, and were made in a furnace of 3,000 H.P. The new electric blast-furnace of Domnarfvet is of 12,000 H.P. and should produce 100 tons of pig-iron per day.

Iron ores are smelted by the electro-thermic process in California, in Italy, in Norway and at many places in Sweden. The production of electric pig-iron in this last country was 122 tons in 1900 against 17,600 tons in 1912. The world's production in 1912 was approximately 25,000 tons.

The Noble Electric Steel Co., of California, has in operation three furnaces of a total capacity of 8,000 H.P. There are in Scandinavia 20 furnaces absorbing over 36,000 H.P.

Ferros.—The name "ferro" is used to designate special varieties of pig-iron which are used as a final adjunct in the metallurgy of steel. These are ferro-manganese, ferro-silicon, ferro-chrome, ferro-molybdenum, ferro-tungsten and ferro-titanium. The pigs produced in the electric furnace are expensive products of high quality. In 1910, according to the statistics of "l'Industrie Minérale" the average value of ferros produced in the electric blast furnace was $21.00 per ton, whilst the ferros of the ordinary blast-furnace was sold at $2.00 per ton.

Ferro-Silicon.—Ferro-silicon is used in the converting of pig-iron for the production of steel. The world's production is over 100,000 tons of ferro-silicon per year. Two Canadian companies manufacture this product: The Lake Superior Power Co., at Sault Ste. Marie, with an electric furnace of 250 H.P., and the Electric Metals Co. at Welland, operating four furnaces of a total capacity of 5,000 H.P.

Ferro-Titanium.—The manufacture of ferro-titanium in the electric furnace is particularly interesting on account of the large deposits of titanium ore in the Province of Quebec. The United States' production of ferro-titanium for the year 1912 has been estimated at 3 763 tons and nearly 600 000 tons of titanium-treated steel have been manufactured, as against 400,000 tons in 1911.

Production of Steel in the Electric Furnace.—The electric furnace used for the production of high and medium grade steel has so many advantages over the other furnaces that its general use appears absolutely certain in the very near future.

There are already more than 120 furnaces in operation in the world, and the production of electric furnace steel has risen from 33,000 tons in 1908 to 175,000 tons in 1912. Germany has tripled her production since 1910, and in 1913 had in operation 15 plants producing about 102,000 tons a year, placing her in the lead of the other countries. The United States, after having manufactured, in 1910, 52,000 tons, including a large quantity of electric furnace steel rails, is now awaiting the results of the use of these rails and is only turning out in the electric furnace special high-grade steels to the amount of 18,000 tons annually.

The electric furnace is also extensively used for melting steel for castings.

Conclusions.—The different industries which have been enumerated absorb approximately 1½ million hydro-electric horse-power, and Canada's contribution to this enormous utilisation of power is just about 3·5 per cent. of the total.

This paper can only be considered as a very brief survey of a very large field, and it would be rash to attempt to draw from it any definite conclusions. It is evident that all the industries mentioned above would not be sure of success in Canada, and that every particular case should be studied with the utmost care before trying to attract the investing public.

The great advantage of the water-powers of Sweden and Norway is the remarkable height of their falls and the consequent smaller volume of water required for the same power.

It would be possible on our navigable rivers to sub-divide the cost of development between navigation and industry. This would so reduce the cost of the industrial part of development that the unit cost of these low-head hydro-electric plants might compare with the figures of the Scandinavian developments. This Government help has been given to several plants in Europe and America and explains in a measure the apparently low cost of some of their enterprises.

There is no getting away from the fact, however, that the criticism of foreign engineers is partly correct. We are in a measure handicapped, and there are numerous obstacles, economical, educational and physical which interfere with the rapid development of our water-powers.

It is significant to note that the countries which have given the greatest number of years to the technical study of their water-powers have the highest percentage of utilisation: Germany, the Scandinavian countries, France and Switzerland, for example, were the first countries of Europe to undertake the systematic study of their rivers and falls, and these nations are now getting a greater return from their natural forces than the other countries.

It is only recently that such studies have been undertaken here. At present, the Canadian Public Works Department, the Department of the Interior, the Quebec Streams Commission, the Hydro-Electric Power Commission of Ontario, and the Province of British Columbia, have undertaken the scientific discharge measurements of some of our rivers, and have established gauges all over the country.

It is safe to say to-day, that through the lack of surveys, of discharge measurements and of gauge readings there are very few of our waterfalls which could be offered to oversea bankers.

The development of our water-powers has also been greatly handicapped by the difficulty in obtaining a clear title of ownership, and by the uncommerciality of some of the clauses contained in Government leases.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

4,045. "Electrical switches." A. P. Lundberg, G. S. Lundberg, P. A. Lundberg and G. Pegg. March 15th.

4,046. "Electrical switches." A. P. Lundberg, G. S. Lundberg, P. A. Lundberg and G. Pegg. March 15th.

4,054. "Electrical turning-gear for starting internal-combustion engines." F. H. Royce & Rolls-Royce, Ltd. March 15th. (Complete.)

4,076. "Storage-battery separators and process of making same." J. A. Willard. March 15th. (Complete.)

4,079. "Means for collectively actuating and controlling alternating-current motors." J. L. [illegible]. March 15th. (Addition to 735/13.) (Complete.)

4,083. "Electric clocks." F. O. Read & E. G. Thompson. March 15th.

4,087. "Means for regulating the voltage of dynamos.". S. F. Tyler & W. J. E. Beere. March 15th.

4,090. "Carburettors." Electro-Generateur Gamma Soc. Anon. March 15th. (Convention date, March 16th, 1914, Belgium.) (Complete.)

4,097. "Production of Rontgen rays." J. E. Lilienfield. March 15th. (Convention date, November 15th, 1913, Germany.) (Complete.)

4,110. "Means for connecting electrical conduits to their fittings." F. L. Broughton. March 16th.

4,130. "Interchangeable gas and electric light fittings." A. C. Eberhardt & E. A. Short. March 16th.

4,138. "Electric conductors, cables, and the like." H. Terry & Sons, Ltd., & C. Terry. March 16th.

4,144. "Oil circuit-breakers." F. B. Holt & H. Smith. March 16th.

4,172. "Associated internal-combustion engines and electric motors used in connection with the propulsion of water-craft." Wolseley Motors, Ltd., & A. A. Remington. March 17th.

4,190. "Thermostatically-controlled valve mechanism for steam traps, calorifiers, and the like." Royles, Ltd., J. J. Royle & G. E. Royle. March 17th.

4,203. "Controlling-mechanism for electric vehicles." British Thomson-Houston Co., Ltd. March 17th. (General Electric Co., United States.)

4,206. "X-ray plate-holder for absorbing secondary rays." A. O. Forder. March 17th.

4,209. "Rheostats." Igranic Electric Co., Ltd. March 17th. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

4,211. "Sparking-plugs for internal-combustion engines." A. Christmas. March 17th.

4,229. "Electrical coils and methods of winding the same." H. Wade. March 17. (J. R. Leeson, United States.) (Complete.)

4,230. "Winding-machines for winding electrical coils." H. Wade. March 17th. (J. R. Leeson, United States.) (Complete.)

4,239. "Synchronisation of phonograph and kinetograph." C. H. Verity. March 18th.

4,253. "Electric visual and audible signalling-appliances." H. Green & W. de Manuel Landon. March 18th.

4,263. "Air-cooled tanks for electrical apparatus." Babcock & Wilcox, Ltd. March 18th. (Babcock & Wilcox Co., United States.) (Complete.)

4,271. "Aero-electric combined marine and aerial torpedo." R. P. Williams. March 18th.

4,285. "Automatic telephone exchange systems." C. A. W. Hultman. March 18th. (Convention date, March 18th, 1914, Sweden.) (Complete.)

4,331. "Motor control." D. Murray. March 19th.

4,332. "Phonic wheel motor for distributors of electric telegraphs." D. Murray. March 19th. (Addition to 3,436/14.)

4,348. "Telegraphy." Eastern Telegraph Co., Ltd., & A. C. Gardiner. March 19th.

4,353. "Thermic telephones." Elektrotechnische Spezialkonstruktionen G.m.b.H. March 19th. (Convention date, March 24th, 1914, Germany.) (Complete.)

4,378. "Telegraphic printing apparatus." M. Balsera. March 20th.

4,401. "Rotary converters." M. Walker. March 20th.

4,411. "Vibrating reed and like apparatus for signalling, indicating, and other purposes." F. W. Lanchester. March 20th.

4,412. "Telephones and like apparatus." F. W. Lanchester. March 20th.

4,432. "Protective devices for alternating-current systems." British Thomson-Houston Co., Ltd., & E. B. Wedmore. March 20th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1913.

26,929. Method and Means for Comparing and/or Measuring Electrical Quantities. C. G. E. Milne, H. F. George, P. M. Levy and J. Tucker. November 22nd.

1914.

2,089. Electric Switches. British Thomson-Houston Co. January 26th. (General Electric Co.) (Cognate application, 11,943/14.)

4,470. Cases or Holders Especially Intended for Carrying Electrical Batteries upon Motor-cycles. A. S. West. February 20th.

4,627. Electric Lampholders and Reflectors. M. Challer. February 23rd. (March 22nd, 1913.)

5,351. Electrical Train-controlling Systems for Railroads. H. J. Warthen. March 2nd.

5,354. Electrically-controlled Locks. L. Cadenel. March 2nd.

5,455. Protective Devices for Alternating-current Electric Generators. British Thomson-Houston Co. & E. B. Wedmore. March 3rd.

5,511. Electric Compound Transformers. B. Holm-Hansen. March 4th (March 5th, 1913.)

5,513. Electro-magnetic Brakes, Clutches and the like. J. P. Hall & Co. and A. Nield. March 4th.

5,583. Method of Making Electrostatic Condensers. G. B. Burnside and Wallace. March 5th.

5,616. Make and Break Switches. R. Hacking and C. H. Hamley. March 5th.

5,890. Devices for Intermittently Making and Breaking Electric Circuits. R. G. Fyson. March 9th.

5,903. Communicating with Trains. H. A. Thompson. March 9th.

6,668. Means for Transmitting and Receiving Messages and Exhibiting Signals Electrically. T. D. Smith. March 16th.

6,739. Methods of and Means for Effecting the Combination of Gases. British Thomson-Houston Co. March 17th. (General Electric Co.)

6,853. Incandescent Electric Lamps. W. J. Owen and C. Damry. March 18th.

6,867. Combined Mechanical Support and Electrical Connection for Electric Fans. J. H. Collie. March 18th.

7,274. Electrostatic Separators for Sorting Out the Constituent Parts of Commodities According to their Electric Capacity. A. Bibolini and P. [illegible]. March 23rd.

8,665. Electrical Connections. Soc. Anon. le Carbone. (April 7th, 1913.) April 6th.

10,733. Electric Light Switches Shining in the Dark. G. Santostefano [illegible]. May 1st. (June 5th, 1914.)

11,404. Electrical Condensers and the Manufacture Thereof. G. Giles. May 8th. (July 3rd, 1913. Addition to 10,895/14.)

11,881. Magnetic Compasses. M. B. Field. May 14th.

12,746. Electric Light Pendants. W. O. Teasdale. May 23rd.

14,548. Electric Switches. J. H. Tucker. (Divided application on 10,388/13. February 27th. Cognate application 16,045/14.) June 17th.

14,558. Sparking Plugs for Internal-combustion Engines. S. R. Jackaman. June 17th.

14,595. Mechanical Selector for Electromagnetic Waves to Wireless Telegraphic Receiving Apparatus. R. B. Goldschmidt. June 17th. (December 29th, 1913.)

14,884. Spark Gaps for Radio-telegraphy. J. [illegible] & J. Bethenod. (June 23rd, 1913.) June 20th.

15,798. Liquid Resistance Apparatus. H. [illegible] & M. J. Railing. July 1st.

19,122. Electric Switches for Switchboards. C. H. Worsnop. August 27th.

19,944. Electric Railway and Like Systems. F. F. Mallaney. September 18th.

20,248. Electrical Resistance Thermometers. Cambridge Scientific Instrument Co. & W. H. Apthorpe. September 26th.

22,270. Construction and Arrangement of Self-induction Coils for Use in Duplex Telephone Systems Operating on the "Pupin" Principle. A. H. Olsson and H. B. M. Pleijel. November 9th. (November 11th, 1913.)

THE

ELECTRICAL REVIEW.

VOL. LXXVI. APRIL 9, 1915. No. 1,950.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: April 9, 1915. [No. 1,950.

Page
Science and Industry ... 497
Copper ... 498
American Trade Activity ... 498
Preferential Rates ... 499
Patents in 1914 ... 499
The Electric Vehicle (*illus.*) ... 500
Industry, Science and Finance ... 501
The Cardiff Accident (*illus.*) ... 502
Aerial Wire Ropeway for Automatic Disposal of Ashes (*illus.*) 502
Legal ... 504
Electrical Supply Trade in South America ... 506
War Items ... 507
Telephone Troubles in the Tropics, by W. L. Preece ... 508
Our Legal Query Column ... 510
Business Notes ... 510
Notes ... 514
City Notes ... 517
Stocks and Shares ... 521
Electric Tramway and Railway Traffic Returns ... 522
Metal Market—Fluctuations in March ... 523
Temperature Measurement in a Modern Power House, by C. S. Jeffrey ... 523
Reviews ... 525
Commissions ... 527
Electric Cooking ... 528
New Electrical Devices, Fittings and Plant (*illus.*) ... 530
Private Generating Plant ... 531
British Electrical Patents Applied for or Communicated by Residents in Germany, Austria or Hungary ... 532
New Patents Applied for, 1915 ... 532
Abstracts of Published Specifications ... 532
Contractors' Column ... Advertisement page xx

THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address. "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates. Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 1s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.
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MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto I 307.
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TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

1915 EDITION

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SCIENCE AND INDUSTRY.

IT has been our privilege to attend two conferences at the Mansion House, at which the theme discussed was the need for co-operation between science and industry. One of these was held between nine and ten years ago—it was the inaugural meeting of the British Science Guild, at which the Right Hon. R. B. Haldane was elected first President. Interesting speeches were delivered by men of unquestioned eminence—a Bishop, an Admiral, engineering leaders such as Sir Wm. Mather and Sir J. Wolfe Barry, the respected chief in the world of textiles (then Mr. Macara) and others. The proceedings were well attended and even enthusiastic. If we recollect one feature more vividly than any other it is the speech in which Mr. Haldane, as he then was, extolled the German system in respect of its appreciation of the value of science and scientific principles, and in its method of dealing with the workman who would not work.

Much water has flowed under the bridges since that date; Governments have changed, and the turn of fortune's wheel has brought into power one in which the first President of the British Science Guild forms one of its most distinguished members—now Lord Haldane of Cloan—than whom, we supposed, few knew, or thought that they knew, the soul of Germany better. Within the intervening decade we have witnessed the immense development of Teutonic industries consequent largely upon their full appreciation of the value of scientific production and organisation and financial co-operation, assisted though, as everybody sees now, by unscrupulous machination. The British Science Guild is entitled to credit for all that it may have done to change the attitude of Governments, manufacturers, and the general public towards science, scientific education, and scientific principles, and Lord Haldane is equally entitled to our sympathy if to-day he has to deplore the fact that obsession with the manifold important duties devolving upon a Cabinet Minister, in a decade marked by very democratic tendencies, has prevented him from inducing the British nation to avail itself more thoroughly of the object lessons that he had been privileged to observe in Germany.

The second of the Mansion House Conferences, of which a report appears on another page, was not convened by the same Guild. Yet the speeches of 1915 had very much in common with those of 1905. The hall, the stage, the theme—were the same; there were other actors, but the need for a more general utilisation of science in industry was shown to be still one of the most urgent of all our needs, indeed the urgency of the question was emphasised by the added experience of these 10 years of German industrial advance. But the fact that we are now at death-grips with the people whose system Lord Haldane once extolled, should bring home to the national mind most forcibly the seriousness of the whole question in relation to our future trading abilities. We have ventured to hope that all the industrial lessons that we have been learning or re-learning since last July have persuaded Ministers, manufacturers, and others in authority, that this is no purely academic question, but one in which we are all vitally concerned. Yet, if we were to judge from the proceedings and attendance at this second conference, we should feel that we had yet a long way to go before the real facts had been properly brought home to the public mind. We were permitted to listen to the reading of a chapter from a book already published, which stated very convincingly once again how science has contributed to Germany's success in economical and competitive production. The audience was very small, but we should judge that those who were present knew the argument full well. There was a brief discussion, in which Sir Philip Magnus very reasonably asked what it was proposed to do to bring about the alteration that seems to be so essential, but it cannot be said that those who asked for bread got anything better than a stone. One of the most telling speeches was that in which Col. Cassel made an indictment of the Government itself—in which Lord Haldane sits upon the Woolsack—for advertising for chemists with high qualifications, for service at Woolwich, at two pounds no shillings and six pence per week! Of what avail is it to agitate for raising the scientific status if the Government itself values the services of scientifically-trained men in so niggardly a fashion, and when it excludes from the Board of British Dyes, Ltd., expert chemists of unquestionable eminence? The first President of the British Science Guild, if he still holds the views of his earlier years, should surely make his voice heard in the councils of his party in these momentous days. How can we expect to raise the status of science if we keep the monetary reward of the scientist below that of the artisan or labourer? The second conference seemed to agree that the matter was not one to tackle in a hurry—no cut and dried scheme could be propounded. How far that attitude differs from the one adopted by the conference of 10 years earlier the few who were present on both occasions may be left to judge. Others who were present last month and care to turn to their Electrical Review for November 3rd, 1905, may feel that there is much in common between the two reviews of the position and of the need for educating the race from top to bottom in regard to the value of scientific principles and their application in every department of life "to the problems which modern life presents in peace or war." Really from the standpoint of conference we do not appear to be any "forrader"—we are as conservative as ever in some things. The resolution passed last month stated that it was desirable, "in order to improve the working conditions in which British industry at present operates, that there should be closer co-operation between industry, science, and finance." In our opinion it does not require discussion to secure approval for that view from such an audience at this late date. What *is* required is that something should be *done*, otherwise we may see the end of this war, and talk on for another 10 years, perhaps losing ground all the while. Since the conference we have received a communication from the Institute of Industry and Science, which convened it, stating that something "will not be disclosed until the dinner which is to be given in about a month's time to leading industrialists, scientists, and bankers." We will endeavour to rest our souls in patience, waiting for something tangible. Publicity galore, advertisement and talk are not a very satisfying diet for hungry men.

Copper.

There has been an uninterruptedly firm tone about the copper market for weeks past, and all the more cautious expressions of opinion which have been met with are now being thrown to the winds, as it becomes more and more probable that there is a big and concerted plan of manipulation at work to rig the market. American producers, stiffened by the contraband policy of the British Government, and backed as all the world knows by important German interests, are engaged in rushing up the price of their product, regardless of the fact that while they have been restraining output, thus keeping labour out of employment, they are also inveighing against the action of the Allied Powers in "stopping their trade." That it is sheer nonsense, does not appear a factor in the eyes of the German coppermongers, who are coining money while Europe bleeds. There is undoubtedly a large consumption of copper, and the full benefit of it falls into the coffers of the American copper producers, who, indeed, are reaping a golden harvest, and who seem able to push up prices much higher still. Their argument that the British Government can afford to pay even £100 a ton is, no doubt, all right, for wars for national existence have to be fought out to the end, regardless of cost, and the German-Americans are no doubt quite wise in their generation in preferring to sit snugly at home in New York or Boston, and coin dollars, rather than put their manhood to the test in Flanders or in the desolation of West Russia. It must be kept ever in mind that half-bred German interests are pretty powerful in America, and when these are linked up in an endeavour to rig the market in conjunction with what are frankly American manipulators, the result can only be higher prices. Output is being kept down as closely as may be to consumption, though the former has undoubtedly increased to a considerable extent lately. It is improbable in the extreme that the copper magnates will permit it to expand to a degree sufficient to permit of a decline in prices, and some of them are boasting now that the policy of small output and big profit has come to stay, as against big output and small profit. This can only foreshadow a period of manipulation, until possibly the American copper trade is again threatened with a Government inquiry based upon anti-trust lines. Something of this is being held over the heads of the American spelter industry now, and may have a restraining effect upon the cupidity of the leaders of the trade. The responsible head of the United States is, however, hardly the man to show stiffness of attitude in any matter requiring the display of virile qualities or statesmanship. There is an additional factor, too, to be considered just now in the copper position, and that is, that the scarcity of vessels is becoming so great that it is a question whether shipments can be made from the United States to Europe on anything approaching the scale necessary to enable goods to be exported. For weeks past metals have been waiting shipment on the quay at New York, and they seem likely to wait there for weeks more. Shipping is not to be had, and this is the plain fact about the matter. Notices have already been given to certain large consumers here that it will not be possible to ship copper bought by them till July, and turn where one will, the same tale is told. Under these circumstances and in view of the manipulation at work, it is impossible to hold very bearish opinions as to the future. America can put prices higher if it is considered desirable, and there is no doubt that the times are regarded as very auspicious for a campaign of squeezing Europe, such as has been initiated, and the early phases of which are now with us.

American Trade Activity.

We have recently had occasion to call attention to the activity which is being displayed by the U.S. Government and American firms generally to take advantage of existing circumstances to improve their position in the world's markets. A further evidence of this activity has now come to our notice, this time with particular reference to the extension of trade with France. The American Consul-General in Paris, it appears, has arranged to publish a weekly bulletin of offers received from the United States giving names and addresses of the firms making the offers and the nature of the goods for sale. These bulletins will be distributed to all the trade organisations in Paris, by whom they will be affixed to notice boards, and they will also be given wide publicity in the monthly journals issued by these organisations. Accompanying each bulletin is an invitation to French firms interested in the offers to call at the office of the American Consul-General to examine letters, catalogues and samples. It is hoped that by giving this wide publicity to the desire of American firms to increase their trade with France, satisfactory business connections will be made directly between French importers and American manufacturers. We cannot approve all the methods adopted by American Consuls in their work, but we can at least give them credit for their energy. This particular enterprise would appear to offer excellent opportunities for good, and now that British Consuls are displaying greater enthusiasm than ever before, we may hope efforts to similar ends for British trade may be more numerous than they have hitherto been. Another evidence of American activity appears in a cable which has recently been received by the American Government from the Commercial Attaché in Madrid, in which he states that the American Ambassador and he recently had an interview with the King of Spain, in which the latter expressed the opinion that the present moment offered an excellent opportunity for American interests, particularly in the mining and metallurgical industries.

As an off-set to the above, it is interesting to note that the American Consul at Buenos Ayres recently reported that a man of great experience in South America had told him that American firms were making a big mistake in refusing to send travellers to that market. He states that English firms have now five travellers to every three they had a year ago, soliciting orders for any kind of future delivery, as they are determined not to let the market slip away from them. He also says that even some German firms are keeping their South American men active, although no one can tell when they will be able to fill orders.

Preferential Rates.

In our last issue we published a communication from Councillor William Smith, late chairman of the Ilkeston Electricity Committee, on the subject of tariffs for electrical energy, which calls for comment. It will be remembered that Mr. Smith resigned his position in order to champion the cause of a photographer who had been charged for electrical energy at lighting rates, although the photographic lamps of another member of his profession were supplied at the power rate; this case is not on all fours with that brought forward by Mr. H. Faraday Proctor some time ago, the question in the latter case being whether it was lawful to supply such apparatus at the power rate, whereas the former was apparently a true case of preferential charging, which is clearly contrary to the law.

The point to which we wish to call attention is the uncertainty which appears to prevail in some municipal quarters with regard to the powers of the supply authority to formulate special tariffs, as exemplified in the first three questions submitted by the Ilkeston Corporation to the Local Government Board. The reply of the Board is, as Mr. Smith remarks, very significant, but it could have been anticipated by anyone who took the trouble to study the terms of the Electric Lighting Acts, which make it perfectly clear that, provided that the maximum charge specified in the authority's Special Act or Prov. Order is not exceeded, and provided that no undue preference as between consumers of the same class is exhibited, the authority is entirely at liberty to lay down a separate tariff for any and every class of consumer. We need only cite in support of this contention the fact that churches, offices, private residences, public-houses, factories, shops, basements, and other classes of consumer, have been and are differentially treated by various supply undertakers, although they all use the energy supplied for lighting. If energy is supplied for motive power at 1d. per unit, and if it is supplied for photographic purposes at 1d. per unit also, it is a mere coincidence or a matter of convenience that the two rates are identical—they really have nothing to do with one another. Parliament has not laid down any rule that power and lighting shall be charged for at different rates, nor has it specified that they shall be charged for at the same rate; the question is left quite open to electricity supply authorities—provided that no unfair preference is shown as between consumers of the same description. The Electric Lighting (Clauses) Act, 1899, Schedule, Sec. 33, states clearly that "the undertakers may make any agreement with a consumer as to the price to be charged for energy, and the mode in which those charges are to be ascertained, and may charge accordingly. In a word, *preferential* rates are forbidden, but *differential* rates are permitted.

Patents in 1914.

The report of the Comptroller-General of Patents for 1914 naturally differs very materially from those of previous years. The state of war has had various consequences upon both inventors and their inventions, and the all-absorbing subject of war has encouraged inventive ingenuity in military and naval matters, while our relations with other countries led to the passage of special Patent legislation. The statistics are, of course, affected, as the following figures for two years show:—

	1913.	1914.
Patent applications	30,077	24,820
Completed specifications ...	19,309	16,445
Sealed specifications	16,599	15,036
Income...	£346,324	£322,829
Expenditure	£194,423	£194,767
Surplus...	£151,901	£128,062

In the course of the usual review of the trend of invention, it is stated that the electrical industry, as a whole, is very prominent, although there are few outstanding features that are considered to call for comment. Continued progress in automatic and semi-automatic telephone systems is noted, and attention has also been given to receiving arrangements for cable telegraphy, and to ionised gas relays for use in telephony and wireless receivers. The subject of locomotion in general still maintains its pre-eminence, and the flow of applications was equal to that of the previous year, until the outbreak of war, when a considerable falling-off set in. Applications in connection with motor-vehicles and internal-combustion engines are still very numerous, but there is a notable falling-off in the total. Tractors for agricultural and military purposes, and signals for indicating to a following vehicle an intention to turn or stop, are mentioned as noteworthy features. The interest in visual signal-indicators for mines has been well maintained. There is a well maintained interest in railway signalling, without any marked departure from known types of apparatus.

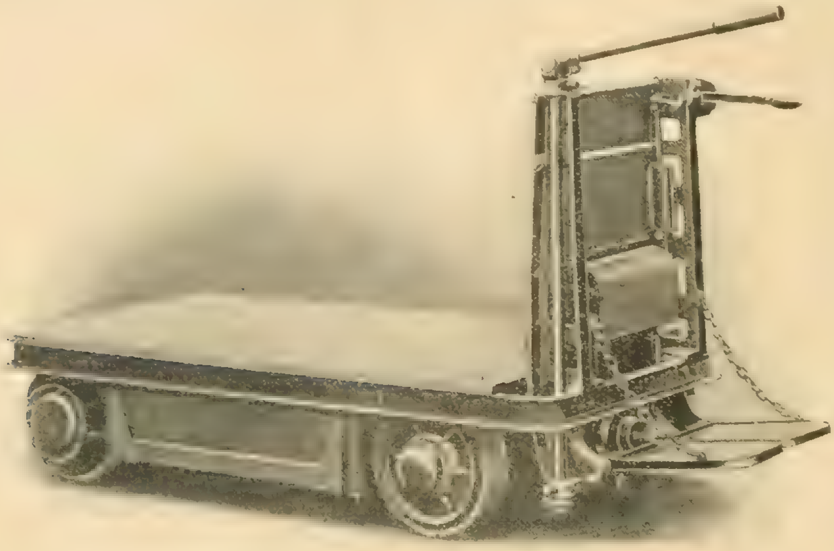
Among the war features in the year's record is the stimulus given to aerial warfare and submarine mining. Methods for detecting submarines and torpedoes, and for protecting ships therefrom, are also specially noted. The disaster to the submarine A7 directed attention to the problem of locating wrecked submarines and signalling to, and rescuing, their occupants.

As to the future effects of the war upon invention, we cannot possibly foresee these, but it is certain that we cannot expect to avoid the consequences of wholesale carnage. Among the millions of lives that are being sacrificed are some of Europe's best. Potential genius, germs of inventive greatness, which might have benefited coming generations, are squandered at the bidding of Kultur-cum-Militarism. The world generally is being robbed of its heritage. But there may be compensations as usual. Hundreds of thousands of men will never return to their former occupations, but may be compelled to subsist in calmer spheres where the inventive faculty may have a freer scope. The experiences of the period of war have turned thousands of minds in directions that they might never have followed in continued peace. The new and vast constructive operations that will ensue when the destroyer's hand has been stayed will be sure to give a stimulus to innovation and invention, and the lessons learned from the applications of science in connection with German achievement may lead most countries to desire to spend larger sums upon research and investigation. It may be that, after accounts have been settled, German industrial concerns will have less money to devote in such directions, but though the financial stress and strain may be severe there will be a great unwillingness to cut down such items of expenditure, and inventive advance may contribute largely to the solving of coming problems, for is not necessity still the mother of invention?

THE ELECTRIC VEHICLE.

Elwell-Parker Battery Trucks.

We are glad to note that an up-to-date method of handling passengers' baggage, &c., on and about station platforms has recently been introduced by the London and North-Western Railway at Euston. Two Elwell-Parker battery trucks are now in use for conveying passengers' baggage and general platform freight. These were supplied by Mr. J. D. Gillespie, of the Railway Track Supply Co., who are sole agents for the Elwell-Parker Co. This class of truck is now being used in England for many purposes, chiefly amongst the railway companies. The Great Western, Midland, Lancs. and Yorks., and Great Central Railways have one or more Elwell-Parker trucks in use. At the Great Western Company's locomotive works at Swindon 14 Elwell-Parker trucks are employed for conveying works materials from one point to another; the trucks are easy to operate, and can be turned in a short radius. The cost of maintenance is exceedingly low, and the energy consumed very little. The L. & N.W. is the first English railway company to employ these electric trucks generally for platform use, although other railways have experimented with them, and in every case the results have been successful. In the United States electric battery trucks are universally employed, the majority being of Elwell-Parker make.



Electric Baggage Truck supplied to the L. & N.W. Railway Co.

The truck which we illustrate is of 2 tons carrying capacity; its special features are the automatic control, automatic braking and four-wheel steering. It is fitted with an Edison battery, carried in a spring suspended cradle arranged for easy removal of the battery for replacement, and a special motor operating at 24 volts pressure, and capable of running the loaded truck up a 15 per cent. gradient.

The motor and driving gear are enclosed in an aluminium dust-proof case; the motor pinion drives a differential on a countershaft, the pinions on the end of which engage with internal rim gears on the driving wheels.

The driver operates the steering lever with his right, and the controller handle with his left hand, while standing on a projecting platform.

The latter is divided in halves, interlocked respectively with the control and brakes, so that when the driver gets off one side an automatic circuit-breaker in the main circuit opens, and when he leaves the other the brakes are applied. An upward movement of the controller handle causes forward motion, and a downward movement the reverse. Trucks are supplied with driving platforms at each end, the controls being interlocked. The speed of the truck loaded is 5 or 6 miles an hour; the turning radius of the outside wheels 12 ft. and it measures 12 ft. 5 in. × 3 ft. 9 in. over the body, weighing 2,780 lb. empty.

G.V. Electric Motor Vans.

For some months Messrs. Hay's Wharf Cartage Co., Ltd., have been using 2-ton G.V. electric motor vans for delivering meat from Smithfield Market to various firms in the London area and outlying districts, including Redhill, Kingston, Harrow, Enfield, Dartford, &c. It will be noticed that the vans, of which six are now in use, are regularly running on hilly country roads —the utility of the electric on well paved city streets is beyond question—and giving every satisfaction, so much so that a third repeat order has been given to the General Vehicle Co., who supplied the original vans, Messrs. Hay's Wharf Cartage Co. having satisfied themselves that, compared with horse vans, the saving to be effected in two years will be sufficient to pay for the first cost.

The vans frequently run 70 miles a day, as upon their return, after having run some 40 miles (the normal distance on one charge of the battery) they receive a boosting charge, and then run another 30 miles. The drivers, who were previously employed in driving horse vans, have quickly become accustomed to their new work.

The particular vehicles referred to have a sheet-covered van body with a driver's canopy, and are mounted on a standard G.V. chassis, fitted with rubber-tired wheels and roller bearings. There are two separated foot-operated brakes.

A single totally-enclosed traction-type ball-bearing motor is fitted, capable of taking 300 per cent. overload for 20 minutes; this drives through Morse chain on to a differential countershaft and thence by roller chains to each road wheel.

HAYS WHARF CARTAGE C° L
CARRIERS & CONTRACTORS
REGULAR SERVICE FROM SMITHFIELD MARKET
HARLESDEN, WILLESDEN, HARROW & WEALDSTONE
HAYS WHARF CARTAGE COMPANY L
CARRIERS &
REGULAR SERV

G.V. 2-Ton Electric Trucks used by Hay's Wharf Cartage Co.

A 44-cell Ironclad-Exide battery is carried below the chassis, and the controller is placed under the driver's seat and operated by a handle at the side; there are four forward speeds and two reverse speeds. A three-way running switch is provided having neutral, running and charging positions; the driver can remove the handle in the neutral position, in which and the charging position the controller is inoperative.

An ampere-hour meter is fitted which automatically trips the circuit breaker when the battery is fully charged; the meter also tells the driver the state of his battery.

We gather that the acceleration of these vehicles is excellent, and that on London roads they are running loaded at speeds of 15 to 16 miles an hour, although rated at only 12 miles an hour on the level.

INDUSTRY, SCIENCE AND FINANCE.

The announcement that a Conference of the Leaders of Industry and Science would be held at the Mansion House on March 25th, to consider the mobilisation of industry and science and the working conditions in which British industry at present operates, and to suggest a new basis at the conclusion of the war may have raised hopes that this vitally important matter was at last to receive adequate treatment. Such was not the case. With all due deference to the positions and qualifications of those gentlemen who attended the Conference, we feel sure that they would be the last to maintain that the gathering was truly representative or worthy of the vast importance of the subject under discussion. The attendance may have been affected adversely by the fact that the Royal Society and the Chemical Society had meetings on the same afternoon, and it is peculiarly ironical that an Institute preaching efficient organisation should be the victim of clashing engagements.

One seeks in vain in the afternoon's proceedings for any vigorous and definite proposal of policy, and the resolution carried by the Conference ". . . that it is desirable, in order to improve the working conditions in which British industry at present operates, that there should be closer co-operation between Industry, Science, and Finance," is, at this late date, unutterably feeble. Of course it is desirable that there should be closer co-operation. That has been obvious for years past, and has formed the text of innumerable sensational but barren articles and treatises during the last eight months. The whole point is first to determine how such co-operation may be secured, and then to secure it. From this point of view, the Mansion House meeting was sterile. It is, as Sir Philip Magnus remarked, too much to expect a complete constructive policy to emerge from a single afternoon's discussion, but any institute essaying to increase co-operation between industry, science, and finance, by generalising on the subject, is simply wasting the time of its members. Precise schemes are needed, and, while we bear no ill-will against the Institute of Industry and Science, or any other body organised to deal with this important matter, we feel that the whole problem of co-operation is one demanding immediate attention by individual parties.

Individual manufacturers must realise that properly trained scientific men are good investments and, as such, are entitled to adequate remuneration and proper encouragement to invent and improve machinery and processes. Individual scientists must realise that their work must conform to the requirements and conditions of industrial practice or be handed over, at the earliest opportunity, to men able, by their training and experience, so to adapt and apply it. Individual bankers must realise that Messrs. A. and B.'s new works, new machine or new process is, subject to the judgment of a commercial scientist, whose mind does not live in a test-tube, a fit and proper security on which to advance capital for its development. It is no use talking about the matter as a general proposition. It is a subject for immediate *action*. Messrs. A. and B. can afford to pay salaries such as will bring them men with scientific qualifications and commercial and industrial experience fitting them to develop processes and plant on which Messrs. C., the bankers, can safely advance capital. But Messrs. A. and B. must not regard their scientific men as interesting freaks, commercially lunatic, to be snubbed as often as possible and placed entirely under the control of a commercial board of directors.

With Sir Philip Magnus, we agree that our output of science, our standard of technical education and our industry and inventive genius are as great as those of the world in general and of Germany in particular. With Colonel C. E. Cassel, we agree that the present position of scientists in industrial concerns in this country is ineffective and degrading. We must imitate Germany to the extent of securing the best scientific advice obtainable and giving it proper weight and influence in our industrial councils. Faults in the past and present composition and working of individual firms must be fearlessly laid bare and ruthlessly uprooted.

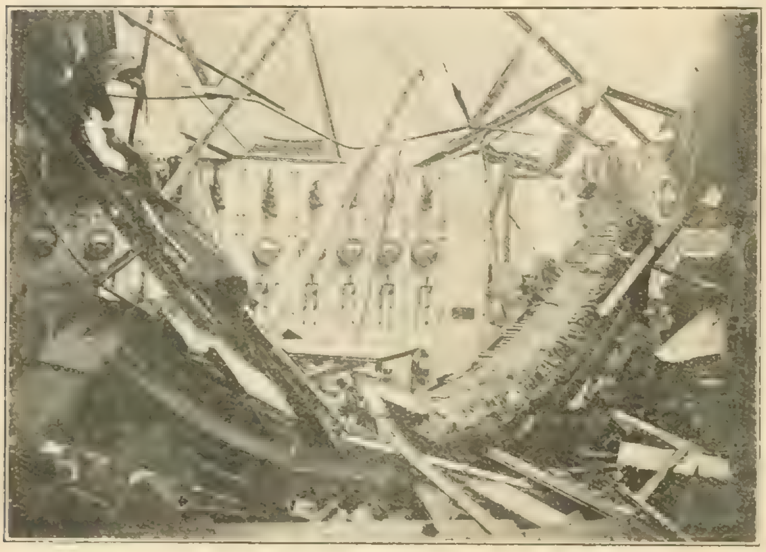
The reason for these urgent words and drastic proposals is not far to seek. During the war, we have industrially a breathing space—so far as concerns German competition. Great and urgent as are our industrial problems in other directions, we must find time now to frame individually—since it seems hopeless to expect any adequate general solution—the measures by which we are to conduct the coming industrial war. Once the sword is sheathed, the industrial ability and organisation of Germany will be directed to underselling in every market. The indemnity imposed by the Allies will compel great wage reductions in Germany, and the over-extended factories of that country will literally flood the world with cheap German goods. Nor shall we be immune from severe competition by our allies and by neutrals—chief among them America. To meet the unprecedented conditions which must surely arise and to avert what can only be lasting industrial ruin, we must cheapen production. As Lord Portsmouth took care to emphasise, this cannot be done in the United Kingdom by wage reductions. We shall have to increase our efficiency of production, which means utilising existing and new scientific methods to the greatest possible advantage—again a matter for immediate and sustained individual effort in individual cases. Organisation of sales and commercial methods in general is a closely allied but still distinct problem.

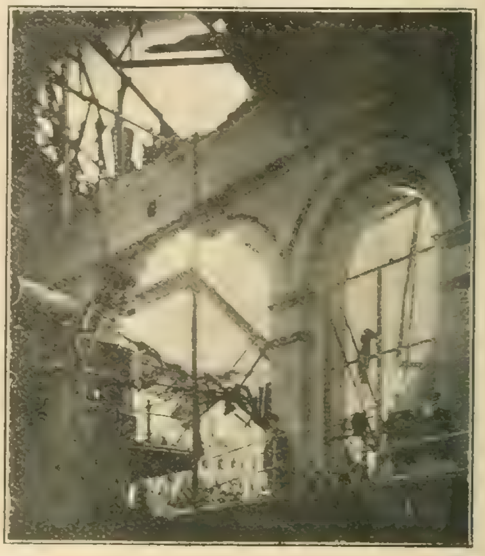
During the past century the development of science has exerted an ever-increasing influence on political economy, but, though we agree with Mr. J. Taylor Peddie that this has rendered unsound many of the theories formerly held by political economists and has practically given any and every industry to that country which prosecutes its development most scientifically, though we agree that the direct and reflex influences of inventions and improved methods and equipment are far-reaching, and have done more to further the progress of human development than any political measure, yet we feel that Mr. Peddie underrates the value of the assistance which can be given to science and industry, separately and conjoined, by judicious legislation and State finance. Extraordinary as the organisation of German firms has been, technologically and commercially, German industry could never have reached its present development without the diplomatic, legislative and financial assistance accorded to it by the German State. In these directions, we feel that it is up to our own Government to do many things which it has failed to do in the past, but the necessary machinery will take long to construct and bring up to speed. Meanwhile, the problem must be tackled and largely overcome by individual private effort. Until such effort has been made extensively and effectively, pressure can hardly be exerted on the Government, and definite schemes and policies can hardly be formulated with advantage by private associations.

Electrically-Driven Barges.—Our contemporary, the *Motor Ship and Motor Boat*, recently described a type of electrically propelled barge, of which about 100 are in service in one part of Germany, engaged in carrying bricks and limestone into Berlin. They are long shallow craft, built of steel, having a displacement of 250 tons and a draught under 5 ft. Their length is about 125 ft., beam 14 ft. 6 in., and depth 6 ft. A battery of 80 cells, with a capacity of 700 ampere-hours, each cell weighing 120 kg., is installed in a ventilated lead-lined chamber 10 ft. × 14 ft. × 5 ft., near the stern, and supplies energy to an 8-H.P. motor driving the propeller direct at speeds of 120 to 150 R.P.M. The speed of the barges is very low, not exceeding 3 miles an hour; they run trips in normal operation of about 70 miles, and are stated to have given satisfactory results.

THE CARDIFF ACCIDENT.

In our issue of March 26th last, p. 434, we referred briefly to the extraordinary accident which occurred on Sunday, March 21st, at the Roath electric power station of the Cardiff Corporation, and resulted in damage estimated at some £20,000, as well as the shutting down of the tramway service and dislocation of electricity supply in the city. We are now able to publish some views taken in the station after the accident, which will convey a better impression to our central station readers of the state of affairs then existing, than any amount of description. Some idea of the position, however, was conveyed in the report of Mr. Arthur Ellis, the city electrical engineer, at an emergency meeting of his Committee, held soon after the accident, when he is reported to have stated, amongst other things, that :—


Section of Stator which Fell into Switchroom.

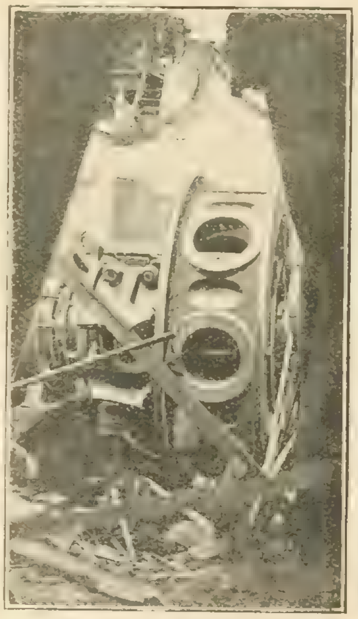

The Damaged Engine Room.

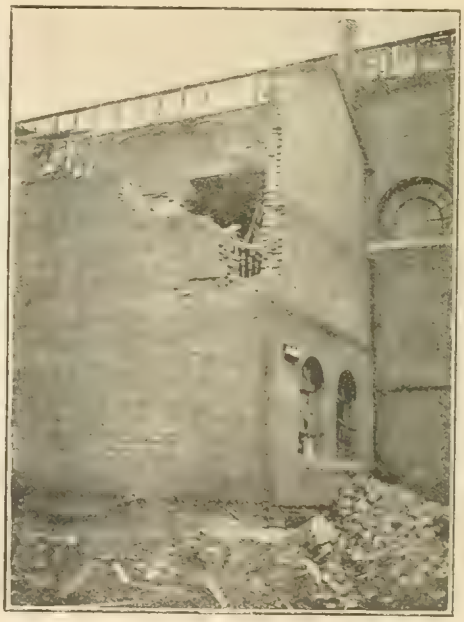
Accident at Cardiff Power Station.

The most urgent need of the moment was to give temporary cover to the machinery, which was now exposed to the weather. The position was that one of the large engines had been entirely wrecked, and in his opinion it would not pay the Committee to re-erect or re-construct it, because. nowadays, with a modern type of plant, they would probably get a turbine at considerably less cost than they would have to pay for the re-erection of the wrecked engine. He had never heard or known of anything of the kind happening in any electric power station in the country before. He had no doubt in his mind that the engine accelerated to enormous speed, and the flywheel, of a deadweight of over 70 tons, with an electric generator of about the same weight coupled to it, burst and simply shattered the end wall and demolished most of the roof It also damaged the engine immediately opposite to it, but the damage to that was not so extensive. The greatest difficulty had been with the large 20-in. water pipes serving the new machinery. These had been broken, and the water rushing down the centre of the engine-room, together with the force of the bursting of the flywheel, had affected the foundations of the engine very seriously. Large masses of concrete had been loosened and broken up. It was found that the waterworks department had new pipes in stock. He was hoping that the concrete would have been removed in order to put the new pipes in, but there were many tons of solid concrete to be dealt with, and the task had been greater than anticipated. It was possible that it would be all removed by that evening, after which the new circulating pipes would be put in and the new plant in the power station could then be put in commission.

Whilst the accident itself was extraordinary, the escape from loss of life was more extraordinary still. One could see pieces of metal, weighing as much as 30 cwt., all over the place.

The cause of the accident was now quite unascertainable, and he did not think they would ever know the reason for it.


Flywheel Boss and Remains of Rotor.


Damaged Building Containing H.T. Switchgear.

AERIAL WIRE ROPEWAY FOR AUTOMATIC DISPOSAL OF ASHES.

Some years ago we published particulars of an aerial wire ropeway at the Neepsend electricity works of the Sheffield Corporation, installed by Messrs. R. White & Sons, of Widnes, for the automatic disposal of ashes from the boiler house. It will be remembered that the ropeway in this case served a dual purpose. In the first place, it automatically disposed of the ashes, and secondly, these ashes were used to fill up part of a ravine, and make it level with the railway line on the top side of the works, and so provide extra coal storage space, and room for extra railway sidings. This work has now been completed, and in order to find further tipping ground it has been necessary to erect a fresh ropeway across the railway line, and to tip the ashes on some waste land on the east side of the railway. This involved the raising of the ashes to a sufficient height to allow the ropeway to be carried well over the railway, and leave room for a protective bridge over the railway itself.

The level of the boiler floor at this point is about 50 ft. below the level of the line, and it was therefore necessary to provide two electric hoists with a total lifting height of 110 ft., allowing ample head room.

The ashes are loaded directly from the boiler furnaces into the tipping wagons, each wagon holding ¾ cb. yard, and are then run by hand to the foot of the electric hoist. The man in charge turns an electric switch, and the wagon with its contents is at once raised to the top. At this point the wagon engages a bar fixed in such a way that the hoist not only stops automatically, but the wagon at the same time is automatically tipped into a storage hopper immediately below it, shown in the adjoining view. The man at the bottom then turns the switch again, and the empty wagon descends with the hoist. It will be noticed that the whole of this arrangement is automatic, and it is not necessary for the attendant to travel with the loaded wagon. The hoist is supplied in duplicate, and is driven by electric motors, with counterbalance weights in the usual way.

The hopper at the top is capable of holding 10 tons of these ashes, and when it is full the man in charge proceeds to empty it by the use of the aerial ropeway. Fig. 2 shows one of the carrier boxes which has just been loaded with ashes from the hopper.

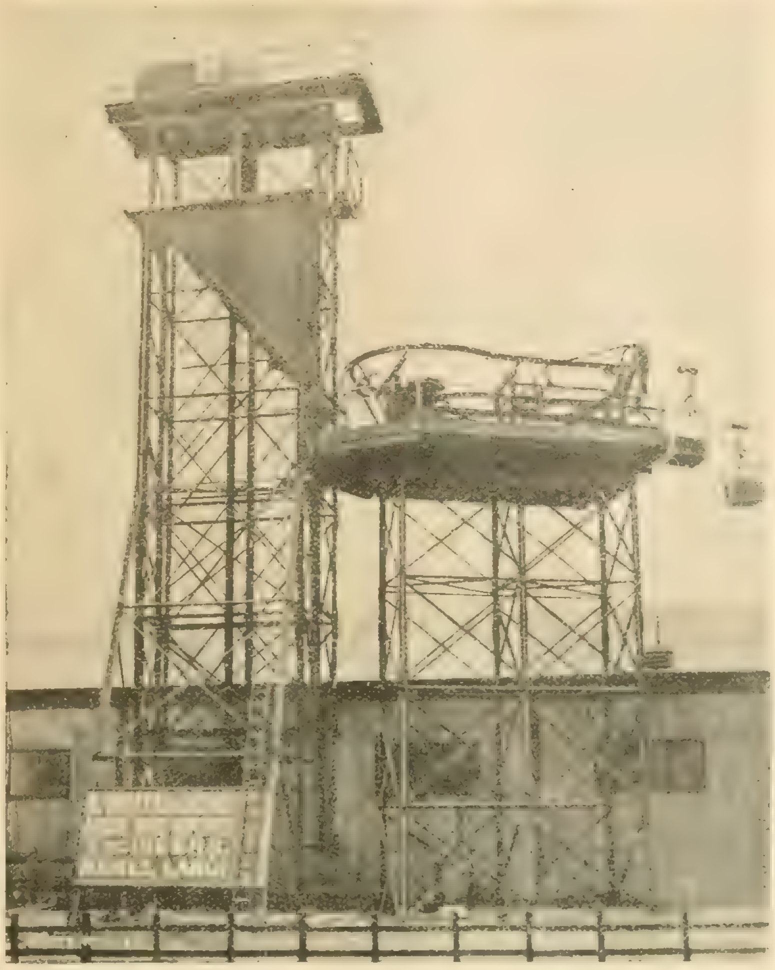


Fig. 1.—Side View of Loading, Driving and Tension Terminal of Ropeway, with Electric Hoists, Storage Hopper and Steel Staging.

It will be noticed in the views that the ropeway makes two vertical angles *en route*, and one horizontal angle. In order to comply with the railway company's requirements, it was necessary to run the line of the carrying rope horizontally, so as to keep the carriers, both loaded and empty, well within the sides of the protective bridge already mentioned. As soon as the ropeway leaves the railway it at once rises up a gradient of 1 in 3, until it arrives at the angle standard, which is 60 ft. high from the ground level, with an angle of 145°, as shown in figs. 3 and 4, in order to provide plenty of tipping height. The carriers, whether loaded or empty, pass through this angle station quite automatically, both on the forward and return journey.

From here, the carriers proceed directly over the tipping ground, where they are discharged automatically in the manner shown in fig. 3. Proceeding onwards, they are conveyed to the far end of the line, where there is an automatic return

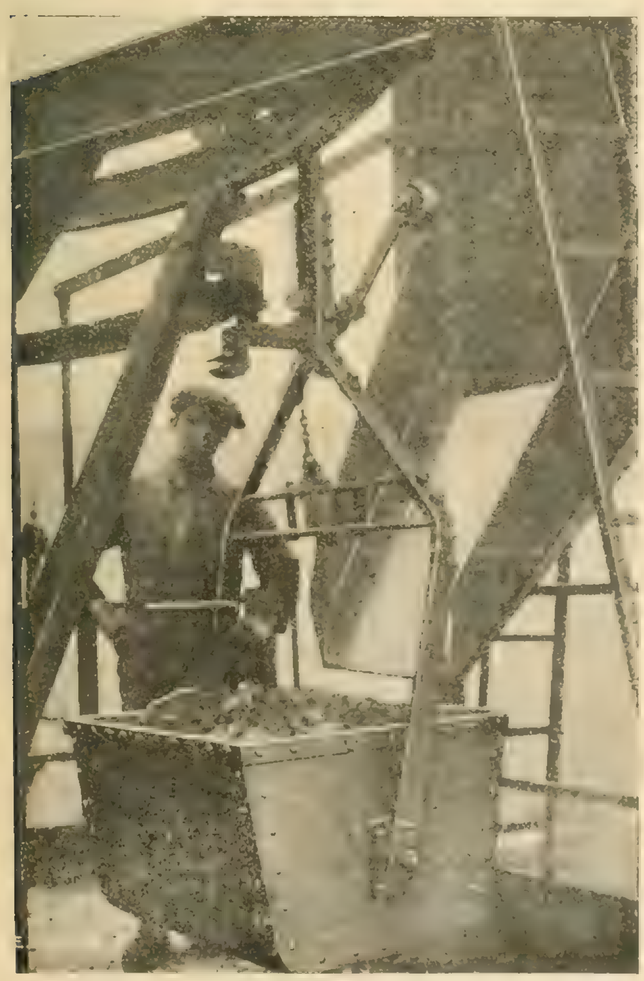


Fig. 2.—Loading a Carrier Box from the Storage Hopper.

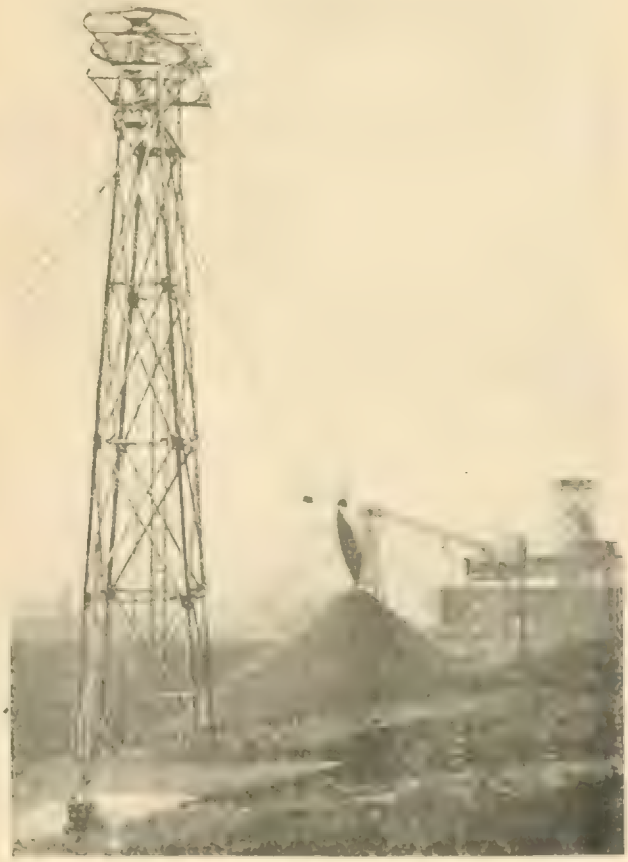


Fig. 3.—Return Terminal of Ropeway and Carrier discharging Ashes.

terminal fixed at a total height of 50 ft. above the ground level, as shown in fig. 3.

The ropeway is erected on the side of a ravine, and in addition to the very high tipping space provided by the standards themselves, there is room for a very large quantity of material, due to the peculiar formation of the ground at this point, and it is estimated that the ropeway in its present position, although only 600 ft. long overall, will provide tipping space for about 53,000 cb. yards of ashes. By means of Messrs. White's special arrangement of dummy standards this space can eventually be increased to about 200,000 cb. yards.

It is understood of course, that the tipping, as in the previous installation, is done entirely automatically, as is clearly shown in fig. 3, and the carriers not only go round the return terminal automatically, but also through the angle station, so that as a matter of fact the carriers are not touched by hand from the time they leave the loading berth until they arrive there again on the opposite side of the ropeway, where they are automatically released from the hauling rope and stand on the fixed run rail ready to load again.

The ropeway is designed for carrying 10 tons per hour, but this can be increased if necessary by merely adding extra buckets. It is driven by a motor of 6 B.H.P., of the protected type, fed with two-phase alternating current at 200 volts, 50 periods, and provided with an auto-transformer starter. The electric hoists are driven by means of similar electric motors of 12 B.H.P. each, with wound rotors, and controllers of the reversible type.

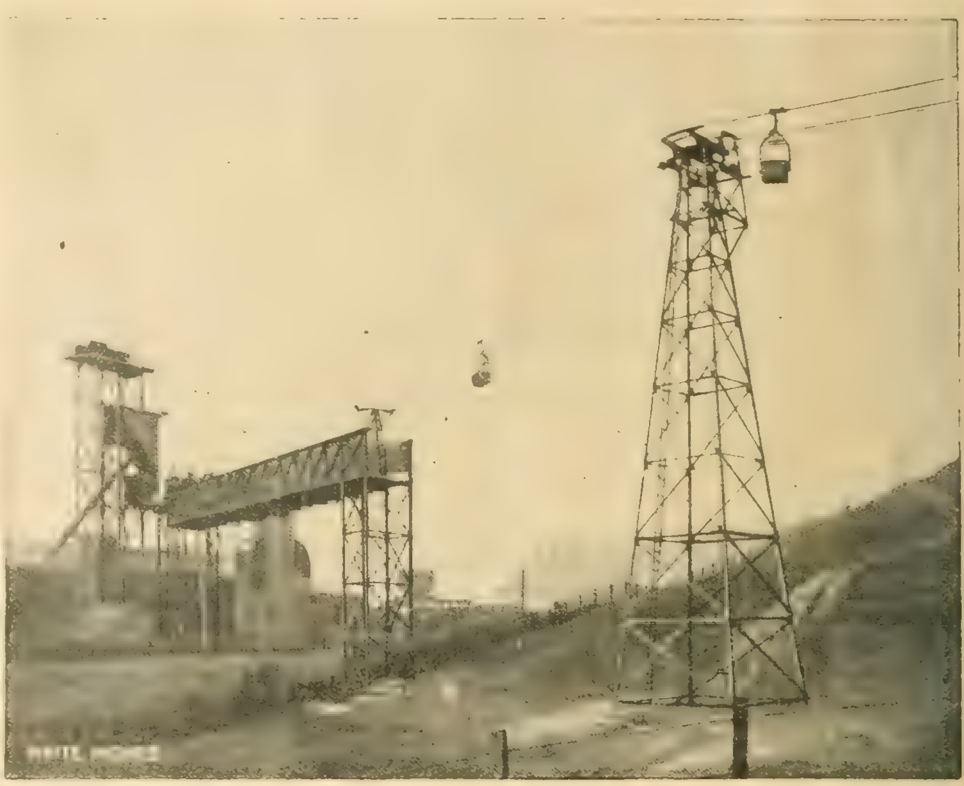


Fig. 4.—Bridge over Railway, and Automatic Angle Standard.

Messrs. Gilbert Heathcote & Co., of London, provided the bridge over the railway; the whole of the remainder of the installation, including the electric hoists, was provided by Messrs. R. White & Sons, of Widnes.

The installation is a very interesting piece of work, and we congratulate Mr. Fedden, manager of the electricity department, on the satisfactory results attained.

LEGAL.

The Return of Electrical Goods.

In the City of London Court on Friday, March 26th, before Mr. Registrar Wild, a claim was made by Otto Bohndel (sole proprietor of Schoen Bros.), 29, Cock Lane, against the Wirthy Incandescent Light Co., electricians, 200, Portobello Road, Notting Hill, for the balance of account for electrical goods supplied in the way of trade.

The Plaintiffs' representative said that the claim arose from the fact that the defendants had returned goods which the plaintiffs could not accept. The goods were delivered in June, 1912, and the defendants returned them in July, 1914. Of course the plaintiffs could not accept back goods which had been kept for over two years.

The Defendant said the statement was not true. The arrangement made with the plaintiffs' traveller was that all faulty goods should be returned, and that was what had been returned. As, however, the defendants had stopped dealing with the plaintiffs, they had refused to change the last lot of goods.

The Registrar: It is said that the goods returned were delivered in 1912.

The Defendant: No; they were not.

The Plaintiffs' Representative: I can prove it.

The Defendant said there was one line, amounting to 1s. 7½d., delivered in 1912. The rest of the goods returned were delivered in January, 1914, and were returned in July.

The Plaintiffs' representative said their agreement was that no goods could be returned after six months.

The Defendant said the plaintiffs had always changed goods previously, and had never stipulated that it should be done in six months.

The Registrar intimated that if the defendants ordered goods of the plaintiffs upon ordinary sale or return terms, kept the goods for six months, and then returned them, in his (the Registrar's) opinion, that was a great deal too long to keep them, unless it was shown that there was a contract between the parties to that effect, or that it was well known in the trade that goods could be kept for six or seven months before returning them.

The Defendant said he could only prove his arrangement by previous transactions, and he had not brought the necessary papers with him to do that.

The Registrar suggested that the defendants' point might be brought out by questions asked of the plaintiffs' witness, but the plaintiffs' representative said they would not exchange any goods after six months.

Continuing, the Witness said when the defendant returned the goods plaintiffs went through them carefully and exchanged part of them. Others they could not accept, having been too long delivered.

The Defendant said the arrangement made with the plaintiffs' traveller was that they could exchange batteries and lamps after six months.

Plaintiffs' representative said no such agreement was ever made with the defendants. They could not do it.

The Defendant stated that his dealings with the plaintiffs were through their traveller, who had said the firm was very fair in its dealings.

In answer to the Registrar, it was stated that the goods in question were of German make, and the Plaintiffs' representative remarked "about the best ever supplied in the trade."

The Defendant: We thought we could not get a British article better than the German. We did not know it until now.

The Registrar pointed out that a part of the case that seemed to strike him was that some of the goods might have become faulty while in the defendant's possession.

The Defendant: That was the reason for the guarantee being given. Further, he said he had kept batteries in stock for 12 months and the plaintiffs had exchanged them and had said nothing against it until now.

The Registrar said if the defendant could prove that the plaintiffs had accepted back goods under circumstances such as he alleged, there might be something in his case. It was denied by the plaintiffs, and the defendant's contention seemed unreasonable to him (the Registrar).

The Defendant, in answer to questions by the Registrar, said there was nothing to prevent him testing batteries. He did not send back one or two batteries at a time, but at the suggestion of the traveller had kept them until he had a number of faulty articles to return.

The Registrar thought there was something in the defendant's suggestion as to keeping some of the goods over time, while waiting to return others in time, and ordered the case to be adjourned for the plaintiffs' traveller to attend. The Defendant should also bring his documents to prove that he had returned goods to the plaintiffs as he alleged.

On Tuesday, March 30th, the defendant produced two credit notes in respect of goods which he had returned and which he said had been kept as long as the returned goods over which the dispute now arose.

The Registrar said he should require to see the invoices under which the goods, in respect of which the credit notes were given, were supplied. Without seeing such documents he (the Registrar) could not judge whether the goods had been returned within a reasonable time or not.

The Defendant said he did not think about bringing the invoices within him.

The Registrar said he saw that the credit notes were dated September 13th, 1912, and February, 1913, but the goods might have been invoiced the day before. The defendant wanted to prove that notwithstanding that a period of six months had elapsed it was a custom in the trade in his dealings with the plaintiff that he would accept the return of goods after such a period. The adjournment had been given for the defendant to prove his assertion. He (the Registrar) was afraid he could not help the defendant.

The Defendant said he thought the credit notes would be sufficient for his purpose.

The Registrar said the credit notes were only evidence that goods were returned upon certain dates, but they did not state how long the goods had been kept, and the plaintiffs complained that the defendants had kept the goods far too long.

The Defendant said he had kept back some batteries which were faulty, at the express request of the plaintiffs' traveller.

The plaintiffs' traveller, Ames, denied that he had requested the defendant to keep back batteries (dry cells); they were to be sent back immediately.

The Defendant said that that was a perfect lie.

The Registrar said that the defendant did not give him an opportunity of judging whether there had been such a customary dealing as he alleged. Therefore the case came back to the question whether it was reasonable for the defendant to have kept the goods as long as he had. The goods now in question had been kept at least seven months. The defendant had not proved his custom, and the plaintiff would have judgment for the amount claimed, without costs.

The Prize Court.—Seizure of Electrical Fans.

In the Prize Court on March 30th the President, Sir Samuel Evans, had before him a suit by the Crown asking for the condemnation as enemy property of five cases of electric fans, seized on board the P. & O. steamship *Poona*, in London on October 17th. The goods were claimed by Isaria, Ltd., a company duly incorporated in England.

Mr. J. B. Aspinall, for the Crown, said that the fans were sent to Germany at some time before the outbreak of war by Isaria Zahlerwerke, of Munich. The outer wooden case in which the goods were packed bore labels printed in Germany, and also had the words "made in Germany" stencilled upon them, and each of the fans was wrapped in paper bearing printed German labels. They were forwarded to Australia by the steamship *Rheinland*, but were afterwards sent back to this country to Isaria, Ltd., a company duly incorporated in England.

The President: When did they reach Australia?

Mr. Aspinall: Before the outbreak of war. They were sent back to this country on the ss. *Poona*, consigned by Messrs. Lascelles, Parrington & Brasche, of Melbourne, "to order," London.

The President: How did the firm in Melbourne get possession of the goods?

Mr. Aspinall: They were handed over to them by one Brandl, who is alleged to be the Australian traveller of the English company, but who I shall ask your Lordship to say was the Australian traveller of the German company. I submit that these goods were so tinged with German interest that they ought to be condemned. The contention on the other side is that the goods are the property of the English registered company. Counsel quoted the following passage from the judgment of his Lordship in case of "The Tommi and Rothersand," with reference to the question of an English company consisting entirely of aliens. "These technicalities have not been allowed to bind decisions in the Prize Court. They have been treated rather as gossamer to be brushed aside, and the Prize Court rather regards the essential qualities of any transaction and tries to arrive at the realities of the case. . . . It no doubt is the case that a company registered in this country under the Companies' Acts is a separate entity, and such a company can own a ship. Whether a company consisting entirely of aliens can own a British ship is a question which probably has never arisen, and has never, therefore, been decided. I am not sitting here dealing with maritime law, and, therefore, I am not called upon to decide that question, but I do not want it to be assumed that the Prize Court could not say, looking at the realities of this thing, that even if the transfer has been completed, and if the shareholders in the British company became the purchasers, this vessel ought to be regarded as a German ship."

The President: That was before the decision of the Court of Appeal in the Continental Tire and Rubber Co.'s case.

Mr. Aspinall agreed. In that case it was held, Lord Justice Buckley dissenting, that an action of debt was maintainable by an English company of which all the directors and shareholders were alien enemies. Lord Justice Buckley's dissenting judgment, however, was of very great force and strength, and Lord Lindley, in a letter to the *Times*, agreed with him.

Mr. Aspinall called attention to an affidavit by Mr. Frank Morton, manager of Isaria, Ltd., of 208, Tower Bridge Road, from which it appeared that the company were merchants, and dealt in electrical appliances, including electrical fans. The great majority of the shares were held by the German company. Four directors of that company and another person, all resident in Germany, held one share each, while another share was held by a Frenchman.

In reply to the President,

Mr. Aspinall said that looking at the reality of the transaction his case was that the goods were probably the property of the German company. But even if they were not, but were the property of the English company, then he contended for the purpose of prize, that that company was so German that if the goods belonged to them they ought still to be condemned. He asked his Lordship to follow up what he said in "The Tommi and Rothersand case," and look at the "realities of the thing." He submitted that apart from the decision of the Court of Appeal his Lordship sitting in prize with a discretion and with an ability to look through the transaction, would do justice to the British Crown. He invited the President to consider very seriously whether looking through the fog of the class of affidavit put forward in this case, he could not see the light and the real truth of the matter, and to use his Lordship's own expression brush aside the gossamer.

The President: Perhaps that expression was a little too strong.

Mr. Aspinall: I think it was an expression extremely apt for the purpose of that case, and very suitable for my argument.

Mr. Elkin, for the claimants, said his submission was that where the goods were shipped and seized in a British ship trading between two British ports, the onus was on the Crown to prove that the goods were of an enemy character.

The President: No.

Mr. Elkin said that then he submitted that the goods were clearly the property of the English company, and as such were not confiscable. The transaction was a simple one. The goods were ordered from the Munich company by the British company, and were sent direct to Brandl, the British company's Australian traveller, and he handed them over to the British company's Australian agents, Messrs. Lascelles, Parrington & Brasche, on sale or return terms. The goods proved not to be suitable for the Australian market, and the agents shipped them back to London. At the time of seizure they were the property of the English company.

Mr. Frank Morton, the English company's manager since August 3rd, gave evidence to the effect that the goods were bought outright by the English company from the German company, and had been paid for by running account.

In a letter which Messrs. Lascelles, Parrington & Brasche wrote in September, when forwarding the bill of lading in respect of the goods to the English company, this passage occurred:—"There has been some delay in connection with the matter owing to the war, as it was Mr. Brandl's intention to attend to the business, but he has been naturally very unsettled, and as the bill of lading is no good to us, the best thing to do is to let you have it, and trust that you will be able to obtain possession of the goods."

The hearing was adjourned till Tuesday, April 13th, for further evidence.

Costelloe v. Universal Radio Syndicate, Ltd.

At Listowel (County Kerry) Quarter Sessions last week, before County Court Judge Dromgoole, John Costelloe, formerly an employé at the wireless telegraph station at Ballybunnion, County Cork, sued the Universal Radio Syndicate, Ltd., in liquidation, for damages for injuries sustained whilst in their employment.

The Plaintiff, in his evidence, stated that for about 10 months he had been employed at Ballybunnion wireless station, owned by the syndicate. On January 18th last he received notification from the manager to the effect that his services would not be required after Saturday, January 23rd. In accordance with the usual custom, he was paid, with the other employés, about noon on January 23rd, but was not to leave work until 5 o'clock that evening. He came back from dinner at 1 o'clock, and together with four other employés went, at about 2.30 o'clock, up the pole or tower of the wireless station, which is about 490 ft. high. They went up from the inside for the purpose of fixing steps. Their directions were that whenever the weather permitted they were to ascend the tower and fix on the steps. The morning of January 23rd last had been very wild, and when the weather cleared up at 2.30 o'clock, they ascended in accordance with the instructions received. At about 4.15 o'clock, after fixing on about 18 steps, they decided to go down again as the evening was getting dark, and when at a distance of about 40 ft. from the ground plaintiff lost his hold and fell to the ground—a concrete foundation. He received injuries to the head, neck, legs and sides, and, as a result, was under the treatment of Dr. J. Costello for about eight or ten days. Although no bones were broken plaintiff still felt very sore, and was unable to work.

The evidence was corroborated by the other men who were working with the plaintiff.

Mr. C. T. Elwell, manager for the syndicate for the defence, said the men had no authority to ascend the tower on that occasion.

His Honour held that the plaintiff was in the employment of the syndicate at the time of the accident, and granted plaintiff a decree for £5 and costs.

Herbert Morris, Ltd., v. Saxelby.

The Court of Appeal, composed of the Master of the Rolls, Lord Justice Phillimore, and Mr. Justice Joyce, on March 31st, delivered judgment in this case upon the plaintiffs' appeal from a judgment of Mr. Justice Sargant.

The proceedings in the lower Courts have already been fully reported in our pages.

The Master of the Rolls held that the covenant was unreasonable and was an unusual one in the engineering trade. He could not, he said, think it was reasonable to require the defendant to put aside all the skill and experience he had acquired during 10 years, and to practically begin life afresh. There was no suggestion that the defendant had been guilty of any breach of confidence or that he had disclosed, or threatened to disclose, any secrets of the plaintiff company. He thought the decision of Mr. Justice Sargant was correct.

Lord Justice Phillimore dissented, being of opinion that the covenant in the modified form, to which the plaintiffs agreed, was not too wide. He thought, therefore, that the appeal ought to be allowed.

Mr. Justice Joyce agreed with the judgment of the Master of the Rolls, and the appeal, therefore, by the majority of the Court, was dismissed, with costs.

Lighting Summonses.

At the Manchester Police Court on Thursday last week the Stipendiary Magistrate fined two shopkeepers trading in a main thoroughfare £1 apiece for having too brilliant a light in their shop windows after having being cautioned. These were stated to be the first cases in Manchester under the Defence of the Realm Act lighting restriction order.

ELECTRICAL SUPPLY TRADE IN SOUTH AMERICA.

The following are extracts from certain reports which have been received by the American Government from its Consular representatives in South America as a result of the general inquiry referred to in a leaderette in a recent issue of the Electrical Review, as having been made in oversea countries with a view to the possible expansion of American trade in electrical goods; the reports are not being published in full, but are being reserved for inspection by American manufacturers.

ARGENTINA (ROSARIO).—Argentina offers a growing market for electrical supplies of all kinds. The total imports of such goods increased steadily from about £643,000 in 1908 to about £1,951,000 in 1913; and while the figures for 1914 will undoubtedly show a falling off, this can be ascribed to temporary causes—financial depression, in the first place, and the interruption of trade with Continental Europe.

Electricity is extensively used in all the leading centres of population and is gradually entering the smaller country towns, many of which are already electrically lighted. The industrial census of 1910 showed that in that year, or somewhat earlier, 21,790 electrical horse-power were used in Argentine industrial establishments, and the census taken last June will undoubtedly reveal a great increase in this direction. Opportunities for the utilisation of water power in the Andes and other mountain regions, as well as the current of the Uruguay River between Hervidero and Santo Tome, will give an additional impulse to the use of electricity for light and power. It is safe to say that the demand for electrical supplies will increase steadily in Argentina; on the other hand, it will be a long time before foreign firms will have to meet serious home competition in this field.

Official statistics of imports give to Germany the leading position for practically all kinds of electrical supplies. The United Kingdom is the chief source of a few lines, particularly certain grades of wire, commutators, vulcanised fibre, telephone and telegraph supplies (imported largely by British companies operating in Argentina), batteries, &c. The United States led in 1912 (the latest year for which detailed figures are available) in only two lines, namely, small motors (called "motorcitos"), of the type used for driving electric fans, &c., and wall sockets.

The failure of American manufacturers to obtain a larger share of the trade in electrical goods is generally attributed to the fact that German products are lower in price and German firms more liberal in the matter of terms. Another factor is undoubtedly to be found in the absence of large consumers of electrical supplies operating with American capital and interested in the extension of American trade. European concerns controlling Argentine railways, tramways, power plants, electric-light companies, telephones, &c., are in some instances directly interested in the manufacture and sale of electrical supplies. The importance of this will be seen when it is stated that in 1912 electrical supplies, valued at about £225,000, were entered free of duty; that is, by railways and other public utilities enjoying the privilege of free entry.

Several leading European and American manufacturers of electrical materials are represented at Buenos Ayres either by agents or by branches. The present tendency appears to be to establish branches. As regards Rosario, one of the large German factories has a branch here, and an electrical concern with factories in several countries is represented by the Rosario branch of its Buenos Ayres agents. Other concerns represented at Buenos Ayres are in close touch with the Rosario market, most of them selling to local dealers without distinction.

Some of the large general importers of hardware and machinery at Rosario maintain an electrical section, import electrical supplies, and install lighting systems, small power plants, &c. There does not seem to be much inclination on the part of these large hardware and machinery jobbers to extend this branch of their business; in fact, it appears from information obtained recently that some of these firms intend to give up their electrical sections, as the active competition of a host of small electricians, largely Italian, has reduced profits on electrical work to a minimum. The tendency is rather for the leading manufacturers to establish branches at Buenos Ayres, which will presumably be followed later by supplies at Rosario, which deal direct with the electricians and dealers. This does not, of course, mean that some of the Rosario jobbers, importing direct or buying from Buenos Ayres branches, do not continue to do an important business. It is evident that with leading manufacturers represented at Buenos Ayres it is difficult for firms, without good connections in Argentina, to get any important share of the trade. As already stated, difference in price and readiness to grant credit have thus far given German manufacturers a considerable advantage. As long as the war lasts Germany will experience difficulty in supplying the local market, but American manufacturers are reminded that the United Kingdom already does a much larger business in electrical supplies with Argentina than does the United States, and that Italy is only a short distance behind. The Sociedad de Electricidad de Rosario (light and power plant), in an effort to increase the consumption of current at Rosario, particularly during those hours when consumption is ordinarily smallest, has rented a large store on one of the principal business streets, and has there installed electric fans, drying apparatus, toasters, irons, table and cooking utensils, stoves, motors for sewing machines, &c. While the company does not seek to sell apparatus or appliances, it may eventually carry a small stock of articles that local firms do not handle. When business picks up again the activities of the Sociedad de Electricidad may be expected to lead to an increased demand for electric appliances and supplies at Rosario.

BRAZIL (PERNAMBUCO).—Considering its population of some 250,000, Pernambuco's present demand for electrical supplies is small, but as soon as the plant now nearing completion is ready to furnish current to the city—which will be about May 1st—an opportunity will be presented for the introduction of electrical materials of all kinds. Manufacturers and exporters of such goods are advised to begin immediately to study the conditions on the market and to make satisfactory business connections with a view to extending their trade later in this district, inasmuch as Pernambuco is the distributing point for many small cities, some of which already have electric lighting and power stations, and others are now arranging for the installation of such plants. Olinda, a suburb of Pernambuco, but having a separate municipal Government, has its own lighting plant. It has been reported that a concession for an electric lighting and power plant at Goganna, a city of about 15,000 inhabitants, some 50 miles north of Pernambuco, has been granted to a Brazilian company, which contemplates erecting a 200-KW. station and also a 100-KW. auxiliary hydroelectric plant. Maceio, the capital of the adjoining state of Alagoas, Parahyba, the capital of the State of the same name north of Pernambuco, and Natal, the capital of Rio Grand do Norte, have electric lighting and street railway systems.

COLUMBIA (CARTAGENA).—Electric stoves have not come into use as yet in the Cartagena Consular district. The old-fashioned Spanish clay stove, burning charcoal, still holds first place. Electric stoves would prove far too expensive for the vast majority of families in this section. Further, the electric light and power company furnishes current during the night only; a uniform charge of $1.50 per month for one 16-C.P. light is made. There is no meter system. There has been some discussion regarding the installation of a larger and more modern plant, but no definite steps have been taken, and it is probable that nothing can be done until commercial conditions improve considerably.

VENEZUELA (MARACAIBO).—Electricity for lighting purposes is now in general use throughout the larger towns of the Maracaibo district, but the fact that power is supplied only at night effectively eliminates a trade in electrical household articles, such as irons, stoves, vacuum cleaners, and washers. Beauty in lighting is not striven for; there is scarcely any attempt to conceal the wiring, and the call for electroliers is slight. Electrical signs and advertisements are unknown here. Wire and wiring materials are imported direct by the companies supplying the power; hardware firms handle a small number of portable lights, electroliers, telephones, &c.

Electrical Trades Benevolent Institution.—At the annual general meeting that is, as already announced, to be held at the Institution of Electrical Engineers, Victoria Embankment, W.C., on Monday, April 19th, at 6.30 p.m., the report and accounts for 1914 will be submitted, and the following members of the Committee of Management, who retire by rotation, will be eligible for re-election:—Messrs. E. J. Clark, Guy Burney, H. Bevis, H. H. Berry, Lt.-Col. H. M. Leaf, Lord Vaux of Harrowden, F. J. Walker, R. J. Wallis-Jones, and S. D. White.

WAR ITEMS.

Trade with Italy.—The present war will no doubt be the cause of a considerable set-back to German trade in Italy, but it will only be temporary unless United Kingdom firms awake to the fact that more practical and up-to-date methods must be adopted for cultivating the Italian market. Since the last years of the nineteenth century, German trade with Italy has increased proportionally by leaps and bounds. This is the result of perseverance and adaptation, not of chance, and British firms interested in the Italian market should bear in mind the following points to which German export commerce owes a great deal of its success, viz.:—

Representation.—The German trader cultivates his market either by personal visits or else by means of well-trained commercial travellers speaking fluent Italian, whereby personal contact with customers is established. On the other hand many British traders conduct their business in Italy by correspondence with agents they have never seen.

Quotations.—The German trader invariably quotes in Italian currency or in French gold, and in metric weights and measures, preparing his catalogues and price-lists accordingly, whereas his British competitor usually seriously handicaps himself by quoting in £ s. d. and in British weights and measures, so that calculation and comparison are extremely difficult for the Italian buyer.

Delivery.—Most German traders will deliver "franco domicile," thus saving customers the trouble of calculating freight, duty, carriage, etc. Or his quotations are at least given c.i.f. port of disembarkation, whereas British offers are still often merely made f.o.b. British port.

Credit.—Thanks to his system of personal contact with customers, the German trader is in a position to judge what credit may safely be granted, and is thus generally able to give much easier terms of payment than his British competitor. In spite of the long credits often conceded, it is said that the Germans very seldom made bad debts.

Trade Grouping.—The system in vogue in Germany of grouping several large firms together to work in conjunction, no doubt had the effect of assisting German penetration. If an extensive and complicated industrial plant is required, it is difficult to find a British firm to supply all the different parts, and still more difficult to find that the various units combine in such a way as to make a perfect whole. Most British firms are specialists, and in order to favour British contractors, it is necessary to sub-divide contracts, giving rise to difficulties, besides the trouble the customer has in treating with several contractors.

The majority of solid people in Italy would prefer to do business with the United Kingdom if only things were made easier for them. The British manufacturer should therefore be much more painstaking as regards the Italian market, and advantage should be immediately taken of the present conjuncture to establish a firm footing, for otherwise it is to be feared that, after the war, Germany will rapidly make good the ground she now seems to be losing. Discouragement should not be felt if profitable business does not immediately ensue; close quotations, reasonable credit terms, perseverance and adaptability, will be required, and with regard to the language, if it is not possible to use Italian, French will be found very useful. Representatives of British firms travelling Italy will be afforded assistance at the various offices of this Chamber, especially with regard to suitable agents, likely buyers, interpreters, etc. The Chamber is prepared to receive and exhibit in its Genoa offices, free of charge, any small samples or catalogues of British merchandise that may be sent to it; catalogues should be sent by book-post, small samples as "samples, no value," but registered.—"Bulletin of the British Chamber of Commerce for Italy."

Science in Industry.—Sir William Lever, presiding recently at the annual meeting of the London Commercial Travellers' Association, said that they heard a good deal about capturing German trade. As reported in the "Financial Times," Sir William Lever said that when they talked in a narrow way of antagonism with the enemies of their country they must not let the war obscure their view of the fact that countries were dependent upon each other in regard to commerce. We had in this country the finest material and all the attributes which made for leadership and for maintaining the initiative, but we had allowed them to slip behind. The technical training which our youths required to fit them for the highest positions in the scientific conduct of business had been neglected. If we were to capture German trade, it could only be done on the basis of the application of greater scientific training in general. They must have a better article to show. If we concentrated on more scientific attainments and found our business outlook enlarged, that would be one of the many useful lessons of this war.

A Melbourne Contract.—According to a report in the "Melbourne Age," for February 10th, at a meeting of the City Council Coun. Cabena, chairman of the Electric Supply Committee, submitted a report on the tenders which had been received for the supply of a 5,000 kw. turbo alternator for the city power house. He stated that about sixty tenders had been received, the most favourable being that from the British Westinghouse Electrical and Manufacturing Co., of £15,111 for the plant, and £1,015 for spare parts. In accordance with a previous resolution of the Council, the Finance Committee had asked for a statement from the company as to whether any German or Austrian material, manufacture, or capital, would be employed in supplying the plant. The Committee had received a sworn affidavit from the Melbourne manager of the firm stating that out of 2,432 shareholders in the company, representing a capital of £1,150,000, there were only five persons whose names appeared to be German or Austrian, and these only held shares to the amount of a little over £2,000. "I believe," said Coun. Cabena, "that it would be practically impossible to get any large concern that is nearer to being an all-British company." Coun. Davey said he agreed with the remark of Coun. Cabena that it was very difficult to get any large company without a small amount of German capital. But were they going to discriminate between a small amount and a large amount? He did not think the case was any worse or better than the case of Siemens Brothers. As they did not exclude consideration of Siemens Brothers' tender, he certainly supported the recommendation, which was unanimously adopted.

Sydney Contracts.—It is reported in the "Sydney Morning Herald" that on February 9th, at the City Council meeting, a letter was read from the British Trade Commissioner (Mr. G. T. Milne) pointing out that, if the recommendation of the Works Committee, that no contract be entered into with a British firm unless all the shareholders were British, was carried, the interests of a number of bonâ-fide British concerns would be gravely prejudiced. Under the conditions of modern industrial finance, and owing to the international character of Stock Exchange operations, some of the shares of a company strictly British in character might be held by foreigners without in any degree modifying the company's essential character. Its capital might be wholly employed in the United Kingdom in the manufacture of goods wholly made by British workmen, and so long as the majority of the shares were held by British subjects the company should be regarded as British, not only because of its being registered in the United Kingdom, but actually. If at the outbreak of hostilities some of the shares happened to be held by, say, German subjects, this in no way affected the British character of the concern, so long as the number so held represented a minor portion of the capital. If the Council adopted the recommendation of the Works Committee it would, in his opinion, defeat the patriotic purpose and intention embodied in its previous resolution regarding British preference, and would also aid neutrals, and by doing so divert money from Imperial channels.

British Trade with Russia: A Suggestion from Petrograd.—In a letter received by us in reply to a communication addressed to the Russo-British Chamber of Commerce, 4, Gorochovaia, Petrograd, the Secretary says:—"In Russia there is a great desire to deal with British firms of high standing, and we ask you to kindly make known to your readers that any firms desirous of exporting their goods to Russia, or of appointing agents or opening branches here, can apply to this Chamber, giving references, and also send their catalogues for the Special Collection of Catalogues of the Chamber." We are sure that British manufacturers will not be slow to take advantage of this invitation.

British Trade with China.—Reuter's correspondent at Hong Kong reports that the local Hong Kong Press displays a good deal of anxiety concerning the outcome of the negotiations between Japan and China, and reflects feelings strongly held by British merchants in expressing a strong hope that an official announcement will shortly be forthcoming from the British Government demonstrating that no trade monopolies imperilling British commerce are to be apprehended.

Manufacturers and Electricity Works Extensions.—The Employers' Parliamentary Association, at a meeting held in Manchester recently under the presidency of Sir Charles Macara, adopted the following resolution:—"That this meeting is of opinion that permission should be accorded to the Manchester Corporation, and to other Corporations similarly situated, by His Majesty's Treasury, to raise fresh loans for the purpose of the extension of any electricity undertakings, as any refusal to secure permission would hamper to a very considerable extent those firms engaged on Government contracts who are dependent upon the Corporation for their supplies of motive power, and this Committee is emphatically of opinion that where it can be shown by any Corporation that the extension of electricity plant is necessary for an adequate supply of motive power on account of the additional requirements of firms engaged on Government contract work, on application by the Corporation concerned, permission to undertake such extensions ought to be granted with all possible expedition."

Board of Trade Assistance.—The Commercial Intelligence Branch of the Board of Trade has issued List No. 14 of articles which enquirers desire to purchase. This list is of inquiries received during the week ended March 27th, and contains the following:—Bakelite; electrical apparatus and accessories—bells, black vitrite for lamp caps, caps for electric incandescent lamps, electric light fittings, ignition devices and accessories, insulators (moulded and porcelain), metal cases for pocket lamps, white flame carbons (18 m.m. cored) for lamps for photographic purposes, galalith material; lighting plant; searchlights; [illegible] and electric massage machines; tungsten.

Munitions of War: Additional Labour.—With reference to the appointment of a Committee to take the necessary steps to provide additional labour for ensuring a sufficient supply of munitions of war, Mr. Herbert G. Riddle, Secretary, Society of Model and Experimental Engineers, writes to the "Standard" as follows:—"In view of the expressed opinions of the leaders of the Government as to the difficulties of manufacturing munitions of war and the acknowledged shortage of labour, the Society of Model and Experimental Engineers desires to call attention to the existence in this country of the considerable amount of mechanical ability and experience possessed by people who are not professionally occupied in engineering. No doubt many of these would be willing to offer themselves for service in Government workshops if suitable conditions of employment could be arranged. The society suggests that the Government consider the formation of an industrial branch of the Royal Engineers, in which such men might enlist without having to conform to the existing military standards. The proposal might also attract trained workers whose services are not at present being utilised for Government work."

Anglo-Russian Trade.—At the meeting of the Hull Chamber in March, Mr. Bernard Barton presiding, a letter was read from Mr. A. Bournasheff, Russian Consul at Hull, stating that the success of German imports into Russia was due to (1) the adjustment of the manufacturers to the demands of the Russian markets; (2) the extensive credit given to Russian buyers; and (3) sending goods on commission, thus keeping stocks in Russia and avoiding the necessity of ordering the same every time from abroad. He suggested further that the success of British imports would depend upon the willingness of the English manufacturers to send their goods on credit and also on commission to Russia, and he gave the name of Mr. Tcheremicinoff as the agency from whom reliable information as to credit of Russian firms could be obtained.—"Chamber of Commerce Journal."

London Electrical Engineers (T.R.E.).—On Friday, March 26th, a dinner and smoking concert was held at the Feathers Hotel, Westminster, by No. 15 Squad of this Corps. An excellent programme made the time at their disposal pass very quickly, and a notable item of the evening was the presentation of a framed photograph of the members of the Squad to the Chairman and Instructor, Sergt. W. Robinson, who responded with an appropriate speech. The members were fortunate in being honoured by the presence, as guests, of the senior N.C.O.'s of the regiment, each of whom contributed a few well-chosen remarks. The proceedings closed with a vote of thanks to the Chairman, Auld Lang Syne, and the National Anthem.

International Metal-Workers.—The "Times" states that it is now proposed to change the headquarters of the International Metal Workers' Federation from Berlin to London. The membership, according to an official statement just issued, numbers 912,707. Germany is represented by 544,000, and Great Britain by 115,000. The new president of the British section is Mr. J. T. Brownlie, of the Amalgamated Society of Engineers.

No Obstacle to Recruiting.—The Bolton Tramways Committee has authorised the manager to grant, without condition, permission to any employé who may wish to join the colours, notwithstanding that men so leaving will necessitate a reduction in service.

Personal.—The "Times" states that the Headquarters of the Mechanical Transport Column of the City of London National Guard Volunteer Corps are now at the offices of the Commercial Motor Users' Association, 83, Pall Mall, S.W., and that Colonel R. E. Crompton, C.B., has been appointed Hon. Commandant.

Mr. J. J. McMahon, electrical engineer in the overhead equipment department of the Manchester Corporation Tramways undertaking, was a passenger on the ill-fated "Aguila," which was recently torpedoed, but a message received in Manchester last week stated that he was one of a party who got safely away in a boat, and was rescued. He was taken on board the "Lady Plymouth," which proceeded to Madeira. Mr. McMahon has not been well recently, and, being one of the important officials in the service of the Manchester Corporation who had to forego his holiday last year, he decided to make a trip to the Canary Islands.

Mr. A. W. Mulliner, of the Eccles Corporation electricity department, has been gazetted a lieutenant in the King's West Surrey Regiment.

Mr. John Hodgson, until recently an accounts clerk at the Anchor Cable Works, Leigh, who enlisted as a private in the Army Service Corps in September last, has worked his way up until now he holds the position of warrant officer, although he is only 20 years of age. It is suggested that he is possibly the youngest warrant officer serving in H.M. Forces.

In a lengthy list of Aliens, to whom certificates of naturalization were granted during March, there appears the name of Morten Dahl Röer (Norway), electrical engineer, Leith.

Roll of Honour.—Private J. H. Caine, of the 1st Loyal North Lancashire Regiment, formerly employed at the Darwen electricity works, has been killed in action. He was 40 years of age, and has left a widow and two children.

Private J. Barrett (single), aged 30, formerly a Manchester Corporation car driver, has been killed in action.

Private Frederick Harkness, 1st Battalion Grenadier Guards, a former employé at the Manchester Corporation Electricity Station, Dickinson Street, was killed in action on March 10th. He served through the Boer War, and re-enlisted in his old regiment when the present war broke out. He leaves a widow and five children.

Mr. Albert Gay, borough electrical engineer, of Islington, has sent us a photograph of a Roll of Honour of the employés from the works—26 in number—who have joined the Colours. The roll, which is artistically designed, is the work of Mr. W. E. Bradshaw, the mains superintendent; the original is executed in colours.

TELEPHONE TROUBLES IN THE TROPICS.

By W. LLEWELLYN PREECE, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *on March 25th*, 1915.)

The climatic and other consequent troubles experienced give the engineer who is responsible for the maintenance of a telephone system in a tropical country more worry and anxiety in one week than his colleagues elsewhere experience in a year. The main troubles are due to the damp, and to the many natural effects caused by damp heat. In many places the humidity of the atmosphere varies between 80 and 90 per cent., and this damp heat produces a marvellous growth of vegetation, while insect life is as prolific as the vegetation, and sometimes even more trying.

Lightning has a virulence unknown here. The electrical state of the atmosphere has an effect on the human nerves which seriously disturbs one's temper. Even wild animals do their best in some places to increase the engineer's labours. For instance, in some parts it is not unusual to have a mile or two of lines wrecked by giraffes, elephants, or monkeys. The giraffes roaming over the wilds of East Africa come up against a telegraph or telephone line; they have not the sense to draw back and duck their heads under the line, but they push on and on, carrying wires and sometimes the poles with them. As similar troubles are experienced not only in telegraph systems, but also in heavy electrical installations, especially where overhead transmission lines are employed, the author hopes that this paper may be of some interest to all branches of the electrical engineering profession.

Instruments.—So far as white ants are concerned, we find that the use of teak practically prevents their ravages. A swarm of bee-like insects of Nigeria took a great fancy to use an instrument as a hive. Their entrance was the slot of the switch-hook, and the comb formed in the interior was cleared out many times, but each time it was re-formed by the insects, until in despair the engineer had the whole apparatus removed. The spider is a real pest all over the tropics; it builds for itself a nest in the telephone case, so that it is no uncommon experience to find instruments entirely *hors de combat* from the work of this insect.

To circumvent the insect plague it is essential that these telephone cases should be sealed up as closely as possible. The switch-hook should carry a brass plate which keeps the slot in which the arm works entirely covered. It is also desirable to have no terminals above the instrument, but to take the conductors through holes into the case and seal up these holes. Besides this, the internal wiring should be made as simple as possible; the wires must not be bunched together, but well stapled to the body of the instrument in separate ways. It is generally found that enamel insulation with a silk covering is very suitable, though enamel insulation does not always give satisfaction.

In a tropical climate the ebonite sheath of a receiver may become soft and pliable; this is easily remedied by using blocked brass sheaths covered with enamel. In a tropical country a lot of trouble was caused by the insulating block which carried the contact springs in a capsule transmitter of a micro-telephone being warped by the damp heat, so that both springs touched the metal case of the capsule and short-circuited the microphone.

In most of the tropics the faults in the subscribers' instruments caused by lightning are very few, and so long as the engineer takes the precaution to fix the lightning protector at the point where the wires enter the house little trouble need be feared. Where the casual custom of fixing them near the instrument is followed it is not uncommon for the building to be set on fire. Until the protectors were fitted to the eaves of the roofs outside the building walls, the telegraph offices of Northern Nigeria were repeatedly burned down through lightning.

The only other trouble likely to be experienced with the subscriber's instrument is that due to maltreatment by the subscriber himself. The tropical climate is not conducive to an equable temper. Even in this country the vagaries of the telephone cause occasional outbursts; there it is far worse. The owner of a large rubber estate complained bitterly time after time of his instrument; finally the engineer discovered that this subscriber was in the habit of using the mouthpiece of his micro-telephone, which hung from a wall-instrument by his desk, as a cigarette ash tray.

Exchange Switchboard.—Until lately the craving of the tropical engineer was to have the up-to-date central-battery system. There is, however, one obstacle in the way; the maintenance of really satisfactory insulation on overhead lines is almost impossible in the tropics, and if a pressure of 24 or 40 volts was applied to the line, even moderately fair working of the system would be extremely doubtful. The author has therefore set himself strongly against the central-battery board, unless a Government is prepared to place the whole system underground—which is usually prohibitive in cost seeing that some of the subscribers' premises are perhaps 20 miles or more from the exchange.

If this is the case with a central battery, what chance is there of satisfactorily maintaining an automatic system? Not only are we to expect insulation troubles with the high pressure on the lines, but there are also the intricate selectors and pre-selectors and other apparatus which would have to work in a climate capable of causing trouble even in a simple magneto system.

At present the author is entirely in favour of a magneto system, using either mechanically-restored indicators or incandescent lamps controlled by relays.

Experience of enamelled wire has shown that in the tropics it is not altogether satisfactory, especially for small-gauge windings of coils. Two colonies had boards equipped with enamel-insulated wires throughout, but in a very short time various relays failed. On making inspection it was discovered that there were disconnections in their windings. On unwinding the coils, tiny green spots were seen, apparently caused by the damp acting on the copper. This could only be accounted for by assuming that these very fine wires do not, when passing through an enamel bath, pick up the enamel evenly, and either there was at various points a very thin coating of enamel, or else no coating at all. As soon as these coils reached a tropical climate, the damp atmosphere, often laden with salt from the sea, soaked into the coil and acting upon the copper at these weak points ate it through. The only conclusion we can come to is that simple enamel insulation is not suitable for very fine gauge wires, but for all other purposes it certainly seems to give entire satisfaction. We are now in search of something more satisfactory for these coils, which cannot be said to be the case with either silk, cotton, or wool. These faulty coils are at present being replaced by others insulated with silk, the whole coil being then dried in a vacuum, and placed, whilst there, in a bath of "Voltalac," so that this insulating varnish may work its way right into the heart of the coil. It may possibly be sufficient to treat enamel-insulated coils with this "Voltalac," in which case there would still be the advantage of having the coils small. This will be tested shortly. The one drawback to the use of an insulating varnish is that, should any fault occur in it, the complete coil must be scrapped, as unwinding and rewinding on the spot is out of the question. On the other hand, faults in such a coil should be extremely rare, even in the tropics.

Certain types of the mechanically-restored indicators have also given some trouble, especially the "eyeball" type. This is sometimes owing to dust and damp clinging to the eyeball and preventing it rotating. One board of this type which was sent to the tropics had the eyeballs mounted on steel pins; in a very short time these pins rusted badly and "seized." For tropical climates, wherever it is essential to use iron or steel the metal must be galvanised, "coslettized," or coated with some other non-rusting material. The plain metal rusts most rapidly and invariably leads to breakdown. Where phosphor bronze or gunmetal can be used, they are far superior to steel. Even the steel tips on the plugs, though used daily, will have a complete coating of rust in the morning after the night's rest.

The question of operators causes the traffic department considerable worry. In the majority of tropical places it is impossible to employ European operators; for such work the Governments have to rely on half-caste girls or native men, neither of whom, with rare exceptions, have mental equipments comparable with those of European women. With the only available operators, 60 lines to a position is all that can be managed in some places, and 80 lines per position is generally quite as much as can be handled.

One other most trying and frequent worry in an exchange is the objection that subscribers have to "ringing off" after a conversation. To avoid this source of annoyance and the consequent delays in freeing cord circuits, an automatic clearing signal has been fitted to all the boards in the Malay States, even to those for 50 subscribers.

Line.—The normal type of overhead construction now employed in most tropical countries is fairly well standardised. The poles used are either wrought-iron taper tubes with cast-iron bases, or are built up of tubes of riveted sheet steel. In most parts it is hopeless to use wood poles, owing to the prevalence of white ants, which in a very few years demolish the whole of the interior of such poles. The arms, on the other hand, are fairly often of this material, for the white ant will not work its way up 15 or more feet of iron tube to reach these arms, and in some countries most excellent hard wood is obtainable locally.

Where hard wood is not obtainable, tubular iron arms are employed. These arms carry 6, 8, or 12 Cordeaux porcelain insulators, mounted on iron stalks. The very best practice is followed as regards workmanship and finish, yet the average insulation of these lines is very low. The atmosphere, with a humidity of 80 or 90 per cent., naturally has considerable effect in reducing the insulation resistance.

A more troublesome factor, however, is the vegetation; more troublesome in that, whilst the clearing-away of these trees would be of very great assistance in keeping up the insulation resistance, the high cost of doing this in most places, and the reluctance of the Government and the public to allow this work to be carried out, hamper the engineer.

In the towns and suburbs underground cables would obviate the trouble; outside the towns, however, the roads run through dense jungles or thick plantations of rubber trees or coco-nut palms. The normal clearing for roads is 60 ft., but in practice such a clearance is often not maintained; and with even 60 ft. clearings the line must be within 20 ft. of the trees at the best, and is actually often less than 10 ft. Unless a further 50 ft. clearance is made on the side of the line away from the road, and properly maintained, contacts and breakages due to falling trees must remain almost a daily experience. The expense of keeping down the undergrowth is also a considerable annual charge.

Another line trouble that the tropical engineer is bound to experience is caused by insects, some of which delight in making their homes between the petticoats of insulators. The author has seen an insulator so covered with a spider's nest as to be itself invisible, the base of the nest being on the arm and the apex above the insulator. Constant attention on the part of the line men is necessary to prevent the insects getting such a hold on the insulators. It is quite usual to find, formed in a single night, webs glistening with dew and connecting the wire to the insulator stalk, the insulation resistance of the line being reduced as a result to a few ohms. Oil insulators are useless. Mr. Guthrie Spain, the telegraph engineer of British Guiana, first brought to the author's notice the fact that insects will not enter glass insulators. The author is told that glass insulators are used in Cuba for this reason. Apparently these insects prefer a dark place for their home, which obviously is not the case when the insulators are made of glass. The author is inclined to think that if oil insulators of glass could be easily obtained, considerable improvement in the insulation should result.

Another widespread source of line trouble in the tropics is lightning. In many places thunderstorms are of almost daily occurrence throughout the greater part of the year. In certain towns a single storm will often result in 50 per cent. or more of the subscribers' telephone lines being earthed at the pole boxes, this being caused by the strong discharges through the protectors to earth, which carry so much carbon dust across the gap as to place the two carbon blocks in contact; so that practically after every storm a number of line men had to be sent to all those boxes to clean the protectors.

This trouble can, however, be cured to a great extent by using the vacuum type of protector, in which the two carbon blocks are inserted in an exhausted glass tube, the opposite surfaces being serrated and fixed about 1/16 inch apart. These protectors are now used to a considerable extent by Mr. Cadman in the Malay States, and are, the author believes, found to be quite satisfactory. Occasionally an extra heavy discharge will burst the tube, but they are very easily replaced. This possibility, however, makes it essential that fuses shall also be inserted, for if a discharge were so heavy as to burst the protector, the line would be no longer protected and a subsequent discharge might damage the cable seriously.

The one disadvantage of these protectors was their size, which involved the use of a very large pole box, even for 25 lines; but a new type of box designed early this year has practically solved this difficulty. An earthed iron wire stapled to the tops of the poles, and also connected to their earth-wires, has been found most effective in guarding the lines from lightning.

For underground work in the tropics the usual practice is to use armoured lead-covered air-space cables terminating in boxes on distribution poles, and hitherto the engineers have followed the British Post Office practice of making the joints so that dry air can be periodically pumped through. The author is inclined to think that the American solid joint would give much less trouble. If the cable were well sealed with paraffin wax immediately it was opened for jointing, the damp could not enter it unless the lead covering was damaged. If such an accident did happen, the length would have to be replaced. Exactly the same result must, however, occur if the practice is to employ open joints and dry air pumping. Once the damp has the chance of entering a cable in the tropics, no amount of pumping will drive it out completely, and the length must be replaced without much delay.

Armoured lead-coloured cables are normally very free from faults, except those due to [illegible] the roads. There is in Shanghai a curious flying insect which is able to bore holes in which to lay its eggs in the lead covering of overhead cables, but the author knows of no case in a tropical country where [illegible] lead-covered cable, or where the damp has caused faults if the joints are securely protected. In low-lying water-logged soil it has been found desirable to lay the cables in troughs filled with bitumen, but otherwise armoured lead-covered cable gives extremely little trouble.

Staff.—The last trouble peculiar to the tropics to which the author wishes to refer concerns the local staff. It would obviously be far too expensive to obtain from England [illegible] only engineers but inspectors, foremen, and line men. Speaking generally, no white man can live in the tropics—with any pretension to comfort—on less than £250 per annum; and in countries where the men have to pay for their voyages home and back when leave is granted, they should receive about £300 per annum if there is to be any chance of keeping them contented. As such salaries are prohibitive, native labour is essential for the lower grades on the technical staff. Unfortunately, whilst these natives can be trained by the engineers, they must, unless a complete white superintending staff is provided, be left very largely to look after themselves in carrying out their duties. Most natives have not the smallest conception of responsibility, nor have those who are made inspectors any power of command. Thus the engineering department is largely dependent for the maintenance of lines on native linemen, who are very much inclined to neglect their work, and on native inspectors who have no power of controlling these linemen, and who are equally ready to slack; whilst in the majority of the tropical colonies the chief engineer is kept too short of technical assistants to allow of proper supervision of this native staff.

This is largely due to the somewhat unfortunate but universal practice of making the telegraph and telephone department a branch of the Post Office. For as the engineer is a subordinate officer in the postal department, he naturally ranks with postal subordinate officers, although the whole responsibility of the maintenance and extension of the telephone and telegraph systems of the colony rests on his shoulders. In consequence of this practice, the engineer's salary is in every case lower than it should be. Further, as his superior officer and the heads of the Government are very rarely technical men, they are unable, in many cases, to appreciate the desirability of the engineer's proposals, nor do they realise the importance of allowing the chief engineer a sufficient number of trained assistants, or, often, of granting reasonable salaries.

As it is now, the technical appointments in all tropical colonies are too few, and as even these are not made sufficiently attractive, it is difficult to fill them.

The tropical engineer, taking things all round, richly deserves our sympathy and also the esteem of the profession for the way in which he steadily tackles this trying work, though almost invariably under-rated, under-paid, and overworked.

OUR LEGAL QUERY COLUMN.

"Law-less" writes:—"Can you inform me if a municipal authority which possesses no special powers with regard to wiring, hiring, show-rooms, etc., is legally justified in opening show-rooms for the display of fittings, apparatus, etc., provided that no articles are disposed of, inquirers being referred to contractors or manufacturers?

"In the recent case of the Ilford Gas Co. *v.* Ilford Council, judgment was given against the defendants on various points, one being that of their show-room, which was ordered to be closed.

"In a note in one of your contemporaries of the 18th inst., it is stated that when the Doncaster and Dewsbury Bills were recently before the House of Lords Committee, a representative of the Board of Trade stated there was no need to include the clause relating to show-rooms, as all authorities already had these powers under the General Act. Is this so and, if so, where may these powers be found as I cannot trace them?"

*** It is difficult to understand why the contention referred to in the last paragraph of this query was allowed to prevail before a Committee of the House of Lords, because there is no *public* Act of Parliament known to this writer which confers any such rights on local authorities supplying electricity. In his notes to S.25 of the Electric Lighting Act, 1882, the learned editor of "Will's Law of Electric Lighting" writes:—"In the absence of statutory authority, undertakers who are a local authority cannot provide lamps, fittings, motors, or apparatus other than meters which are provided for by Ss. 52, 55, and 56 of the Schedule to the Electric Lighting (Clauses) Act, 1899. . . . It is now quite common to find in the special Acts of local authorities a clause enabling them to sell, let, hire, etc., but not to manufacture lamps, meters, electric fittings, apparatus, etc." He cites, as illustrations, the Acts obtained by the following towns: Nottingham, Manchester, Halifax, and Leith. In London, of course, the borough councils are authorised to supply fittings by the London County Council (General Powers) Act, 1906 (6 Edw., 7c. cl.).

As to the first question, if a local authority may not expend the ratepayers' money in the business of selling fittings, it seems reasonable to suppose that no expense must be incurred on things ancillary to such a business.

Prices Advance. — The British Thomson-Houston Co., Ltd., announce that from April 7th there will be a 10 per cent. advance on the price of their electrical fittings.

BUSINESS NOTES.

Catalogues and Lists.—Messrs. J. H. Tucker & Co., King's Road, Hay Mills, Birmingham.—Illustrated and priced folder relating to their new pattern ironclad switches.

Messrs. Bergtheil & Young, Ltd., Finsbury Court, London, E.C.—Booklet containing illustrations and brief particulars of "Bandy" patent single-phase motors. The pictures all represent photographs of actual installations, the motors being used for crane driving, pumps, lifts, transporters, printing presses, &c.

The Coventry Chain Co., Ltd., Spon End Works, Coventry.—Pamphlet emphasising the silence of the "Coventry" chain drives. Also a 72-page catalogue (Engineering Section), very fully illustrated, describing the "Noiseless" chain and its principle and the methods of guiding it on the wheels. Many pages are occupied with tabulated data relating to wheel sizes, chain lengths, teeth, hints to users, and so forth.

Messrs. P. E. Chappuis & Co., 85, Fleet Street, London, E.C.—8-page illustrated and descriptive price list of Chappuis's trough reflectors for "Striplite," tubular and ordinary tungsten lamps; also "Conoid" silvered reflectors.

Messrs. W. N. Brunton & Son, Wire Mills, Musselburgh.—40-page pocket catalogue giving tabulated particulars and prices of their silver steel, drill rod steel, high speed steel rods, and steel wires for hardening and tempering. Copies will be sent to any interested reader on application.

Messrs. Higgs Bros., Sherbourne Road, Balsall Heath, Birmingham.—20-page catalogue containing illustrations of their motor-generators and booster sets, brushgear, "C" type shunt and series motors, from $\frac{1}{16}$ to 25 h.p., "C" type shunt generators, controlling gear, starting switches, &c. A special copyrighted system of listing dynamos is adopted. Prices and dimensional and shipping particulars are tabulated.

Temple Press, Ltd., 7-15, Rosebery Avenue, W.C.—New catalogue of technical manuals, touring handbooks, &c.

British Thomson-Houston Co, Ltd., Rugby.—Illustrated price list No. 7,100B, giving particulars of B.T.H. fan motors and exhaust fans.

Staff Supper.—About 30 members of the headquarters (Manchester) supply department staff of the British Westinghouse Electric and Manufacturing Co., Ltd., sat down to an excellent hot-pot supper at the Exchange Hotel, on Monday evening, March 29th. Afterwards there was a smoking concert, at which Mr. J. Gibson (manager of the supply department) presided, 50 members of the supply staff and a few specially invited guests being present. During the evening the chairman said that so far as the turnover of the department was concerned they had been successful to the extent of an increase of about 30 per cent. He felt sure they missed several old faces, particularly that of his chief assistant, Mr. G. Ellam. As they all knew Mr. Ellam had been away many months in Russia, and he was doing good work for the department. Before sitting down he asked them to drink silently to the memory of those who owing to the war would never return. During the evening the following toasts were enthusiastically honoured:—"The King," proposed by Mr. J. Gibson; "His Majesty's Forces," by Mr. L. E. Wilson; "The Westinghouse Co.," by Mr. W. S. Robson, this toast being responded to by Mr. W. J. Hollick; "Our Visitors," by Mr. A. Pougher, responded to by Mr. L. E. Wilson; "Our Chairman," by Mr. H. H. Bent, responded to by Mr. J. Gibson. The following artistes contributed to the entertainment of the company:—Messrs. A. Pougher and T. Jackson as pianists, Mr. A. Pougher (flautist), Mr. T. E. Kenyon (humorist), Mr. T. Clough (elocutionist), Mr. O. C. Oakley (baritone), Mr. W. S. Robson (violinist), Mr. McColl (humorist), Mr. F. Freeman (elocutionist), Mr. D. E. Elliott (Newcastle dialect recitation), and the "Inharmonius Four," who caused great merriment by their vocal efforts. The proceedings terminated with the singing of "Auld Lang Syne" and "God Save the King."

Charge of Stealing. — Sentence. — Before Judge Rentoul, at the Central Criminal Court, on Tuesday, Raoul de Redon, 32, electrician, pleaded guilty to counts of an indictment charging him with stealing one electric battery, and one X-ray tube, the goods of the Governors of the London Homœopathic Hospital, one X-ray tube and one milliamperemeter, from the West London Hospital, one X-ray tube from the Royal Free Hospital, and similar articles from Hampstead General Hospital, and Guy's Hospital. Counsel for the prosecution said that, for some time past various articles had been missed from the surgical departments of London Hospitals, and, information being given to the police, inquiries were made, which resulted in the arrest of the accused, who, it was alleged, had been found dealing with the stolen articles, soon after the thefts, for sums of money considerably below their cost price. It was stated that the hospital authorities had been put to the greatest trouble and inconvenience in consequence of the theft of X-ray apparatus and other surgical appliances. Judge Rentoul sentenced the prisoner to three months imprisonment in the second division.

Liquidations. — Otis Elevator Co., Ltd. — This company is winding up voluntarily, with Mr. R. P. Sellon as liquidator. A meeting of creditors is called for April 14th.

Spanish National Submarine Telegraph Co., Ltd.—This company is winding up voluntarily, with Mr. J. Jeffery, of 106, Cannon Street, E.C., as liquidator. A meeting of creditors is called for April 12th.

Bankruptcy Proceedings.—George I. T. Parfitt, 11, Priory Road, Keynsham, near Bristol, Somerset, consulting electrical engineer.—The receiving order in this matter was made on the petition of a creditor, the act of bankruptcy being the failure of the debtor to comply with the requirements of a bankruptcy notice served upon him. According to the statement of affairs the liabilities amount to £2,024, to meet which there are no assets. It appears that until 1888 debtor was employed as an electrical engineer, but at that date he and his brother-in-law took over the book debts and liabilities of an electrical engineering business carried on at 9, Denmark Street, Bristol. They paid £320 for the goodwill and stock-in-trade, and continued the business under the style of Parfitt, Webber & Co. Debtor introduced a capital of about £300 on commencing, and has since put in further capital, amounting to about £1,700, while his partner has from time to time introduced capital of about £600. In 1912 the partnership was dissolved, the partner going to South Africa, but no formal dissolution took place, and the business was continued by the debtor. The partner returned from South Africa about the end of 1913, and on January 20th, 1914, they transferred the business to the Colston Electrical Works, Ltd., in consideration of £1,650, payable in £1 ordinary shares, of which 450 were allotted to Mr. Webber (the partner), 450 to the debtor, and 450 to his sister, in consideration of moneys advanced to the firm, 200 to the manager of the business for wages and money advanced, and 100 to Mr. E. Brock for services rendered to the firm prior to and on the formation of the company. The company took over the whole of the assets and liabilities, with the exception of £420 owing to seven trade creditors and the overdraft at the bank, which amounted to about £750. Certain payments have since been made to these trade creditors on account of their claims. Debtor has undertaken several contracts for the supply of electrical plant and fittings. A full set of books was kept prior to the sale of the business to the company, but no books of account have been kept since that time. The failure is due to losses for goods supplied to, and through guarantees given for, a certain firm, which went into liquidation, and loss of business occasioned by the war, and debtor admits knowledge of his financial position last October. The following are the creditors :—

Crompton & Co.	£20
Edison-Swan Co., Ltd.	112
General Electric Co.	25
Higgins & Sons, Ltd.	22
Fletcher & Co.	84
Siemens Bros. & Co.	64
Willey & Co.	71

H. J. Godfrey, electrical engineer, 188, Balham High Road.—Last day for proofs for dividend April 16th. Trustee, Hon. W. J. H. Boyle, Official Receiver, 132, York Road, S.E.

Private Arrangements.—The British Prometheus Co., Ltd., Salop Street, Highgate, Birmingham, Warwick.—The following are among the creditors :—

Attwater & Sons	£21	Jaroslaw, D.	£56
Bridgwater, W., & Sons ..	35	Meakin & Parkes, Ltd.	38
Clane Manufacturing Co. ..	19	Pugh, E., & Co.	179
Doulton & Co , Ltd.	125	Prometheus G.M.B.H.	72
Diamond Foundry Co.	43	Restall, Round & Gloster ..	84
Electrical Press, Ltd.	46	Rigby, Robt.	78
Electrical Review	62	Von Schwartz, J.	20
Electrical Times, Ltd.	38	Siemens Bros. Dynamo Works Co.	24
Edison & Swan, Ltd.	50	Voight & Haeffner England, Ltd.	26
Electrical Printing Co., Ltd. ..	16	Wacker & Doerr	40
Forman, T., & Sons	15	Haselwood & Dent	20
Hoskins & Sewell, Ltd.	17	India-Rubber & Gutta-Percha Co.	20

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LIII, No. 245. April 1st, 1915.—This issue contains papers on "Electric Cooking, mainly from the Consumers' Point of View," by W. R. Cooper ; "Registering Trains of Electricity Supply Meters," by S. Evershed ; "Dimensions of Transformers," by A. R. Low ; "Relation Between Flux and Magnetising-Current Waves at High Flux Densities," by A. L. Tackley ; "Distribution and Rise of Temperature in Field Coils," by Prof. M. Maclean, D. J. MacKellar and R. S. Begg ; and "Electric Furnaces," by T. D. Robertson. London : E. & F. Spon. Price 3s. 6d.

"Submarines, Torpedoes and Mines." By W. E. Dommett. London : Whittaker & Co. Price 1s. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV, No. 3. March, 1915. New York : The Institute. Price $1.

"Scientific Papers of the Bureau of Standards." No. 239, "A Vibration Electrometer." No. 234, "Insulating Properties of Solid Dielectrics." Washington : Government Printing Office.

Trade Announcements.—Messrs. Parmiter, Hope and Sugden, of Manchester, have opened a London office at Queen Anne's Chambers, Westminster, under the direction of Messrs. Nathan & Allen. Samples of the new Fluvent fuse system may be seen there.

Messrs. Newton Bros., electrical and mechanical engineers, of Derby, have converted their business into a limited company (Newton Bros. (Derby), Ltd.). All debts and liabilities of the firm are undertaken by, and all debts due to the firm are to be paid to, the company. The directors are Mr. C. A. Newton, Mr. R. Newton and Mr. H. Newton, and the constitution and control of the business will be precisely as heretofore, the alteration not in any way interfering with the management or scope of the undertaking.

Larger premises at 329, Lord Street, Southport, have been opened by Messrs. T. Wainwright & Sons, Ltd., electricians.

Italy.—An agent in Milan desires to represent United Kingdom manufacturers of parts of electrical and mechanical plant. Inquiries should be addressed to the British Consulate, Milan.

LIGHTING and POWER NOTES.

Australia.—According to the *Sydney Evening News*, an agreement was practically reached between the North Sydney Council and Sydney City Council, for the latter to carry out the electric lighting in North Sydney.

The proposal for the Sydney Council to purchase a coal mine has now been abandoned.

Singleton (N.S.W.) is considering the question of an E.L. installation, and two estimates have been obtained.

Barking.—New Plant.—The Electricity and Tramways Committee has adopted the recommendation of the acting electrical engineer for the installation of a 1,000-kw. Ljungstrom turbine set at the electricity works.

Barrow.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £12,500 for the electricity undertaking. The Council approved of £124 being distributed amongst the staff of the electricity works as remuneration for the extra work thrown upon it in connection with the extensions carried out during the past 18 months.

Blackburn.—The T.C. has decided to apply to the B. of T. for consent to the construction of a generating station on land at Whitebirk recently leased by the Corporation.

Boston.—E.L. Scheme.—The R.D.C. has, on the invitation of the B. of T., decided to send representatives to confer with other interested parties on the proposed E.L. scheme for the district.

Cahir (Co. Tipperary).—Proposed E.L.—A public meeting has considered proposed increases in the prices of gas, and decided to form a company for the introduction of electric lighting. A committee was appointed to deal with the matter.

Chelmsford.—Restricted Lighting.—The Electric Supply Corporation, Ltd., has offered a rebate of £112 in respect of the public lighting account for the quarter ending December 31st, on account of the restricted lighting.

Colne.—A Sub-Committee of the T.C. is considering the question of adopting an optional system of charging for electricity on the rateable value basis, with a secondary charge of, say, ¾d. per unit for current consumed through one meter for all purposes.

Croydon.—The charge for electrical energy for lighting on the flat rate has been increased by ½d. to 4d. per unit as from March 25th. It was stated that the increased cost of coal was equivalent to an increase of £9,000 per annum ; the extra charge would bring in £3,000 to £3,500. The Committee is going into the question of increasing the charge to the tramways, which it is believed, with one exception only, is the lowest in the kingdom.

Darlington.—Proposed Loan.—A loan of £3,400, to cover the cost of additional plant required for the proposed supply to the North-Eastern Railway Co., has been applied for by the T.C.

Dublin.—Electricity Report.—In compliance with the resolution of the T.C., the city treasurer and city accountant have issued a report on the financial side of the Corporation electricity undertaking for the seven years ended March 31st, 1914. This contains a great many figures, from which we abstract the following :—Total capital borrowed, £790,717 ; indebtedness, £592,844. Deficits since 1907-8 total £16,270 and surpluses £30,814. The amount paid by levy from the rates was £4,147, and paid by the undertaking in relief of rates, £5,500. The consumers increased from 1,687 in 1908 to 6,372 in 1914, and the units sold from 2,720,226 to 7,091,729 in 1914.

During the seven years to March, 1914, £299,811 was expended on capital account. The total amount levied upon the rates since the inception of the undertaking in 1891 was £52,174, the net amount standing at £46,674 for 23½ years. In the last 10 years no charge has been made on the rates, and some £1,363 has been paid in relief of them. In the five years to 1913-14 the revenue from consumers rose from £38,354 to £87,810 ; for the year 1914-15 to March 18th receipts from private consumers (excluding Corporation departments) amounted to £85,733, an increase of £10,813 on the corresponding figure of the previous year.

While power and heating supplies increased to over 43 per cent. of the private supply in 1913-14, the load factor only increased from 13·47 to 13·99 during seven years, and the reporters suggest consideration of the regulation of the proportion of the power and heating supply, and the possibility of some differentiation in power rates to ensure that current shall be sold at an economical figure. They also agree with the proposed temporary increase in price put forward by the Electricity Committee.

Gillingham (Kent).—Owing to the increased cost of fuel, &c., the T.C. has, from April 1st, increased all rates for current for lighting by ¼d. per unit.

Messrs. E. J. & W. Goldsmith have asked for an estimate for the cost of connecting the Rainham Cement Works with the mains.

Elland.—The Council has advanced the price of current for lighting purposes, and the prices for power supply will probably have to be increased.

Hereford.—Proposed Loans.—The T.C. has been informed that the application for a loan of £1,000 for services, cannot at the present time be sanctioned, and in consequence no connections will be made until the end of the war to premises where mains do not already exist. A further loan of £8,000 for plant extensions was about to be asked for, but has been abandoned.

Heywood.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £6,440 for electricity purposes.

Holmfirth.—E.L. Scheme.—The U.D.C. has defined the compulsory area on which work should be commenced under the electric lighting order, and has also decided that the building of the generating station should be let by tender in one contract.

Irish Water Power Schemes.—A private company has been formed to carry out extensive electric supply schemes at Belleek in the north, where the waters of Lough Erne would be used, and at Limerick, in the south, where it is proposed to utilise the River Shannon.

Japan.—The Japanese Department of Communications has just issued a revised series of regulations in connection with electrical undertakings in Japan, particularly those connected with the generation and distribution of electrical energy for power purposes. Among the new regulations are conditions with regard to standard periodicities and distribution pressure, provision for the transmission of current from one system to another in case of breakdown, simpler formalities for the conveyance of power plants in accordance with the Factory Mortgage Law, and the stricter enforcement of the official inspection of private companies, power distribution, and supply terms and procedure.

Keighley.—The T.C. has decided, in response to the L.G.B. circular endorsing the requirements of the Committee of Imperial Defence for more army recruits, to permit those of its servants who are not absolutely indispensable to enlist or enter urgent Government services, and that no men of military age, unless they have been rejected in respect of army service within a month previous to the application, should be accepted for employment in the Council's works departments.

The Electricity, Gas and Water Committees have been instructed to confer as to the best means of avoiding a danger arising out of the possibility of the fusing of gas mains which are laid near electricity cables; it was reported that recently an 18-in. trunk gas main had been fused near a large works in the town.

Kingstown.—Electric Supply Arbitration.—Last week Mr. Justice Barton, in the Chancery Division of the Irish High Court, granted an application by the Dublin Southern District Electric Supply Co., Ltd., making an arbitrator's award as to the payment of £3,608, as the price to be given by the Kingstown Urban Council for the electric lighting undertaking a rule of Court. The solicitors for the Dublin Southern District Electric Supply Co., writing to the Dublin Press, point out that the Arbitrator by his award decided that the Kingstown Council should pay £3,608 for the undertaking; the Arbitrator's fees, amounting to £183; and the costs of, and incidental to, the arbitration proceedings and the award. Further, it was pointed out that the Kingstown Council, notwithstanding the fact that a letter had been written to its solicitors that the deed of transfer would be returned approved of immediately the order was obtained, filed an affidavit to prevent the obtaining of an order, thereby compelling the company to bring the motion which had been decided by Mr. Justice Barton. The costs against the Council, and their own costs, will amount to £30.

Leyton.—New Plant.—Application is to be made to the L.G.B. for sanction to borrow £1,000 in respect of new services. The Electric Lighting Sub-Committee has had under consideration a report of the electrical engineer in regard to the necessity of providing additional plant at the generating station, at a cost of £17,158, and in connection therewith an offer of the Hackney B.C. to give a bulk supply. The Council has decided on the provision of additional plant as recommended by the engineer.

London.—Woolwich.—The B.C. has received a letter from the L.C.C. with regard to the application for the balance of the loans required in connection with Globe Lane works extension. In this letter the County Council's Finance Sub-Committee states that it is now in a position to deal with the Borough Council's application for £35,000, but that the balance (£13,000) will have to stand over until a more detailed statement is supplied by the Borough Council, showing how the total estimated cost of these extensions, which amounts to no less than £77,000, is arrived at. From a statement of the loans to be dealt with, it appears that the total amount of loans granted for 42 and 39 years for plant and machinery is £64,732, and the condition proposed to be attached to the Council's loan sanction is that the amount outstanding at April 1st, 1920, in respect of this sum be repaid within one-half of the periods then unexpired of the loans in which the amount in question is included. Subject to this condition, the Sub-Committee has agreed to recommend sanction to the borrowing of £35,000, as follows:—Buildings, £9,000, 30 years; plant and machinery, £26,000, 15 years. The Finance Committee of the B.C. recommends the Council to accept the conditions attached to the County Council's sanction to the £35,000, it being understood that no further conditions will be imposed when the further balance of £13,000 yet required is dealt with. At a meeting of the B.C. this recommendation was agreed to. H.M. Office of Works has given the B.C. permission to wire some 200 houses, forming a portion of the Government housing scheme at Eltham, and to provide the necessary fittings, including lamps. Application is to be made to the L.C.C. for sanction to borrow £2,172, the cost of carrying out the work. In addition, it will cost £443 to provide the necessary transformer, kiosk and services.

Kensington.—The General Purposes Committee of the B.C. has considered a letter from the Notting Hill Electric Lighting Co. relative to a proposal to increase the price of current from 5d. to 5¼d. per unit, and suggests that this should be assented to by the Council.

Maidstone.—Increased Charges.—The T.C. has decided owing to the extra cost of coal, to increase the price of current for lighting and heating by ¼d. per unit from April 1st, and by ½d. for power as from January 1st.

Manchester.—A letter has been received from the L.G.B. stating that the sanction issued on August 15th, 1908, authorising the borrowing of £1,000 for the purposes of the electricity undertaking, has been cancelled.

Richmond-on-Thames.—The Electric Supply Co. has informed the B. of G. that the price of current has been increased by 10 per cent.

Salford.—Great dissatisfaction is felt by the inhabitants in connection with the lighting of the streets of the borough, and the attention of the Military Authorities has been called to the state of affairs.

The Electricity Committee has given instructions that no further extensions of mains and services be carried out during the war except in those cases where, in the opinion of the electrical engineer, they are absolutely necessary.

Sheffield.—L.G.B. Inquiry.—An inquiry was held on the 31st ult. relative to the Corporation's application for sanction to borrow £164,373 for extensions to the electricity works and plant, to enable it to supply much needed assistance to the large armament works which are now engaged at top pressure on Government orders.

South Africa.—A ratepayers' meeting has been called for April 23rd to adopt a resolution to borrow £15,000 for providing for the cost of the hydro-electric scheme at Worcester, Cape Province.

The East London (Cape Province) T.C. proposes to spend £20,034 on the electricity supply undertaking for extensions and additions at the power station and to the distribution system.

The Wellington (Cape Province) Municipality proposes to borrow the sum of £1,500 for extensions to the electric light works and the purchase of fittings and accessories.

Southampton.—Year's Estimates.—The estimates of the Electricity Committee show that it is expected to receive £53,860 from the sale of energy, meter rents, and miscellaneous receipts during the ensuing year. This represents an increase of £758, as compared with the actual amount received during 1914-15, and a decrease of £3,614 as compared with the estimate for that year. Expenditure during the next 12 months is estimated at £36,408, leaving a gross profit of £17,452, as against £19,940 for 1914-15, and for which the estimate was £21,201. From this amount has to be deducted £16,254 in respect of interest and redemption charges, and £1,100 for special expenditure, leaving £98 available for appropriation. This figure compares with £230 during 1914-15, and £1,948 the estimate for that period. The Electricity Committee is considering the question of extinguishing street lamps at midnight between March and September.

Stockton-on-Tees.—L.G.B. Inquiry.—An inquiry was held on March 30th into the application by the T.C. for sanction to a loan of £10,100 for mains, services, and rotary converters, &c. There was no opposition, and it was explained that current was being largely supplied to shipyards and works engaged on Government work, and that the extension of plant was urgent.

Swansea.—An official inspection has been held of the new three-phase plant at the electricity works, estimated to have cost in all some £40,000. The Mayor started up a new Curtis turbine set.

Torpoint.—E.L. Scheme Inaugurated.—The public lighting scheme of the Torpoint Electrical Supply Co. having been completed, the new generating station was opened by Lady Beatrice Pole-Carew on the 31st ult. The constructional work was carried out by Messrs. Brooking & Co., of Exeter, and about 90 public lamps are to be lighted.

Upper Greetland.—The Yorkshire E.P. Co. has applied to the B. of T. for consent to the erection of overhead lines in the district for the supply of current at a pressure of 400 volts.

Venezuela.—La Compania Electro-Industrial de Barquisemeto is the name of a new undertaking that has lately been organised, with a capital of £20,000, to establish an electric lighting station and ice-making plant in the town of Barquisemeto.

Worthing.—Public Lighting, &c.—The Electricity Committee of the T.C. has been considering the question of revising the charges for electricity supplied for public lighting. The Highways Committee has agreed to a new arrangement for paying the actual capital and maintenance charges on so much of the plant as is provided for public lighting purposes plus the actual running cost of producing the current supplied. Had this system of charging been in operating during the whole of the past financial year it would have meant a saving of £242, as compared with the system of charging a flat rate. The expenditure on the electric light account during the past year totalled £11,497, the income amounted to £11,453; an estimated surplus of £617 became an actual deficiency of £44. In the financial year ending March, 1914, the undertaking contributed £500 of its surplus to the district fund for the reduction of the rate.

Worcester.—L.G.B. Inquiry.—Mr. H. R. Hooper resumed the inquiry last week into the application of the City Council for sanction to borrow £5,250, £1,973 and £800 for purposes of the electricity undertaking. The inquiry was adjourned for the preparation of particulars of the expenditure on loans previously granted. The inspector stated that the Treasury would not sanction loans for any extension of the undertaking unless it was necessary for war purposes, and pointed out there was an excess expenditure on loans of £1,959, which was as far as they could deal with the application; the other part must stand over.

TRAMWAY and RAILWAY NOTES.

Australia.—Twenty-six municipalities in the Melbourne area have held a conference to discuss the question of damage to roads by motor traffic, and the provision of means to regulate such traffic. A committee strongly recommended some form of special taxation of motor-'buses, which are the worst offenders, to be based, it was suggested, on mileage run.

Bolton.—War Bonuses.—A scale of war bonuses has been prepared to apply to adult or married workmen in the various Corporation departments whose wages in any week do not exceed 30s. The bonuses range from 3s. down to 6d., and their payment will involve an annual expenditure of £3,700.

The Tramways Committee has under consideration a letter from the Electrical Trades Union making application on behalf of those members who are employed in the tramway department for an increase of 5s. a week in wages.

Brazil.—According to the *Financier*, the Pernambuco Tramways and Power Co. has at length succeeded in running cars in the more central parts of the town. Some considerable time must elapse before the electric tramway system reaches the suburbs where it is much needed, as the existing system, which has been bought by the company, is quite inadequate. An arrangement for lighting the city, made with the same concern, has now been in operation for nearly a year, with satisfactory results.

Bristol.—Tramways Purchase.—We understand that in addition to the gentlemen named in our issue of March 26th, Mr. H. Faraday Proctor, the city electrical engineer, was also nominated by Sir John Snell to take part in the joint valuation of the sections of the Bristol tramways which are purchasable by the Corporation.

Dunfermline. — Tramway Inquiry. — Under the Private Legislation Procedure Act an inquiry has been held in Edinburgh in connection with the Dunfermline and District Tramways (Extension) order. Power was sought to construct a tramway from Dunfermline to Rosyth by what was known as the Queensferry Road route. The Burgh of Dunfermline and the Earl of Elgin objected to the scheme on the ground that a tramway linking up the same districts by the Grange Road route had already been authorised. It was stated that in the event of the Grange Road route not being constructed the Dunfermline town planning scheme could not be carried out.

After Counsels' addresses, Lord Wemyss announced that subject to the adjustment of clauses and to a promised addition to Clause 4, the Commissioners unanimously found the preamble proved. The effect of the addition to the clause is that the company will construct, within 18 months from the commencement of the order, but subject to limitations imposed by war conditions, the tramway from the dockyard gates to the new station and along the Queensferry Road up to the High Street of Dunfermline.

Edinburgh.—According to the burgh engineer, there are in the city 64 double-decked cars out of 200. With regard to the question of increasing the number, it was reported that a difficulty existed in respect to the low roofing of the existing tramway sheds, and that a considerable expense would be involved in raising the roofs to admit of any considerable additions to the number of double-decked cars. There was also a difficulty as regards haulage, the present power being unequal to the strain of carrying on the various routes of the city a very large proportion of double-decked cars. From inquiry it appeared that 20 to 25 of these cars could be added to the existing number with very little difficulty, and the Tramway Committee of the T.C. is to suggest to the company that another 25 such cars be put on the various routes.

The Tramway Committee is endeavouring to get a self-propelled car for experimental purposes, and is to gather information as to the part self-propelled traction might play in the city.

Halifax.—Year's Working.—The income of the Corporation tramways for the year ended March 31st was £112,792, as compared with £109,650 in the preceding year. This is the largest figure since the system was opened. The profits amount to £17,539, or nearly £3 000 more than last year. The number of passengers carried was 20,707,071.

The Tramways Committee has decided to allow Belgian refugees to travel free of charge on the tramways, and special passes are being issued to these people.

Manchester.—The Special Corporation Committee appointed to deal with the question of the congested traffic in Manchester has held its first meeting and elected Ald. J. R. Wilson (chairman of the Improvements Committee) as chairman, and Ald. T. C. Abbott, deputy-chairman. It is understood that of the three voluminous reports prepared on the subject of traffic congestion by the Improvements, the Watch and the Tramways Committees, the report of the Tramways Committee will be first considered. The first business meeting of the new Committee will be held on April 13th.

A resolution is to come before the City Council that the Tramways Committee be recommended to allow special constables free rides on the tramcars when going to or returning from duty.

It is understood that some of the members of the Tramways Workers' Union are seeking permission to take a ballot on the question of the withdrawal of labour in consequence of the City Council's refusal to grant the increases in wages of 4s. 6d. and 3s. 6d. for carters and carriers and labourers.

Newcastle-upon-Tyne.—Reserve Fund.—At a meeting of the City Council on March 31st, it was stated that the reserve and renewals fund at March 31st, 1914, stood at £94,337, the estimated surplus on the year's working to March 31st, 1915, was £25,350, making a total of £119 687, from which is to be deducted expenditure sanctioned by the Council, leaving in the reserve and renewals fund on March 31st, 1915, the sum of £75,013. The estimated surplus for the year ending March 31st, 1916, was £31,400, but since the last report was issued the following additional estimated expenditure had had to be considered:—Army allowance for dependants (additional), £1,516; war bonus, £8 320; relief of rates, £18,000; additional cost of fuel, £5,000; reduced interest on investments, £1,000. There was, therefore, an estimated deficit of £2,436 on the year's working. Further, it would be necessary to expend from the reserve fund a minimum of £18,000 to keep the undertaking in a working condition, and with these deductions the reserve fund at the close of the year would only stand at £54,577. It would be impossible permanently to reduce the necessary expenditure on renewals in future years below an average of about £25,000 to £30,000 a year until the completion of the repayment of the loans. The Committee was of the opinion that the reduction of the reserve fund to so low a sum as £54,000 was unsafe, and that the contributions to the rates should be reduced in future years until the reserve fund was again built up to not less than £100,000. Alderman Rodgers, chairman of the Committee, in moving the adoption of the report, said the Committee must be allowed to accumulate an adequate reserve fund. He suggested that the allowances to dependants and the war bonus to employés should be deducted from the £18,000 which it had been proposed to allow towards the rates. After discussion the report was adopted.

Portsmouth.—The Tramways Committee has decided against an application of the motormen and conductors for an immediate permanent rise of 5s. per week in wages.

Salford.—It is estimated that the profits of the department will be less by nearly £20,000 this year as compared with last.

Destination numbers on the cars have not proved satisfactory, and the Tramways Committee has decided to recommend that the previous method of indicating on the cars both the route and the destination be reverted to.

Venezuela.—A company has lately been formed to construct and work an electric tramway in the town of Valencia. The work of constructing the line is well in hand, while the necessary current will be supplied from the plant of the existing electric light undertaking.

Wigan.—The Home Office communicated with the Corporation last week with reference to a proposal not to run the cars on Good Friday, and pointed out that the colliers had decided, at Lord Kitchener's request, to restrict their usual holiday and to work on the Friday, and that they would be seriously inconvenienced if the cars did not run. At a special meeting of the T.C. it was stated that the arrangements were made without knowing what the collieries intended to do, and it was decided to provide a service of cars.

TELEGRAPH and TELEPHONE NOTES.

Greece.—Direct communication has been established between Greece and Bulgaria and between Greece and Servia.—*Journal Télégraphique.*

High-Speed Cable-Cutting.—Speaking at Bristol on March 29th, the Postmaster-General said that within four hours of the outbreak of war we had severed every German cable that ran from Germany westwards or eastwards under the sea.

Japan.—Direct telegraphic traffic has been inaugurated between Russia and Japan, by way of the Korean port of Chonjin and Vladivostock.—*Journal Télégraphique.*

Postal Telegraphs and Telephones. — An account recently issued by the Post Office shows that the gross revenue of the British telegraph and telephone services for the year ended March 31st, 1914, was £10,468,399; the amount paid to cable companies, foreign countries, &c., was £878,316; telegram moneys refunded were £3,383; and the amount received in respect of royalties from the National Telephone Co., Ltd., and other licensees was £47,786; while services rendered to other public departments without remuneration were valued at £119,458. The total expenditure, including £1,000,000 for interest and part repayment of capital in respect of the purchase of the National Telephone Co.'s plant, was £9,821,978, leaving a debit balance of £68,034.

The amounts raised for telephone purposes to date made a total of £17,390,000, leaving a balance of £9,910,000 authorised but not raised. The excess of expenditure and interest on telegraph stock over telegraph and telephone revenue for the year was £339,725. The capital expended on the trunk telephone system amounted to £7,549,963; on the exchange system and private wires, including £10,709,249 paid to the National Telephone Co., to £20,096,117; and on stores not allocated to £500,000, making a total of £28,146,080.

The expenditure for the year on the telegraphs was £3,509,010, exceeding the income by £390,794; including the interest on the purchase price of the telegraphs, the estimated pension liability, and provision for depreciation, the deficiency of revenue for the year was £1,211,742.

The expenditure on the telephone service was £3,385,796, and the revenue £6,175,372, leaving a balance of £2,789,576; after deducting interest on loans, pension liability, provision for depreciation, &c., the net surplus was £239,111. The working of the exchange system showed a net profit of £395,664, and of the trunk system a net loss of £156,553. The deficiency on the telegraphs in 1912-13 was £1,175,347, and the surplus on the telephones in that year was £303,343.

Submarine Telephones.—A demonstration was given in London last week of a submarine telephone by Captain Louis Sorcho, an American inventor. The device enables a diver to maintain communication with the surface in spite of the noise in his helmet due to the roaring of the air supply and the pulsations of the pumps.

Telegrams in Code.—The Postmaster-General has given permission for the use of the authorised codes for telegrams to Brazil and French Guiana; the only South American country still excluded is Dutch Guiana.

Turkey.—It is reported that all English and French telephone employés in Constantinople have been replaced by Hungarians. The telephone service has been placed in the charge of an Austrian, and the telegraph service have been taken over by a Hungarian.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—April 20th. U.D.C. One 400-kw. d.c. turbine set, complete with surface condenser and circulating pumps, &c. One water-tube boiler with chain-grate stoker. See "Official Notices" March 26th.

May 4th. Steam and other pipework. Water-softening plant. See "Official Notices" March 26th.

Australia.—Melbourne.—April 19th. 13,560 yards of lead-covered cable, and 13 tons of bare hard-drawn copper cable, for the City Council. See "Official Notices" March 26th.

April 21st. 1,027,900 arc lamp carbons, for the Melbourne City Council. See "Official Notices" to-day.

May 19th. Electric signals and spare parts (Contract 28,591), track transformers (Contract 28,359), electric train stops (Contract 28,590), all for a period of five years. Particulars at Contractors' Room, Spencer Street.*

May 19th.—Machine tools and equipment, and sprinkler, for the Melbourne, Brunswick and Coburg Tramways Trust. Specifications, &c., £2 2s. each, from the Engineer's office, Sydney Road, Coburg.

June 2nd. Electric lighting material for cars (Contract 28,187). Tender box, Railway Offices, Melbourne. Particulars at Contractors' Room, Spencer Street.* Deposit ½ per cent. of amount of tender.

June 2nd. Bogie trucks, wheels and axles for 10 cars of the St. Kilda-Brighton electric street railway (No. 28,621) for the Victorian Railway Commissioners.*

June 15th. Four mechanically-fired boilers, for the City Council. Specifications (£1 1s.) from the City Electrical Engineer.

Queensland.—June 1st (instead of March 16th). P.M.G. Switchboard for Warwick. See "Official Notices" March 26th.

Sydney.—May 31st. Three electric battery locomotives for new public abattoirs, Homebush, for the Public Works Department.

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Basingstoke. — April 19th. Corporation. Diesel engine generating set, motor-generator, balancer, underground cables. See "Official Notices" to-day.

Bradford.—April 17th. (a) 100 tramcar trucks, (b) 200 motors, 200 controllers, 200 automatic circuit breakers, for the Tramway Department. Specifications (a and b) one guinea each, from Tramway Offices, 7, Hall Ings.

Brighton.—April 12th. Corporation. Surface condenser. See "Official Notices" March 26th.

Bristol.—April 14th. Incandescent electric lamps (from local firms or from firms in a position to supply from local stocks), for the Docks Committee of the T.C., from May 1st to August 31st. Mr. T. A. Peace, Engineer.

Darlington.—April 20th. Corporation. 25-ton overhead traveller and economiser. See "Official Notices" to-day.

Dundee. — April 28th. Corporation. Centrifugal circulating pumps, and 750 ft. of 42-in. and 30-in. cast-iron pipes. See "Official Notices" to-day.

Edinburgh.—Offers are wanted for upholding house telephone and electric bell installations throughout the city properties. Superintendent of Works, City Chambers.

Offers are also wanted to supply electrical material for interior wiring and jointing, and insulating material for electricity supply cables. Resident Electrical Engineer, Dewar Place.

Glasgow.—April 16th. Corporation. Cables, meters, carbons. See "Official Notices" to-day.

April 13th. Corporation. Six or twelve months' supply of V.I.R. cables, for the Tramways Department. Specifications from Mr. J. Dalrymple, General Manager, 46, Bath Street.

London.—Southwark.—April 14th. Cable and meters, for the Borough Council. See "Official Notices" April 2nd.

Mountain Ash. — April 26th. U.D.C. Sub-station building, e.h.t. underground cables, l.t. overhead lines and public lighting, e.h.t. switchgear, l.t. switchgear and transformers, for Abercynon. See "Official Notices" to-day.

Manchester.—April 14th. Corporation. Three 1,250-k.v.a. static transformers. See "Official Notices" April 2nd.

Rhondda.—April 17th. U.D.C. Installation, 83 wiring points, 88 lighting points, at the Council Offices, Pentre. See "Official Notices" April 2nd.

Sheffield.—April 12th. Supply of motor-van (petrol or electric) to carry one ton, for the Corporation. Specification (10s.) from the Cleansing Superintendent, Town Hall.

CLOSED.

Australia.—The Prahran and Malvern Tramways Trust has accepted the following contracts:—

Contract No. 61 (booster and switch gear), Messrs. Noyes Bros. Pty., Ltd., Melbourne, £920.
Contract No. 62 (battery), Messrs. Elder, Smith & Co., Ltd., £2,317.

Batley.—The Corporation has accepted the following tenders:—

Brush Electrical Engineering Co., Ltd.—Transformers.
British Thomson-Houston Co., Ltd.—Switchgear.

Burton-on-Trent. — Two stokers and self-cleaning compressed-air furnaces have been ordered from Messrs. Ed. Bennis and Co., Ltd., for the Corporation electricity station. This is a repeat order.

Croydon.—The tender of Messrs. Callender's Cable and Construction Co. has been accepted by the Council for 12 months' supply of cables. The contract will provide for payment on a sliding scale based upon the market price of copper.

Dudley.—The Lighting Committee has accepted the tender of the Earl of Dudley, for a 12 months' supply of steam coal, at 17s. 6d. per ton.

Gillingham (Kent).—The T.C. has accepted the tender of Messrs. Spencer, Whatley, Ltd., for 300 tons of Nottingham slack (through about 2-in. screens), for the electricity works, at £1 3s. per ton; and if the whole of this cannot be supplied, to obtain the remainder from Messrs. Myers, Rose & Co., at £1 3s. 6d. per ton.

Glasgow.—The Electricity Committee has recommended for acceptance the offer of Messrs. John Bennie, Ltd., at £323, for the erection of an electric hoist in the premises of Messrs. Burton, Son & Sanders, Ltd., Kinning Park.

Grimsby.—The Public Lighting Committee of the Town Council has accepted the tender of Messrs. Johnson and Phillips, Ltd., at £296 10s., for a supply of cable.

Halifax.—The B. of G. has accepted the tender of the Gath Electrical Engineering Co. for electrical fittings.

Huddersfield.—An order has been placed with Messrs. Edward Bennis & Co., Ltd., for four pairs of chain-grate stokers, each grate 4 ft. 3 in. by 12 ft. 4½ in. centres, for Stirling water-tube boilers, for the Corporation electricity works.

Ilford.—The U.D.C. has made a contract with the British Thomson-Houston Co., Ltd., for 12 months' supply of their electricity meters.

Leyton.—The Education Committee has accepted the tender of Messrs. E. H. Grimshaw & Sons and Mr. H. H. Taylor for carrying out electric light repairs to the various schools in the district during the ensuing 12 months.

Liverpool.—The Electricity Committee proposes to accept the tender of Messrs. Babcock & Wilcox, Ltd., for three water-tube boilers and accessories, with coal and ash-handling plant, &c., for the Lister Drive power station; also the tender of Messrs. E. Green & Son, Ltd., for three economisers and accessories. The Committee also proposes to accept the following tenders for annual supplies to the Tramways Department:—

Lubricating oils and greases.—Vacuum Oil Co., Ltd.; Matthew, Wells and Co., Ltd.

And the following for similar supplies to the Electricity Department:—

Lubricating oils.—Vacuum Oil Co., Ltd.; Henry Wells Oil Co., Ltd.
Electric fittings and sundries.—Sykes & Sugden, Ltd., 10 items; B.I. and Helsby Cables, Ltd., seven items; British Electric Calibrated Fuse Co., one item; Simplex Conduits, Ltd., 11 items.

The tender of the Staveley Coal and Iron Co., Ltd., has been accepted for the supply of cast-iron circulating water pipes to the Lister Drive power station.

London.—War Office.—A contract for one 300-B.H.P. Hick-Diesel engine has been placed with Messrs. Hick-Diesel Oil Engines, Ltd.

L.C.C.—The Education Committee has accepted the tender of the Lancashire Dynamo & Motor Co., Ltd., at £36 10s., for a 5-H.P. electric motor for driving the various machines at the Shoreditch Technical Institute.

Manchester.—The Education Committee has accepted the tender of Messrs. R. Seddon & Sons for electric lighting at the Alice Briggs Home.

The following tenders have been accepted by the Electricity Committee:—

Six superheaters.—Heenan & Froude, Ltd.
Two low-pressure circulating water pumps.—Gwynnes, Ltd.
Three reactance coils.—Siemens Bros. Dynamo Works, Ltd.
Cable.—Siemens Bros. & Co., Ltd.

The Sanitary Committee has accepted the tender of Messrs. Maitland & Co. for the electric lighting at the new ward pavilions at Monsall Hospital.

Meter Contracts.—Messrs. Ferranti, Ltd., have recently obtained contracts as follows for meters, the contract in each case being for the year ending March, 1916:—

Bristol Corporation, c.c. meters.
Croydon Corporation, c.c. and A.C. prepayment meters.
Hammersmith Borough Council, A.C. prepayment meters.
Ilford District Council, c.c. meters.
Londonderry Corporation, c.c. meters.
Plymouth Corporation, A.C. meters.
Whitehaven Corporation, c.c. meters.

Nuneaton.—The tender of Mr. George Smith has been accepted by the Council for the supply, during the ensuing 12 months, of 2,000 tons Ansley Hall Smudge coal, at 6s. 9d. per ton, to the electricity works.

Richmond-on-Thames.—The Richmond, Heston and Isleworth Joint Hospital Board has accepted the tender of Mr. D. J. MacDonald, of Hounslow, for maintenance of the electrical installation at the hospital.

Salford.—Messrs. Siemens Bros. Dynamo Works, Ltd., have again secured the contract for the annual supply of Wotan, tantalum, and carbon-filament lamps to the Corporation Tramways Department.

The following tenders have been accepted for the purchase of scrap metal at the electricity station:—

S. Openshaw.—Old arc lamps, approx. value of contract, £31.
J. H. Broomhead.—Heavy cast-iron, light wrought-iron and heavy wrought steel, £13 4s.
J. Livesey.—Copper, lead and light brass, £367 7s. 6d.
J. E. Peach & Sons.—Heavy brass, burnt cast-iron and rubber, £48 10s.
T. Mitchell & Sons, Ltd.—Motor-driven boiler feed pump, £40.
S. Openshaw.—Steam feed-water heater, £5.
A. Learoyd.—Battery of accumulators, about 30 tons disused accumulator plates, connecting bars, &c., wood stillages, glass and porcelain insulators, battery booster and switchgear, and two balancers and switchgear, £706.
T. Mitchell & Sons.—Seven old electric motors, £49.

The following tenders have also been accepted:—

Pendleton Ironworks Co.—Steel work for car depôt extension, £1,480.
Hadfield's, Ltd.—Axles, wheel tires and wheel centres, £1,188.

Walthamstow.—The U.D.C. has renewed its contract for the next 12 months for S.P. and D.P. 5 and 10-amp. tumbler switches, with Messrs. J. H. Tucker & Co.

Walton-on-Thames.—Messrs. R. Langston-Jones & Co. have secured the contract for the lighting and equipment for the new cinema for the Walton-on-Thames Cinema Co., Ltd., at £251.

Watford.—The Electrical Apparatus Co. have withdrawn their previous tender for 200 meters, and the electrical engineer has been authorised to purchase the same number from the firm at the scheduled prices, to be taken when required during a period of two years. The tender of the British Westinghouse Co. has been accepted for the supply of 350 larger size meters at scheduled prices, to be supplied over a period of two years also.

The Electricity Committee has refused to grant a request from Messrs. Cory & Son, Ltd., for an increase in the price of coal under contract.

FORTHCOMING EVENTS.

Association of Engineers-in-Charge.—Saturday, April 10th. Social and Dance.

Wednesday, April 14th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Autogenous Welding," by Mr. L. M. Fox.

North of England Institute of Mining and Mechanical Engineers.—Saturday, April 10th. At 2 p.m. At Wood Memorial Hall, Newcastle. Discussion on various papers.

Royal Institution of Great Britain.—Monday, April 12th. At 5 p.m. At Albemarle Street, W. General Meeting.

Institution of Civil Engineers.—Tuesday, April 13th. At 8 p.m. At Great George Street, S.W. Paper on "Impact Coefficients for Railway Girders," by Mr. C. W. Anderson.

Institution of Electrical Engineers.—Thursday, April 15th. At 8 p.m. At Victoria Embankment, W.C. Paper on "The Power Supply of the Central Mining—Rand Mines Group," by Mr. J. H. Rider.

(**Manchester Local Section**).—Tuesday, April 13th. At 7.30 p.m. At Engineers' Club, 17, Albert Square. Mr. Rider's paper as above.

(**Scottish Local Section**).—Tuesday, April 13th. At 8 p.m. At 207, Bath Street, Glasgow. Annual General Meeting. Paper on "Power Plant Testing," by Mr. W. M. Selvey.

(**Students' Section**).—Wednesday, April 14th. At 7.30 p.m. At Victoria Embankment, W.C. Paper on "The Electric Drive of Rolling Mills," by Mr. J. M. Heslop.

(**Birmingham Local Section**).—Wednesday, April 14th. At 7.30 p.m. At University, Edmund Street. Paper on "The Power Supply of the Central Mining—Rand Mines Group," by Mr. J. H. Rider.

(**Yorkshire Local Section**).—Wednesday, April 14th. At 7 p.m. At the Philosophical Hall, Leeds. Paper on "Good Lighting and its Immediate Effects from the Economic Standpoint," by Mr. V. H. Mackinney.

Institution of Mechanical Engineers.—Friday, April 16th. At 8 p.m. At Storey's Gate, S.W. Ordinary General Meeting.

NOTES.

Inquiries.—We are asked for information regarding "the heating of veneer plates by the so-called Hot Press System," for an important Canadian authority. Makers of the "Omnimeter" slide rule are asked for.

For Sale.—Messrs. P. Huddleston & Co. are instructed to sell by auction the cable, wire and fittings used for lighting the Liverpool Exhibition. Particulars are given in our advertisement pages to-day.

An Echo of the Building Strike.—In October, 1913, the London Education Committee accepted the tender of Messrs. Arthur Newman, Ltd., at £460, for installing electric light at the Middle Row School, Kensington. The school is being rebuilt in sections, and the first portion of the electrical work is now finished, the value being £213. Messrs. Newman have asked the Committee for an allowance in respect of the time which elapsed between the signing of the contract and the commencement of the work. The delay was caused owing to the strike in the building trade last year. The responsible Sub-Committee is of opinion that a payment of £6 2s. would be a fair and reasonable settlement of the claim, and has recommended the Committee accordingly.

The I.E.E. Benevolent Fund: An Appeal.—We commend to the sympathetic interest and generous support of our readers the appeal that has been issued by Sir John Snell, the President, on behalf of the Institution's Benevolent Fund. Sir John says:—

"The Committee of Management have before them three urgent cases which it is felt should be dealt with by the brother members of those whose families are in need of help.

"There is one case of a member who died recently while on his way abroad to take up a very good position, whose widow and two children must be assisted by some charitable organisation. Another case is that of a member who was injured in an accident and is now mentally incapable of earning any livelihood, and whose wife and four children are penniless. And there is yet a third case of three maiden ladies, the daughters of a deceased distinguished member, whose age and health make them incapable of earning anything towards their subsistence.

"In all these cases there are no relatives able to assist. The Committee, therefore, feel that each of these cases properly falls within the scope of the Benevolent Fund. There are in addition other cases of members and of families of members who are in receipt of assistance from the Fund, and it is anticipated that further deserving cases will in the near future come before the Committee. For an Institution of the size and importance of ours, a Benevolent Fund, which has been in existence for some 25 years, ought to have a larger accumulated capital than £4,640, and a larger income from investments than £175 per annum. During the year 1914 the annual subscriptions from members amounted to £87 only, and donations of single sums amounted to £93, that is, a total of £180, which is considerably less than could fairly be expected from an Institution of over 7,000 members. During this period of war, the positions and incomes of the majority of the members of the Institution have been only very slightly affected; and I venture to hope that a ready response will be made to my appeal to increase the resources of the Benevolent Fund, in order to enable the Committee to relieve the distressed and to assist the dependents of those of our members who have fallen by the way, as the amount at the disposal of the Committee is at present entirely insufficient to meet adequately the demands made upon it."

Fatality.—Langley.—At the inquest on the death of a labourer named Wilcox, aged 17 years, referred to in our last issue, evidence was given by Mr. John Legge, chief engineer of the Shropshire, Worcestershire and Staffordshire Electric Power Co., Ltd., to whom the wires belonged. He said that the War Office requested the company a fortnight ago to start immediately to get a supply of electricity to the site of the new Government works at Langley, which is near Albright & Wilson's works, to enable the men to work night and day. The nearest point from which they could get a supply was at Messrs. Albright & Wilson's works, and the firm permitted them to connect up from their transformer to the new works. The wires were carried on the top of a wall, the lowest wire being 10½ ft. from the ground, and they were considered to be perfectly safe. It was only a temporary arrangement, and, as soon as the underground cable was laid, the existing wires would be done away with. The voltage of one wire was 270, but if Wilcox caught hold of both wires he would probably receive a shock of about 500 volts. The jury returned a verdict of "Accidental death," and added the opinion that the wires were in a dangerous position. Though the wires were only there temporarily, they thought they should have been in some way protected.

Institution and Lecture Notes.—Royal Institution.—The following arrangements are announced:—

Friday, May 7th, at 9 p.m., Prof. O. W. Richardson, "Electrons and Heat" (experimental).
„ „ 28th, at 9 p.m., Sir John Jackson, "Engineering Problems of Mesopotamia and Euphrates Valley."
„ June 4th, at 9 p.m., Prof. Sir E. Rutherford, "Radiations from Exploding Atoms."

Afternoon meetings (3 o'clock):—

Saturday, May 15th, and Tuesday, May 18th, Prof. Fredk. Soddy, "Advances in the Study of Radio-active Bodies."
Tuesdays, June 1st and 8th, Prof. J. O. Arnold, "The Evolution of Steel: Influence on Civilisation."
Thursdays, April 29th and May 6th, Prof. A. W. Porter, "Advances in General Physics."
Saturdays, May 1st and 8th, Prof. J. A. Fleming, "Photo-Electricity" (experimental).

Institution of Electrical Engineers.—At the meeting of the Birmingham Local Section on Wednesday last a paper was read by Mr. W. O. Acfield on "Development of Main-Line Signalling on Railways," and a discussion followed.

Greenock Electrical Society.—At the last meeting a paper was read by Mr. L Hogg on "Mains."

The following office-bearers were elected for next session:—Hon. president, Mr. Frank H. Whysall; president, Mr. W. B. Smith; vice-presidents, Messrs. Duncan Angus and Samuel James; secretary, Mr. H. G. Wright; treasurer, Mr. Wm. M'Gibbon.

Appointments Vacant.—Engine driver-stoker (30s.), two switchboard attendants (20s.), jointer, meter fixer and reader (35s.), for Ilkley U.D.C.; car-shed superintendent (£200), for Bolton Tramways Department; switchboard attendant (25s.), for Kingston-upon-Hull Corporation; working permanent-way foreman (42s. 6d.), for Burton and Ashby Light Railways. Particulars are given in our advertisement pages.

How to Sell.—The Sales Managers' Association has arranged for to-night, Friday, at 7.30 p.m., a meeting to which "every British Business Man" is invited. There will be an address by Mr. C. Hamilton Wickes, H.M. Trade Commissioner in Canada, on "How to Market British Goods Abroad." Mr. Wickes holds that it is not in the quality of the goods that England is at a disadvantage in the industrial race for the world's markets, but in the methods adopted for making sales. We have no doubt that the meeting will prove a profitable one to all of our readers who can attend at this short notice. The announcement was only issued to us under date *April 1st*, and, of course, was not received by us until after the holidays. It is regrettable that an Association which aims at the improvement of our methods should not have issued a little longer notice of its arrangements—the eve of Good Friday was a particularly unfortunate date to choose for its circulation. We hope, however, that this reference to the matter will make an added impression upon the minds of our busy commercial readers, and will ensure a good sprinkling of electrical men among the audience at the King's Hall, Holborn Restaurant, to-night.

Fire at Dunston.—A fire occurred on April 5th at the Dunston electric power station of the Newcastle-on-Tyne Electric Supply Co., Ltd. An extension of the premises has recently been completed, and some new turbo-generators have been installed, and it was in this section of the works that the outbreak occurred. For some time there were apprehensions of the fire seriously extending, but the work of the employés, aided by the military on duty in the neighbourhood, proved sufficient to limit the trouble. The damage done was said to be considerable, but fortunately the supply was not affected by the accident. One of the employés was rather seriously burned.

Engineer Volunteer Training Corps.—It has been suggested to the President of the Institution of Electrical Engineers, Sir John Snell, by General Sir O'Moore Creagh, V.C., Military Adviser to the Central Association of Volunteer Training Corps, that an Engineer Volunteer Corps should be raised from members of the engineering profession who are either above military age, or who, being of military age, are prevented by some good reason from serving in the Regular or Territorial Forces.

The objects of the corps would be to train men of military age to make them useful Royal Engineers recruits if and when they are able to enlist, and to furnish engineer units to assist in the completion of the volunteer organisation. The units would be so constituted as to ensure that the maximum advantage would be taken of the specialised skill of their members.

Instruction and training will be given in military engineering, with special reference to field and fortress work (including telegraphs, telephones, searchlights, &c.), in addition to drill, musketry and other military operations proper to an engineer unit. Drills will be arranged so that each unit will receive instruction for at least two hours per week in the evening and on Saturday afternoons or Sundays.

The corps will be affiliated to the Central Association, and all the conditions contained in the War Office letter to Lord Desborough dated November 19th, 1914, will be observed. Members joining will be required to provide their own uniforms, and probably some part of the equipment.

The Institution has addressed a circular on these lines in the first instance to members residing in the London area. The question of forming similar corps for members residing outside this area will be considered at a later date.

Copper.—The European visible supply at the end of March was 29,056 tons, a decrease of 5,319 tons during the month. From Messrs. H. R. Merton's tabulated statistics we find that English supplies diminished by 698 tons during the same period. In dealing with the former figure (European supplies), however, it will be noted that the figure given for French stocks at the end of February was based on the stock before the war, while that now issued is in accordance with official figures. The figures for enemy stocks are still, of course, conjectural. Figures of supplies from various sources show American arrivals in Europe largely in excess of any month since last July. The quantity received by England and France from Spain and Portugal during March, 1915, was well over the pre-war average, and the figure for supply from "other countries" was 7,178 tons, nearly half as much again as the pre-war average. Chile shipments were 10 per cent. under the pre-war average, and Australian about ¼ below. Total supplies very considerably exceed those for any month since the war started, and are 4,358 tons above the supplies for January, 1914.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Wimbledon T.C. has been recommended to appoint Mr. H. Oswald as an engineer-in-charge at the electricity works at a salary of £104 a year, rising to £156 by annual increments of £13.

The marriage took place at Oldham on March 24th of Mr. Wm. Chamberlain, one of the joint managers of the Oldham Corporation electricity department, and Miss Lilian Hood, daughter of the late Alderman John Hood, J.P., a former Mayor of Oldham.

Mr. H. A. Histed, of Croydon, has been appointed meter inspector at the Watford electricity works. Mr. T. W. Turner, assistant mains superintendent, has resigned his appointment.

Mr. W. L. Chubb, chief assistant at the Horsham electricity works, has resigned, having been appointed to a similar post at Stafford.

Tramway Officials. — Mr. Frederick Taylor, carshed superintendent at Bolton, has resigned, and applications are to be invited for the vacancy, the salary offered being £200 per annum.

General.—The staff of the offices of the British Insulated & Helsby Cables, Ltd., Helsby, have presented a case of cutlery, suitably inscribed, to Mr. Ernest Barker, of Runcorn, a member of the office staff, upon the occasion of his marriage. The presentation was made by Mr. G. Seddon, the cashier.

Mr. Oscar C. Waygood, of the transformer department of the British Westinghouse Works at Trafford Park, was married at Levenshulme Congregational Church at Easter, to Miss Lily Myers, only daughter of Mr. and Mrs. W. H. Linton, Victoria Park, Manchester.

Mr. H. C. Walker, chairman and joint managing director of Waygood-Otis, Ltd., lift and crane makers, on completing half-a-century's connection with the company, has been presented by the staff and employés with a grandfather clock and a morocco bound album, containing the signatures of 600 employés, and the names of 250 members of the staff who have joined the services.

Mr. James G. Lorrain has changed his address to 9, John Street, Adelphi, London, W.C.

Obituary.—Dr. H. Lewis Jones.—We deeply regret to learn of the death, which occurred on Sunday last at his residence in Harley Street, of Dr. Henry Lewis Jones, M.A., M.D. Camb., F.R.C.P., London. For many years Dr. Lewis Jones had been one of our foremost authorities on medical electricity, indeed as long ago as February, 1893, he appeared among other experts on the side of the Electrical Review in the litigation which followed upon its attacks on a certain extensive electric belt business. The very responsible position which he occupied at St. Bartholomew's Hospital afforded him ample scope for the exercise of his specialised knowledge and experience, and gave him exceptional opportunity for adding thereto. For a lengthy period he was medical officer in charge of the electrical department at that Hospital, and we believe that he was responsible for the electrical equipment there being so efficient and complete. During the last year or two he had been connected with the same department in a less active capacity, as consulting medical officer. His position as a recognised authority on electro-therapeutical and electro-medical subjects brought him into prominence as an author in a department which has too few authoritative exponents, and he occupied the presidential chair of the British Electro-Therapeutic Society in 1903 and 1904. He was an Associate of the Institution of Electrical Engineers, and in 1900 read a paper before that body "On the Applications of Electricity in Medical and Surgical Practice." Other writings of his within our recollection dealt with "Lethal Effects of Electrical Currents" (*British Medical Journal*, 1895); "Electrical Treatment of Infantile Paralysis" (Medical Society of London, 1894); and "The Duration of Discharges of Induction Coils." He was also the author of a well-known work on "Medical Electricity," based on the original work by the late Dr. Steavenson, of St. Bartholomew's, which went through many editions. Dr. H. Lewis Jones, who has passed away at the comparatively early age of 58, was a gentleman with whom it was a pleasure to have relations, and one who could not be known without being esteemed; his passing leaves a blank in an important department of Science, and he was an authority whom we could ill afford to lose.

Sir J. C. Lamb.—We regret to record that Sir John Cameron Lamb, formerly Second Secretary to the Post Office, died on March 30th at his residence at Hampstead. In the course of a lengthy account of his career appearing in the *Times*, it is stated that Sir John, who was born in 1845, entered the Post Office in 1864, and he retired in 1905, after more than 40 years' service. He at first served in the Receiver and Accountant-General's Department, but in 1870 he was selected with others to assist in negotiations for the acquisition of the inland telegraphs, which up to that date had been entirely in the hands of private companies. Mr. Lamb took a prominent part in the organisation of the acquired telegraph systems and their extension to meet the growing requirements of the public. In 1888 he carried out most of the arrangements in connection with the introduction of 6d. telegrams. A rapid development in the international telegraph system has taken place since 1870, and many questions affecting the control of the cables laid by British companies and the relations with foreign telegraph administrations were continually arising for settlement, and Mr. Lamb took a large part in the arrangement of these matters. In 1886 he was one of three delegates appointed by the Secretary of State for Foreign Affairs to attend an international conference in Paris on the protection of submarine cables, and he subsequently served as a member of the Commission appointed to examine the laws of the various countries bearing on the subject. In 1884 and again in 1888 Mr. Lamb attended conferences with the officials of various telegraph administrations, and negotiated agreements for the joint acquisition and working of the Continental cables. These arrangements, which were carried into effect in 1889, resulted in the purchase of the cables from the Submarine Telegraph Co. Mr. Lamb took part in three international telegraph conferences—in 1890 in Paris, in 1896 at Buda-Pesth, and in 1903 in London. At the Paris and Buda-Pest conferences he was the senior British delegate, and at the London conference was elected president. In 1903 he was the senior British delegate at the first International Conference on Wireless Telegraphy held in Berlin. In 1895 Mr. Lamb negotiated the purchase of the telephone trunk lines connecting the various centres, and organised a State system extending to the principal towns in England, Scotland and Ireland, and also to Paris. Mr. Lamb was appointed third secretary of the Post Office in 1896, and in the following year became second secretary. He took a leading part in discussions upon the policy which should govern the relations of the Post Office to the National Telephone Co. and the municipalities in connection with the telephone service, and gave evidence before a Select Committee of the House of Commons in 1898. From 1892 to 1897 he served as a member of the Royal Commission appointed to consider the establishment of electrical communication with lighthouses and light-ships. He received the C.M.G. in 1890, the C.B. in 1895, and a knighthood on his retirement.

Mr. R. Tuke.—The death occurred on April 4th, at the age of 57 years, of Mr. Richard Tuke, Chief Superintendent of Telegraphs at the Leeds Post Office. He joined the telegraph service in Leeds in 1873, and passed through all the successive grades to the post of chief superintendent, to which position he was appointed only last year. His death was quite unexpected, for he attended to his duties as recently as March 27th.

CITY NOTES.

Cork Electric Tramways and Lighting Co., Ltd.

The directors' report for 1914 states that the revenue was £61,604, and the expenses were £37,958. Including £1,352 brought forward, there remains £24,998, less interest on debentures £4,400, leaving a balance of £20,598. Of this amount dividends on the 5 per cent. cum. pref. shares absorbed £6,163, £6,500 had been added to reserve for depreciation and renewals, £1,804 had been written off several items, a 3 per cent. dividend on the ordinary shares requires £3,450, and £2,480 is to be carried forward. The lighting and power business again shows satisfactory progress, agreements for 161 connections being concluded during the year. The additional connections represent a total gain of 467 kw. as against 212 kw. in 1913. The revenue amounted to £61,604, an increase of £1,469. The lighting and power revenue was £1,509 in excess of the previous year and the traction revenue £140 less, the decrease being mainly due to the war. The other revenue items show an increase of £100. The expenses amounted to £37,958, as compared with £37,524 for the previous year. There was a reduction of £1,315 in traction and lighting expenses, mainly due to lower maintenance charges for permanent way and cables. Power expenses, on the other hand, were increased to the extent of £1,700, due partly to the increased output and partly to heavier maintenance charges for the plant. The general expenses show a small reduction. The capital expenditure during the year, amounting to £2,500, has been mainly for house services and additional plant for the power station. To meet the increasing demand for lighting and power the directors have ordered a 1,000 kw. direct-current geared Curtis turbine. In view of the substantial increase in the cost of coal and other materials, also wages, dues to the war, the directors may have to consider the question of increasing the charges for electricity.

The annual meeting was held yesterday.

	Traction.					Lighting and power.	
Year.	Miles open.	Passengers carried.	Average fare.	Car-mileage.	No. of cars.	No. of customers.	8 c.p. lamps (equiv.) connected.
1912	9·89	5,695,103	1·06d.	898,158	35	2,549	168,774
1913	9·89	5,864,339	1·08d.	893,594	35	2,665	170,926
1914	9·89	5,858,904	1·06d.	870,094	35	2,826	[illegible]

Clyde Valley Electrical Power Co.—The report states (says the *Financier*) that, after payment of the preference share dividend and adjusting interest and transferring £12,500 to contingency fund for depreciation, &c., there remains £33,826. The directors recommend that £3,290 be transferred to special reserve, £10,000 applied in writing down cost of accounts, and £9,000 provided for the dividend on the preference shares to April 30th, leaving £11,535 to be carried forward.

Lymington Electric Light and Power Co., Ltd.—The result of trading during 1914, including £769 brought forward, shows a profit to the credit of the net revenue account of £2,668, and after paying interest on debentures, amounting to £450, there is a balance of £2,218; £1,000 is to be placed to reserve account, and a dividend at the rate of 5 per cent. per annum paid on the preference shares, amounting to £321, leaving £897 to be carried forward. During the year the company have invested £1,000 in Colonial Government Stocks.

Oriental Telephone and Electric Co., Ltd.—Subject to audit, the directors recommend the following dividends:—At the rate of 6 per cent. per annum on the preference shares for the half-year ended December 31st last, less income-tax; a final dividend of 6 per cent. on the ordinary shares issued, free of income-tax, making a total of 10 per cent. for the year. The share transfer books will be closed from April 15th to 28th.

Brush Electrical Engineering Co., Ltd.

The annual meeting was held at 1, Kingsway, W.C., on March 29th. Mr. E. Garcke, who presided, congratulated the shareholders on the improved position of the company. The improvement which he was able to report at the last general meeting was fully maintained during the past year, notwithstanding the difficulties and the dislocation of business caused by the war, and the accounts showed that the company was again getting into a thoroughly sound position. Now that they had turned the corner and were making profits, he was able to confess that there were times during the last five or six years when the directors were very nearly despairing of being able to pull the company out of its difficulties, but there were two factors which sustained them, and which explained the success they had achieved. In the first place, they appreciated very much the patience shown by the stockholders and the confidence which they gave the directors, and in the second place the extraordinary efforts made by the managing director and the whole of the staff in their struggle against adversity, were such as inspired everyone with confidence in their ultimate success. During the past year they had completed the re-organisation of the share capital account, and the balance sheet was now free from all items of doubtful validity, and showed a balance of undivided profits which was not only substantial but real. They would be perfectly justified in declaring a moderate dividend on the ordinary stock, but although the directors would have derived much pleasure in paying a dividend, they thought and felt that war time was not a time for a company which had just emerged from a long period of depression to begin the payment of dividends. After the experience they had gained, therefore, they considered that, when the company resumed payment of dividends, it must be with the conviction that in the absence of altogether unforeseeable calamities they would be able to pay dividends regularly later. The uncertainty of war conditions did not provide a reliable basis for any such conviction, and, therefore, they must reluctantly ask the holders of the ordinary stock to exercise a little longer that high quality of patience which they had practised so long with such beneficent effects upon the fortunes of the company. They paid, of course, for the past year, as they had always done, the full interest upon the whole of the debenture stocks, and they also paid a further 4 per cent. for the year on the 6 per cent. second prior lien debenture stock, making 10 per cent. for the year. After dealing with the accounts, the Chairman said that with regard to their operations generally, they had naturally suffered by the falling away of orders during the latter part of the year under review, and they had also been, and were still, handicapped by the shortage of labour and the difficulty of getting raw materials. The latter were adverse factors which, he was afraid, were likely to continue during the war, and might even increase. On the declaration of war everyone's first instinct was to at once begin husbanding resources, and their order sheets for the first two or three months immediately following the declaration of war did not make satisfactory reading. However, as confidence was re-established, an improvement took place, and this was assisted by the Government orders which the company was able to secure. This improvement had continued, and they had no cause to complain of the volume of business obtained since the beginning of the current year. They took early steps to put their manufacturing facilities at the disposal of the Government, and at the present time a large proportion of their output was for material for Government service. They were building not only turbo-generating plant and other engineering and electrical machinery for this duty, but had also undertaken the construction of aeroplanes to standard and improved designs, and they hoped shortly to have the special department they had organised for this work in full swing. In common with other engineering firms, they had granted a substantial all-round increase of wages to their workmen, and they were now faced with a demand for a special war bonus. They fully recognised that the cost of living had gone up, and that the men were entitled to more when more was being earned, but these continued advances of wages were liable to hit the firms engaged in the heavy section of the electrical engineering industry very much, because their contracts were of a nature that often extended over many months, and as they had to engage to deliver their products at a fixed price, it was not possible to obtain relief in respect of higher wages paid as regarded work already in hand. He hoped the men's representatives would admit that these advances could not be permanent, for in the nature of things the present conditions could not be permanent. At their meeting last year he told them of the success of the new steam turbine they had taken up. He referred to the Ljungstrom turbine. He was glad to report that the experience they had since gained in every way justified their action in securing manufacturing rights for this invention. It had fully realised their expectations, and was now firmly established as the most economical turbine on the market, while at the same time its reliability in operation under severe conditions had been completely confirmed. The remarkable results obtained in the way of steam economy appealed strongly to all owners of electric power undertakings in situations where fuel was costly, and the orders in hand and in prospect had compelled the directors to face the problem of providing means for turning out the turbine, with its auxiliary equipment of generators, condensers and pumps, on a larger scale, and with labour-saving high-speed tools. Machine tools of this class were already on order, and some of them would have been installed before now if it were not for the fact that the tool makers were all very busy in turning out machinery for munitions of war. The progress made in exploiting the Ljungstrom turbine, satisfactory though it was, would have been still more marked in more normal times, as many municipalities, who were their principal customers for this class of plant, were holding up projected extensions in their power-houses in consequence of the present difficulty of obtaining the necessary Government sanction for expenditure. At this moment they had a considerable amount of business held up on this account, and he looked for a large demand for the turbine as soon as the existing restrictions were removed. On their rolling stock side the shops had, on the whole, been kept well employed. They were building a large number of cars for the L.C.C. tramways, and were finishing a line of steel carriages embodying many special and improved features for the Central London Railway. They were adapting and extending some of the workshops for the manufacture of aeroplanes, for which they had already important orders in hand. To meet the capital expenditure necessitated by these developments, they proposed, as soon as they required the money, and subject, of course, to the approval of the Treasury, to issue the balance of their prior lien participating second debenture stock. The exact amount of this stock available was £48,899, and it carried fixed interest at the rate of 6 per cent. per annum, and was entitled to a further 4 per cent. out of the net profits of the company available for dividend in any year. The Chairman added that over 20 per cent. of the company's men, including officers, had joined the Army and Navy, and the directors had joined in a scheme which had been propounded by the British Electrical Federation for assisting the dependents of the men.

Mr. B. S. Broadhurst seconded the motion.

An amendment that the meeting should stand adjourned for the purpose of enabling the directors to reconsider the accounts with a view to the payment of a small dividend on the ordinary shares was not seconded, and the motion for the adoption of the report was agreed to unanimously.

British Westinghouse Electric and Manufacturing Co., Ltd.

The 15th annual general meeting was held on March 29th at Hamilton House, Victoria Embankment, Mr. J. Annan Bryce, M.P., presiding. In moving the adoption of the report, the Chairman, after referring at some length to the balance sheet, said that the net profit was about £45,000 more than that of 1913. That excellent result was caused mainly by increased efficiency. They possessed a very able management and a first-rate staff, built up during years by the managing director, and actuated from top to bottom by a spirit of devotion to its work. While he congratulated them on the result of the year's working, he must utter a word of caution. In some of the newspaper comments on the accounts it was said that they seemed to have benefited by the war because they had earned a much larger profit. Although five months of war came within the period covered by the accounts, any such deduction was entirely wide of the truth. The profit of the year was almost entirely, if not entirely, derived from contracts entered into before the war; most of it, indeed, on contracts made in 1913. As a matter of fact, they had already suffered, and were likely to suffer still more, from the war, though its injurious effects were not apparent in the accounts of 1914. The net profit was just sufficient, if they had divided right up to the hilt, to have allowed a distribution of 15 per cent. on the preference capital. But in the opinion of the board it was much wiser, with the present uncertain outlook, to continue the policy of strengthening their resources by building up reserves. They had, accordingly, added £50,000 to general reserves, written £25,000 off goodwill, and carried forward a rather larger sum than last year. When they met last year he told them that up till that date the orders taken during the first three months of the year were about the same as for the corresponding period of 1913, but that there were signs of a slackening in trade. During the succeeding four months, the slackening became marked, and by the end of July their fresh orders for the year were 27 per cent. behind those during the first seven months of 1913. The comparison, however, was not quite fair to 1914, as in that period of 1913 they had taken a very large electrification order from the London & South Western Railway Co. The sudden outbreak of war in the beginning of August perturbed their industry, as it did all others. Happily, they were in a strong financial position and had no anxieties on that score, but trade being for the time paralysed it appeared necessary to shorten sail. Two alternatives presented themselves: either to reduce the staff, or to ask it to accept short time or reduced pay as the case might be. The former course they were reluctant to adopt, not only for their staff's sake, but for their own. They had a splendid personnel which had taken years to build up, and once dispersed it would have been difficult to reconstruct, so they took the other course. The staff without a murmur at once most loyally agreed. The clerical staff accepted reduced pay but continued to work full time, while the manual labour accepted short time. Things having settled down, a return to normal conditions of work and pay was made in a few weeks. As the autumn went on, the stoppage of business with Germany began to make itself felt and orders were given to them in replacement of cancelled German contracts. At the same time the War Office and

Admiralty, to whom they had offered their services at the outbreak of war, placed with them orders for various goods, and they also took sub-contracts from other firms to assist their deliveries. Owing to those causes the volume of orders, which at the end of July had been 27 per cent. behind, finished up at December 31st only 17 per cent. behind that of 1913. So far, therefore, as mere volume of business was concerned, the war had rather improved their position. The mere volume of orders taken in any year, or their character, did not affect in any considerable degree the profits of that year, but had an important effect on subsequent periods. The diminution of 17 per cent. in the orders of 1914 was therefore in itself serious, and had a still more serious aspect when they came to consider the conditions under which they were being executed. In this connection the effects of the war would be found to be very injurious indeed. The active recruiting of the autumn, and the increasing demand for war supplies of every kind, rapidly caused a shortage of labour, especially of skilled labour, which towards the end of the year became acute. Lancashire responded nobly to the call of patriotism, and their staff did not lag behind. By the end of 1914 about one-third of their men had joined the Colours, and they replaced them with great difficulty. But the labour difficulty was not the only evil effect due to the war. The Government work which, for various reasons, they thought it wise to take, was not in itself profitable, the material being furnished to them and their remuneration being based in most cases merely upon a small percentage on wages. There had been a rise of 10 to 12 per cent. in the cost of every material they used, while the enormous rise in freights had seriously affected the results of their contracts for foreign and export work, as well as making further business far more difficult. They would, of course, endeavour to meet present conditions, not only by increasing prices where possible, but by increased efficiency, and, apart from war conditions, he thought their prospects were favourable. Even now there was a fair amount of business offering, and when the war was over there ought to be a chance of securing a good proportion of the business heretofore done in Germany, as there was likely for some time after the war to be in many countries a prejudice against her, even if her industry was not so disorganised as to interfere with her supplying her former proportion of the trade. The report alluded to their acquisition of their American friends' interests in the French and Italian Westinghouse companies. He should explain that their interest in the Italian company was an indirect one through the French company, which held a large majority of the shares of the Italian company. Their friends, after the experience of a number of years, during which neither of those companies had paid a dividend, had come to the conclusion that it was impossible to exercise a proper supervision from the other side of the Atlantic, and in pursuance of this policy they had already transferred their interests in Russia to a local company. They expressed to this company their willingness to cede to it their French interests. They offered what appeared to be favourable terms, trusting from what they had seen of this company's operations that it would be able to make the business both in France and Italy profitable, in which case they would get a return through their large holding in the British company. The French company had a capital of £560,000, divided into 10,000,000 francs cumulative preference shares, of which the American interests owned 8,745,000, and 4,000,000 francs ordinary shares, of which they owned 2,876,700, these holdings in both classes amounting to 83 per cent. of the whole. The Italian company had a capital of £160,000, of which the French company owned 73 per cent. Their American friends had sold them their interest in the French company in exchange for their holdings in the Clyde Valley Electrical Power Co. and the Traction & Power Securities Co., Ltd., at the prices at which they stood on their books on December 31st, 1914, viz., £160,127. The transaction thus amounted to their buying the American interests in the preference shares above at about half their face value and getting their ordinary shares thrown in for nothing. They considered that the bargain was a good one for them. They had of late years had ample opportunity of seeing the working both of the French and Italian companies, and formed the opinion that their want of success hitherto had been due to conditions which they and their American friends were confident that they would be able to improve. By bringing the work of the two companies' engineering and selling establishments into co-ordination with their own, they would be able to avoid over-lapping in both departments, thus saving heavy expenses in development and other work. Both companies had factories well adapted for certain work, and by concentrating at Manchester other work which they had been attempting to do they would be able to add to the volume of their own standard manufactures. At the present moment ordinary electrical manufacture was completely suspended in France, and the works there were entirely taken up with Government contracts for munitions of war, which yielded a fair return; but when the war was over they would have a good chance of securing, in addition to their previous business, a portion of the large amount of electrical work hitherto supplied to France from Germany. The Italian company was busy with contracts for electric locomotives for the Italian Government, a class of business for which it had obtained an excellent reputation, and in Italy, too, there should be good prospects of obtaining a considerable share of the business hitherto done with Germany in ordinary electrical work. Both companies were financially sound, though the Italian company suffered from an inadequate working capital, a deficiency which they believed could be supplied at the close of the war by the French company from its own resources without making any demands upon this company. This company's control of the French company would give an important advantage in another way. Through it this company would obtain an entry into Switzerland, Belgium, Spain, Portugal and their respective colonies, business in which the French company had not developed. With regard to prospects of business generally after the war, they would not expect him to prophesy. As they knew, it was expected by most people that a great depression in trade would follow the close of the war. "The expenditure of the present belligerents alone cannot, if the war lasts only eighteen months, fall much short of 5,000 millions of pounds. Add to this the expenditures by neutrals due to the war, say, another 100 millions; the destruction of property certainly at least another 1,000 millions; the loss by non-creation of wealth from the labour of at least 12 millions of fighting men for eighteen months, at the low estimate of £50 per man, another 600 millions; and the permanent loss by non-creation of wealth, say, for four years from the death or disablement of, say, four millions of fighting men, another 1,000 millions, you get the appalling total of capital loss of, say, 8,000 millions of pounds. And this vast sum does not include anything for the diminished production of wealth caused by the diversion of immense bodies of labour, not only in the belligerent but in many neutral countries, from the production of wealth to the production of unproductive war supplies, or for the consequent disorganisation of industry. Nor does it include anything for the incalculable diminution in production which must follow from the death or enfeeblement by famine and disease of huge numbers of human beings in the war areas." It would certainly take the world a generation to recover from the effects of the war, and its purchasing power must be vastly lessened in the immediate future. But it did not follow that all industries would be equally affected. Those which were, like their own, concerned with the provision of more economical means of production and transport might even benefit, especially considering that so extensive a destruction of the older types of mechanical production might furnish an opportunity of reconstruction on modern lines. Up to the end of 1914, 1,366, or about one-third, of their staff in Manchester had joined the Army, and the number had risen on March 8th to about 1,500. Men had also joined from their London and district offices, and from their Russian and South African offices. Many of them were already at the front and had suffered wounds and death. All honour to the gallant fellows who were braving for their country's sake the horrors of winter warfare in the trenches. And their gratitude was due not only to those with the Colours, but to those who had remained behind to perform the no less honourable task of maintaining the country's industries. "The fight is not at the front alone." At the beginning of September a fund was formed to provide relief for the dependents of men joining the Army. To this fund the company contributed £100 weekly, and to it the staff had up till March 6th contributed £3,550. A system of regular daily instruction for apprentices had been started in a lecture-room fitted up for the purpose. Lectures were given by members of the staff, some of them foremen. Tutorial work by foremen broadened the instructor's own view and tended to create in him a greater interest in the progress and welfare of the boys. The school was open on the average 7½ hours every day, and 271 apprentices had received instruction. He was sure they would agree that this school was performing a most valuable work, and the thanks of the company were due to those who so unselfishly carried it on.

Mr. E. A. **Goulding**, M.P., seconded the motion.

Mr. H. W. **Birks** said that he thought the shareholders looked forward to the future with even greater confidence than the Chairman would seem to by the tone of his speech. The board had done so well in former years that he thought the report encouraged them to hope that their prosperity would continue in the future. He thought something might be done in the way of legislation by which companies like their own should not have to compete with foreigners when local authorities and the Government were giving out their contracts.

The **Chairman**, in reply, said he did not take a pessimistic view of the future for, as he had said, he thought that many companies were likely to be a great deal worse off than themselves. He thought, however, they must not expect that the accounts for the current year, and probably those for 1916, would be as good as those now before them. The labour difficulty was a very serious one, and he thought they had a great deal to thank the trade union leaders for in the way in which they had managed affairs during this trying time. With regard to legislation on the subject of contracts going abroad, there Mr. Birks raised the whole question of Free Trade or Protection, and he felt sure there was very little likelihood of any legislation on the point at the moment. He must say that since the war, owing to the dishonourable pretensions of Germany, he took quite a different view on that particular question to that which he previously held—not that he thought we ought to have Protection, but he would expect that the attitude of persons in this country towards Germans would be different from what it was before the war. He defeated the Prussians but it must not be forgotten that the reason they had been so successful in capturing trade both in this country and in our Colonies was because they were willing to provide what the people wanted, whereas English manufacturers were in many instances too slow to adapt themselves to new conditions. Generally speaking, Government departments had given a preference to English contracts where possible, and he believed that when the war was over that attitude would be very much accentuated here, and especially in France and Russia.

The report was adopted.

Urban Electric Supply Co., Ltd.

Mr. P. D. Tuckett (Chairman) presided on March 31st, at Salisbury House, E.C., at the annual meeting. In moving the adoption of the report, the Chairman said that having regard to the exceptional conditions under which the business was conducted during the latter half of the year they might congratulate themselves on being able to present so satisfactory a report. Their profits were larger by some £4,000, out of which they were able to pay an additional 1 per cent. dividend on the preference shares, after meeting the increased interest and redemption charges, and after appropriating £10,904 to reserve for depreciation. A year ago the corresponding appropriation was £12,000, so that superficially they appeared to be now making a smaller reserve provision, but this was not really the case. The Cornwall company earned in respect of the past year a profit of £17,325, of which only £12,162 was brought into their profit and loss account. For 1912 and 1913 a portion of the reserve provision made in their accounts was earmarked to the Cornwall company, whereas on this occasion that company had made an independent reserve provision for the year of £4,000, so that if they added this £4,000 to the £10,904, which they proposed to set aside, the total provision made for depreciation this year was nearly £15,000, as compared with £12,000 a year ago. The capital expenditure for the year was £35,000, and this was met by the sale of £24,524 debenture stock and by utilising the reserve provision appropriated from revenue, the "amount due to contractors" being reduced by about £1,300. During the current year capital expenditure was likely to show a further reduction compared with recent years, although they might still have to spend something not far short of £30,000, for, in spite of the war, it was neither desirable nor possible entirely to shut off all capital expenditure. They were proposing shortly to make an issue of debenture stock of the Cornwall Power Co. It would be a 5 per cent. stock, of a particularly well secured character, inasmuch as a statutory company could only issue debenture stock to the extent of one-third of its paid-up capital, *i.e.*, to the extent of one-fourth of its capital assets. The company was doing remarkably well, having already in its third year of working earned a return in excess of 8 per cent. on its entire capital, or sufficient to cover the debenture interest more than five times over, and there was every promise of its continuing to make equally satisfactory progress as the business further developed. The proceeds of the issue would be applied in part to repaying the Urban company a portion of the advance which it had made to the Cornwall Co. The issue would probably require the Treasury's approval, and they had not yet secured this, but they did not anticipate that they would have any difficulty in doing so. Reverting to the balance sheet, the various revenue reserves, which amounted to less than £10,000 in 1911, when they reduced their capital, now stood at £73,445, before crediting the provision of £10,904, which they proposed to set aside in respect of the past year, and without taking into account £8,000 standing to the credit of the Cornwall company's reserve for depreciation. On the other hand, the capital reserve had been reduced by a further £9,394 in the process of giving effect to the object for which it was created, and following the same procedure as in previous years. They had connected during the year the equivalent of 76,200 33-watt lamps, or rather less than in the previous two years. Still, it was a most substantial and satisfactory addition of 10 per cent., and it was entirely owing to the war that the previous records were not exceeded, for the connections for the first half-year were considerably larger than those for the corresponding period of the previous year. As it was, the power connections exceeded those for 1913 by the equivalent of 3,704 lamps, the reduction being in the lighting connections, which were less by the equivalent of 10,328 lamps. The lighting connections represented an increase of 5 per cent., and the power connections an increase of 16 per cent. on the previous respective totals. The output for the past year increased by 2,060,571 units, from 22,034,983 to 24,095,554, an increase of rather more than 9 per cent., the lighting units having increased 6 per cent., and the power units 10 per cent. Of this output, the Cornwall company's proportion exceeded 16,000,000 units, and was sold at an average profit of .253d., or a trifle over a farthing per unit, whilst the remainder realised an average profit of 1.104d. per unit. It was interesting to compare these rates of profit with the estimated profit of 3d. per unit on which the original prospectus figures were based in 1901. They could not have a better illustration of the enormous changes which had taken place in the character and conditions of the business, owing to the introduction of the incandescent gas mantle, the creation of a heating load, and the enormous and altogether unforeseen development of the power load for it was to these developments and to the increased efficiency of the plant rather than to any marked inadequacy of price that the difference in the figures were attributable. In illustration of the profitable character of power load at even so comparatively small a profit as a farthing per unit, where the conditions were favourable and the business was conducted with care and judgment, he might call their attention to the yield of over 8 per cent. on the entire capital invested in the Cornwall undertaking, whereas, of their other undertakings, after 10 or 12 years' working, Hawick and Grantham were the only two showing a yield of as much as 6 per cent., and in the case of Hawick the greater part of the load was power. Although none of these figures which he had given were unsatisfactory, there was, he thought, no doubt that they would have been still more satisfactory but for the war, for although they had derived some direct benefit from the war in the case of Hawick where, during the latter part of the year, the mills had been abnormally busy with large Government orders, and in the case of Grantham, where one of the large military camps had been established and was being supplied by them, the majority of their undertakings had, on the other hand, in varying degrees distinctly suffered from the various adverse influences resulting from the war, and he was very much afraid that some of these influences might be accentuated as the war proceeded, and even more markedly perhaps after the war, if it was unduly protracted. The Chairman dealt with the effects of the war on the towns of Dartmouth, Penzance, Berwick, Stanford, Godalming, Glossop and Camborne, where there were undertakings in which the company was interested, and also touched on the rise in the price of coal and other materials and the rise in wages for labour. Lastly, he said, not the least serious loss they had sustained had been in the inevitable disorganisation of their staff consequent upon a number of their men joining the Colours. Altogether they had lost rather more than 100 men, a number they could ill afford to spare from their by no means over adequately staffed stations, for theirs was a skilled business and this was no easy time to replace skilled men trained in their service. They were making good to the dependents of those who had gone any diminution in the pay they were previously receiving. Although they were bound to suffer to some extent, he saw no occasion for unnecessary depression. In spite of the war they had reached the stage when they were able to recommend the payment of the full preference dividend; and he did not anticipate that they would be unable to maintain it, but he did think that it might be somewhat longer than he had hoped before they would be in a position to resume the payment of an ordinary dividend. But, whatever effect the war might have on the immediate prospects of the business, it would not, he felt sure, affect its permanent prosperity or deprive them in due course of the fruits for which they had so long and so patiently laboured.

Sir Douglas Owen seconded the motion.

In reply to questions, the Chairman said he did not think it wise to state the price at present at which they hoped to make the Cornwall company's debenture issue.

The motion was carried.

Cleveland and Durham Electric Power, Ltd.

The annual meeting was held at Newcastle-on-Tyne on March 29th, Mr. James Falconer (Chairman), M.P., presiding. The Chairman said the gross profits for the year amounted to £36,838, and in considering that amount it was necessary to take into account the exceptional circumstances under which the business of the year had been carried out owing to the fact that a war was going on, and that many businesses had been upset by it during the latter part of the year. It had affected that company adversely. With regard to existing customers, in a good many cases there was a considerable diminution in the volume of their business, and not only that, there was not a steady diminution, for they had to keep themselves in a position to supply the full demands, although to a considerable extent their demands did not reach anything like the normal. The cost of production was, therefore, increased. In the coal and ironstone area, which they largely supplied, the volume of business had been very seriously affected by the diminution of the number of men available for the work. They had also increased cost of coal, and that to a substantial extent affected their business. Another additional cost was due to the delay of making connections which had been already contracted for; in some cases plant which ought to have been supplied from abroad, and other from engineering shops at home, could not be delivered because the shops had had to devote their attention to producing articles urgently needed for the war. For this and other reasons it was not possible to draw reliable comparisons between the state of their business for 1914 and the preceding corresponding periods. Under all the circumstances, he thought the gross profits were not unsatisfactory compared with what the directors, at least, thought might be their position when the war broke upon them. After providing for debenture interest, there was a net profit of £16,826, which, with the sum of £8,798 brought forward from the last account, gave them an available balance of £25,624. The directors had come to the conclusion that it was the right thing to pay a dividend of 4 per cent. on the preference shares amounting to £13,348, to transfer to depreciation and renewals £3,000; as against £2,000 for the preceding year, and to apply £1,000 towards the reduction of the expenses of the issue of debentures, carrying forward £8,276. Referring to the work of the year, he said they had completed and connected up a very large supply to the Horden Colliery, and the plant was a complete success, demonstrating that electrical working could be established on a large basis in all departments of colliery working. As to future business, they had at the moment contracted for further connections to the extent of 9,000 H.P., and that included contracts with the Middlesbrough and Stockton Corporations. The company were making allowances to the men who had joined the Colours.

Mr. W. R. Armstrong seconded the report.

Mr. A. Gemmell said he was ready to admit that the directors had had difficulties to deal with, and he believed the directors to be honourable men, but honourable men were sometimes so ill-advised as to accept a wrong policy and had not always the courage to change their course. The Board of Trade auditor had said that he could not check certain figures. Although the Cleveland group consisted of three companies it comprised one business; but there was no audit of the business as a whole and inter-company transactions on a large scale could not be properly checked. When the control of Parliamentary undertakings could be acquired, as it had been by that company, without Parliamentary sanction, by buying shares in companies invested with Parliamentary powers, and when that control was exercised against the interests of consumers and of shareholders, the case was a strong one for drastic remedy.

Mr. Chipchase asked how much the company got for supplying current, and what was their income from investments. He was very doubtful whether they ought to pay a preference dividend this year. There were too many deferred charges or liabilities against the company, including the issue of the debentures. He referred to the question of depreciation and was doubtful whether they were writing off sufficient for this purpose. It seemed to him that the financial position of the company was not yet sound. During the past year the directors had spent £18,000 on capital charges, and it seemed that they would be faced with a further capital expenditure this year, although the directors were silent on that point. To what further expenditure were they committed? Did they think the financial position justified them in making further capital expenditure? Ought not their energies to be directed to getting the best possible out of their present plant. He thought their expenses were much more than they ought to be. Unless the directors could assure them that they were strongly of opinion that the dividend could safely be paid, he moved that it be not paid at all.

The Chairman said there was no point for him to reply to in Mr. Gemmell's speech. In reply to Mr .Chipchase, he said he was not quite sure that he could give all the details asked for from memory, but they had all been carefully considered by the directors. They had always refrained from giving figures with regard to their income from the supply of current, for the obvious reasons that they did not think it was the practice of companies like theirs to give figures that would show the price at which they were supplying the current to different consumers, or even the average price. His own view of the company was that he thought that the time had arrived when it was desirable, and he thought they were fairly entitled, to accept a somewhat higher price than in the past for current supplied. In regard to the question of dividend, he thought that when the preferred shareholders had agreed to accept a dividend which was not cumulative the fair way in which to approach the question of paying a dividend to preferred shareholders was to see what was the profit of any particular year, after making proper allowances. Every legitimate consideration had been taken into account by the directors, and they had come to the conclusion that the right course was to make a payment of 4 per cent., recognising their responsibility in making it. As to further capital commitments, the directors had had in view for some time the importance of limiting so far as possible the capital commitments. There had been no avoidable expense incurred in the way of looking out for new business.

The report and statement of accounts was adopted.

The Chairman moved the payment of the preference dividend and the Hon. Robert James seconded.

Mr. Chipchase proposed that no dividend be paid this year, and Mr. Gemmell seconded, but the amendment was lost, and the motion was agreed to.

Launceston and District Electric Supply Co., Ltd.

The annual meeting was held on March 29th, Mr. R. B. Rogers presiding. The report showed that the business had grown satisfactorily, and that the number of customers at the end of the year was 188, and lamps 5,020. The revenue receipts amounted to £1,130, and the working expenses to £685, leaving a gross profit of £445. The number of units distributed during the year was 50,329. The Chairman said the company were appealing against the assessment as to rates, and they believed they would get it reduced. As to the business, while it was proceeding satisfactorily, he would like to see an increase in the supply of small motors. Mr. W. H. Symons (Vice-Chairman), in seconding the motion, referred to the decrease in working expenses. The town lighting had been approved by the Corporation, and the question of extending the mains was under consideration. He paid a tribute to the Engineer (Mr. Oxenham) for his tact and careful management. The report was adopted and a dividend of 2½ per cent. agreed to.

A vote of thanks was accorded to the directors and staff, special mention being made of the services of the Secretary (Mr. F. Benoy).

Woking Electric Supply Co., Ltd.

The report for 1914, which was adopted at the annual meeting held on March 20th, states that the revenue was £19,292, and the expenses for generation, distribution and management were £10,415, leaving £8,876, plus £622 brought forward and £132 for income tax accumulations. Interest on debenture stock absorbed £2,471, interest on temporary loans £369, dividend on the 6 per cent. cum. pref. shares £2,846, leaving £3,945, out of which £1,500 is placed to depreciation and renewals fund, £500 to reserve, 5 per cent. is paid on the ordinary shares, and £653 is carried forward.

	No. of consumers.	Lamps connected.	Revenue.
1912	1,761	79,717	£15,668
1913	1,901	88,143	£17,584
1914	2,021	95,803	£18,878

During the year the directors issued £850 4½ per cent. debenture stock, £5,379 6 per cent. cum. pref. shares, and £350 ordinary shares. Owing to the continuous growth of the business of the company the directors are still looking towards issuing further debenture stock, and ordinary shares. The expenditure on capital account on December 31st, 1914, amounted to £138,955. During 1914, over three miles of new distribution cables have been laid.

	1913.	1914.
Units generated	1,125,640	1,237,901
Sold	854,016	939,700
Used in works, offices, etc.	28,555	35,085
Total accounted for	882,571	974,785
Energy dissipated in transformers, etc.	243,069	263,116
Maximum supply demanded	645 K.W.	[illegible]

The depreciation and renewals fund account now stands at £14,395, and the reserve account at £850.

Bromley (Kent) Electric Light and Power Co., Ltd.—The directors report that during 1914 the connections have increased from 3,850 to 4,089 KW., but the effect of the war, especially during the last quarter, has been to seriously reduce the current sold. The result of the year's trading, including £1,895 brought forward, shows a profit of £13,884, and after payment of debenture interest and trustees' fees, &c, amounting to £3,013, there is a balance of £10,871. An interim dividend at the rate of 4 per cent. per annum was paid for the half-year in October, and the directors recommend the payment of a further dividend for the second half-year at the rate of 10 per cent. per annum, making a total dividend of 7 per cent. for the year, that £4 000 be placed to general reserve account, leaving a balance of £1,621 to be carried forward.

Telephone Co. of Egypt, Ltd.—After providing for debenture interest, &c., the accounts for 1914 show a profit of £198,281, inclusive of £134,646 brought forward; further dividend of 6 per cent. on both the preferred and deferred shares, making the usual distribution of 10 per cent. for the year are to be paid, carrying forward £171,550.—*Financial News.*

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets returned after Easter to their accustomed haunts, invigorated and refreshed by the change. Members of the National Guard who went to Brighton were amongst the few dissatisfied people, the weather having played them false for the greater part of the time. The signalling section, which was to have had tests in Morse reading, etc., was disappointed of its hopes; but, speaking generally, the old Stock Exchange joke was fairly applicable—that the principal features of the markets after the holiday were sunburnt—and cheerfulness dominated most sections.

There is still brisk demand for investment securities of all kinds, and the difficulty is to get sufficient stock to fill the buyers' requirements. Gilt-edged issues are being eagerly snapped up, and the prospect of another big War Loan fails to subdue the appetite of those who are content with 4½ per cent. on their money, combined with as much security as can be expected while European war rages. Jobbers in the telegraph department retort with bitterness that they are not certificate manufacturers, when they are charged with having neither enterprise nor stock. Conspicuous amongst more speculative markets is the strength of rubber shares, where the activity is such that, anomalous as it may appear, some of the firms connected with the market put in two or three days' work in their offices during the Easter holidays.

The rumour as to fusion between the County of London, the South London and the South Metropolitan companies is obtaining publicity, but it is pointed out that this probably started through the Chairman of the County of London stating at the recent meeting that the company had acquired a block of South London shares and that a working agreement between the two concerns was not improbable. As regards the South Metropolitan Co., the report has been sufficient to maintain the price of the ordinary shares at about 12s. 6d.

City of London shares are good at 14½, and County preference at 11½ are ⅛ higher. The rises in the rest of the list are well maintained, and there is little floating supply of shares—still less of debenture stocks. The coming rise in the price of the current has had no effect upon quotations of electricity supply shares, so that those who expected a similar result in this department to that amongst gas securities, which fell upon the announcement of increased prices, had no cause for their apprehensions. The reason, of course, as we pointed out before, lies in the fact that whereas the gas companies are regulated by the sliding scale, those of the electricity supply undertakings are not subject to any such restriction.

We append our usual list of representative stocks and shares in the markets connected with the industry :—

Home Electricity Companies.

	Mean price. July 27, 1914.	April 6, 1915.	Rise or fall this week.
Brompton Ordinary	9⅛	8½	—
do. 7 per cent. Pref.	8⅝	7¾	—
Charing Cross Ordinary	5½	4½	—
do. do. do. 4½ Pref.	4¾	4⅛	—
do. do. City Pref.	4⅜	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅛	4⅜	—
do. 4½ Deb.	96½	92	—
City of London	16	14½	+ ½
do. do. 6 per cent. Pref... ..	13½	12⅛ xd	—
do. do. 5 Deb.	116½	112	—
do. do. 4½ Deb.	100½	98	—
County of London	12	11⅜ xd	—
do. do. 6 per cent. Pref. ..	12	11½	+ ⅛
do. do. 1st Deb...	102½	100	—
do. do. 2nd Deb.	100½	97	—
Kensington Ordinary	7½	7	—
London Electric	1 7/16	1¾	—
do. do. 6 per cent. Pref... ..	5 1/16	4 13/16	—
do. do. 4 Deb.	92½	87	—
Metropolitan	8½	8	—
do. 4½ per cent. Pref.	4 7/16	4	—
do. 4½ Deb...	97½	96	—
do. 3½ Deb...	83	80	—
St. James' and Pall Mall	9⅜	8½	-
do. do. do. 7 per cent. Pref.	7	6⅜	—
do. do. do. 3½ Deb.	84½	80	—
South London	8 1/16	8	—
South Metropolitan Pref.	1½	1⅛	—
Westminster Ordinary	8⅜	7½	—
do. 4½ Pref...	5⅛	4⅞	—

Telegraphs and Telephones.

	Mean price. July 27, 1914.	April 6, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108½	103¾	—
do. Def.	23	21¾	+ ⅛
Chile Telephone	7⅜	6⅝	—
Cuba Sub. Ord.	8½	8¾	+ ¼
do. Pf.	16½	15	—
Eastern Extension	12¾	13	+ ½
do. 4 Deb.	97½	92	—
Eastern Tel. Ord.	130½	132	+ 1
do. 3½ Pf.	77½	73½	—
do. 4 Deb.	96½	93	—
Globe Tel. and T. Ord.	11¼	11½	+ ¼
do. Pf.	12⅞	12	—
Gt. Northern Tel.	32½	29	—
Indo-European	59	61	—
Marconi	1 15/16	1⅞	+ ⅛
New York Tel. 4½	101	99¼	+ 1¼
Oriental Telephone Ord.	2 5/32	2	—
do. Pf.	1 1/32	1 3/16	—
Tel. Egypt Deb.	98	88½	—
United R. Plate Tel...	6⅜	6	—
do. Pf.	5½	5	—
West India and Pan.	1½	1 3/32	—
Western Telegraph	13⅜	13⅝	+ ⅜
do. 4 Deb.	96½	93	—

Home Rails.

	Mean price. July 27, 1914.	April 6, 1915.	Rise or fall this week.
Central London, Ord. Assented	88	77	+ ⅛
Metropolitan	87½	29	—
do. District	21⅜	17	— ½
Underground Electric Ordinary ..	2½	1 3/16	—
do. "A"	7/6	5/6	—
Income	88	81	—

Foreign Trams, &c.

	Mean price. July 27, 1914.	April 6, 1915.	Rise or fall this week.
Anglo-Arg. Trams, First Pf.	4⅞	4½	—
do. 2nd Pf.	4½	3⅞	—
do. 4 Deb.	91	84	—
do. 4½ Deb...	98½	90	— 1
do. 5 Deb.	96	88	—
Brazil Tractions	66	53½	- 1
Bombay Electric Pf...	11⅜	10⅜	—
do. 4½ Deb...	96	91	—
Mexico Trams..	70	80	—
do. 5 per cent. Bonds ..	84	45	—
do. 6 per cent. Bonds ..	76	50	—
Adelaide Sup. 6 per cent. Pf.	5½	5½	—
do. 5 Deb.	104	103	—

Manufacturing Companies.

	Mean price. July 27, 1914.	April 6, 1915.	Rise or fall this week.
British Westinghouse Pref.	1⅜	2	—
do. 4 Deb.	74½	72	—
do. 6 p. lien	102½	99 xd	—
Callenders	11⅞	12	—
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2½	3 3/16	—
Edison & Swan, £3 pd.	3/32	14/6	—
do. do. fully paid	1¼	2⅛	—
do. do. 4 Deb.	59	63	—
do. do. 5 % Deb.	63½	60	—
Electric Construction	17/32	13/9	
do. do. Pf.	1/16	1	—
Gen. Elec. Pf.	10¾	10	—
Henleys	15	14½	— ½
do. 4½ Pref.	5	4⅞	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	9¼	+ ¼
Telegraph Con.	38½	37	—

Marconi shares have risen to 1⅞, a gain of 2s. 6d., so that the company's recent circular, intimating that there would be no dividend at present on the ordinary shares, has had the anomalous effect of causing the price to harden. Expectation looks for the previous dividend to be maintained when the board consider it advisable to make a distribution. American Marconis have risen to 10s., on account of the prosperity which is said to have recently visited the United States, and which is reflected in very substantial rises amongst American railroad shares of all classes, from investment to rubbish. It would appear that the unfavourable effects of the war upon the States are already wearing off, and that the country is beginning to feel the benefit of the demand from the belligerent countries for those things which the Americans are so well able to supply. Canadian Marconis are better at 5s. 6d.

In the Home Railway market, Central London Assented ordinary improved to 77, and a buyer this week had to pay 78 for stock, the preferred ordinary changing hands at the same price. Districts, however, are dull at 17. Home Railways as a group are stagnant, with a tendency to depression; and this market has received none of the attention which the public are bestowing upon other investment parts of the House. The prior-charge stocks, however, are firm, the disposition in their case being much better than that governing the Ordinary issues.

New York Telephone bonds are 1¼ up at 99¼. Anglo-American Telegraph deferred is better, and there are noticeable rises in Cuba ordinary, "China" shares, Eastern ordinary stock, and Western Telegraphs. The last-named are ⅜ up at 13⅝, with very few shares about. The manufacturing division finds it difficult to supply the demand from investors. Henley's are a shade easier at 14½; but India Rubbers gained ¼, and British Insulated are good at 11⅛. British Aluminium shares have fallen back to 20s. 6d., the recent report falling short of bullish anticipations, and this price is still cum. the dividend of 1s. per share.

Mexican matters look a little less black; and although prices amongst the utility companies are no better than they were a week ago, the pressure to sell is somewhat relaxed. If we were giving tips, we would venture to suggest that the speculator might find in this department useful scope for his peculiar talents. Brazil Tractions are a point higher at 53½, most things connected with the Republic having improved within the past few days.

Armament shares are mending again, Vickers and Armstrongs both being slightly better. The rubber market, however, is the most active section amongst industrials. While the price of rubber itself keeps steady, the attractions of the well-managed producing concerns have suddenly attained public recognition in a highly practical manner; so that those whose business lies along rubber paths find they have as much as they can do to cope with the work flung upon their shoulders. Probably the animation and excitement will prove transitory. Speculation being eliminated, people have to pay for what they buy; and, after all, there is not such a lot of money about that rubber shares can be bought for an indefinite period. So the market will no doubt fall upon quiet times again; but, meanwhile, orders are pouring in from all parts of the country. The wise man, of course, is he who sells when others are buying, though, in applying this axiom to rubber shares, it deserves to be remembered that, even at their advanced prices, the majority return handsome yields, and are likely to pay more in the near future.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

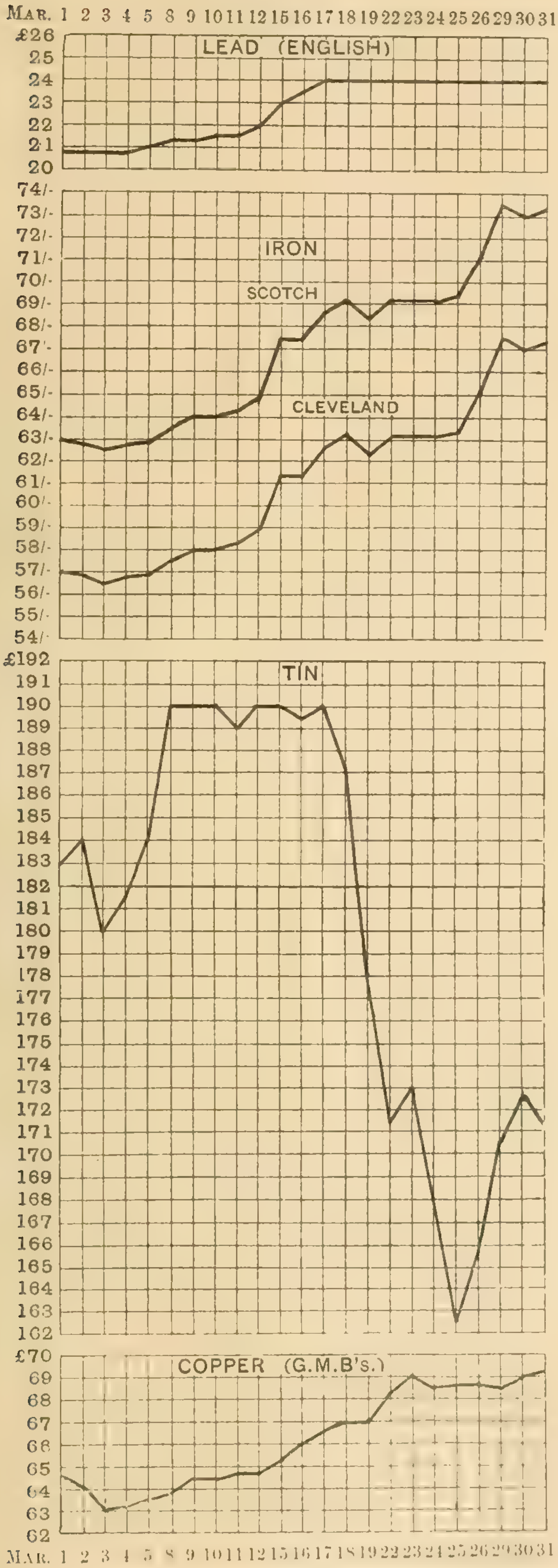
Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Mar 10	2,503	— 423	10	6,391	— 725	..	..
Blackpool-Fleetw'd	April 3	1,825	+ 61	13	4,143	+ 118	8	..
Bristol	„ 2	34,297	+4,071	13	109,792	+ 11,280	30·5	..
Chatham and Dist.	Mar. 18	3,448	+ 689	11	10,641	+ 1,612	14·98	..
Cork	April 1	1,805	— 40	13	6,653	— 216	54·25	..
Dublin	Mar. 26	22,803	+ 806	12	66,945	+ 3,481	9·89	..
Hastings	„ 25	3,038	— 33	..	..	+ 73	19·3	..
Lancashire United	„ 31	6,088	— 13	13	19,550	— 214	42	..
Llandudno-Col. Bay	„ 26	839	+ 154	16	2,924	+ 439	6·5	..
Tyneside	„ 24	2,082	+ 1?0	12	5,955	+ 279	11	..
Anglo-Argentine ..	April 1	206,972	20,418	13	610,676	—74,571	..	..
Auckland	Mar. 12	19,907	—3,425	36	185,935	+ 4,513	25·42	1·05
Calcutta	„ 27	17,044	— 819	..		— 3,494	..	..
Kalgoorlie, W.A. ..	Jan.	2,872	..	4	2,972	..	..	..
Madras	Mar. 15	3,427	— 65	10	9,081	— 203	..	..
Montevideo ..	Feb.	30,007	-5,798	8	118,136	—19,765	..	..
Dublin-Lucan Rly.	April 2	433	+ 53	13	1,555	+ 38	7	..

Stock Exchange Notice.—Application has been made to the Committee to allow the following securities to be quoted in the Official List :—

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Further issue of 60,179 ordinary shares of £1 each, fully paid, Nos. 737,501 to 797,679, and 224,832 5 per cent. preference shares of £1 each, fully paid, Nos. 687,501 to 912,332.

METAL MARKET.

Fluctuations in March.



London Electrical Workers: Threatened Strike.—In the *Times* of April 1st it was stated that the electrical workers employed on repair work on shipping in the Port of London had decided at a mass meeting to strike on April 14th, unless their demands were conceded. The men are mainly employed on fitting up ships taken over by the Government. They are asking for a regular hourly wage of 1s. and a 48-hour week. The same paper states that the engineers and mechanics employed on the tube railways of London have decided to cease work on April 10th unless certain wages concessions are granted by the "T.O.T." combine by that date. Several hundred men who are engaged in the repair and maintenance work of the railways are affected.

TEMPERATURE MEASUREMENT IN A MODERN POWER HOUSE.

By CHAS. S. JEFFREY, A.M.I.E.E., A.Amer.I.E.E.

It should be the aim of every engineer, in order to secure maximum efficiency, to run his plant as nearly as possible under test conditions; in other words, he should make accurate measurements at short intervals of all the factors affecting its efficiency. Of these factors, the measurement of temperature receives least attention in most power houses, although having regard both to economy and to the safety of the plant it is of very great importance.

Various modern types of temperature-measuring instruments were described by Mr. Robert S. Whipple in the *Proceedings* of the Institution of Mechanical Engineers, No. 3, July, 1913. The types of instruments best adapted for power-house work are the mercurial glass thermometer, the indicating or recording mercurial thermometers of the Bourdon gauge pattern, and the electrical resistance thermometer.

Excluding the temperature of the furnace, the highest temperatures that have to be measured are those of the boiler flues and of the live steam, which seldom exceed 650° F.; and the lowest, that of the atmosphere.

In a complete electrical installation the following points should be fitted with thermometer elements and connected up to the temperature switchboard:—

1. Boiler feed-water storage tank.
2. Boiler feed-water inlet and outlet of economiser.
3. Exit flue gases inlet and outlet of economiser.
4. Boiler steam header.
5. Main stop valve of prime mover.
6. Generator stator.
7. Generator inlet and outlet of ventilating duct.
8. Generator bearing oil pipes.
9. Exhaust steam to condenser.
10. Condenser cooling-water suction and discharge.
11. Hot well.
12. Coal bunkers.

Boiler Furnace Temperature.—In the foregoing list the temperatures of the boiler furnaces have been omitted because the temperature-measuring instruments suitable for the other sections of the plant in a power house cannot be used for this purpose. The most suitable instrument for measuring furnace temperature is the optical, or radiation, pyrometer, but such instruments can hardly be entrusted to a fireman or a meter reader.

A knowledge of the temperature of the furnace in a steam boiler may, however, be of great value.

It is now generally recognised that the efficiency of combustion in a boiler furnace varies with the size and composition of the fuel, and that, for example, a furnace which may be well suited for burning anthracite is uneconomical when fired with bituminous coal. In burning anthracite combustion takes place almost entirely on the fire-bars, owing to the very high percentage of fixed carbon, but with bituminous coal much of the heat is obtained from the combustion of the volatile gases after they have been distilled from the coal. High temperature is necessary for the complete combustion of these gases, and for this reason it is necessary to use some form of reverberatory furnace to prevent them coming prematurely in contact with the boiler tubes and being cooled below the temperature necessary for complete combustion.

Although pyrometers for indicating furnace temperature are unnecessary under ordinary working conditions in a power house, they might well be more frequently used in boiler testing, as an assistance to the engineer in determining which is the best size and quality of fuel to use in a particular style of furnace, or, conversely, the best form of furnace for the combustion of a particular class of fuel. The degree of combustion that has been attained is given by analysis of the flue gases. The use of pyrometers in the furnace is suggested to locate the cause of imperfect combustion as shown by the flue-gas analysis.

If high-temperature pyrometers were more commonly used, improvements in the design of boiler furnaces would assuredly result. Station engineers, more particularly those domiciled abroad, are often faced with the problem of adapting their furnaces for the combustion of fuel of an entirely different quality from that for which they were originally designed.

A simple method of estimating approximately the temperature of a boiler furnace is by the analysis of the flames by means of violet glass. The greater the intensity of the action in the boiler furnace the greater will be the actinism of the rays emanating from it; or, in other words, the more perfect the combustion the greater will be the proportion of violet rays emitted by the flames. By means of the violet glass all the rays less active than violet are cut off. In a well-designed furnace, working under good conditions, the whole of the internal surface will be incandescent, and will appear luminous when viewed through the violet glass. If the temperature of the gases is low, then dark patches will appear where the rays are less active than violet, indicating that at those parts of the furnace complete combustion of the volatile gases may not take place.

Boiler Flue Gases and Economiser Temperatures.—Measurement of the temperature of the exit gases from the boiler flues is a matter of no difficulty, and can be effected by means of electrical distance thermometers or by mercurial thermometers of the Bourdon type. Mercurial pyrometers are accurate and reliable, but, if readings are to be taken frequently, it is necessary to have one in the flue of each working boiler, because the time taken for the pointer to reach the true temperature reading is considerable. Flue-gas pyrometers of the Bourdon pattern are more expensive instruments, and are more liable to derangement, than the resistance element of the electrical thermometer. It is true that the indicating instrument of the latter is much too delicate to be installed in a dirty boiler-house in the open, but proximity to the test points is not of great importance. With electrical thermometers it may be considered necessary in a large station to have more than one switchboard, but, in the opinion of the writer, the advantage lies rather in being able to take all the readings at one point.

Usually it is not advisable to admit the feed water to the economiser at a temperature of less than 100° F. on account of the condensation of the corrosive gases from the flues which takes place against the cold tubes of the economiser. Very rapid deterioration of the economiser may take place from this cause. If no exhaust steam is available for the preliminary heating of the feed water up to about 100° F., some engineers feel justified on this account alone in using a live-steam heater. Where feed heaters and economisers are used, temperature readings are the only means available of determining the efficiency of their operation. If these readings are taken regularly, any falling-off in the performance of the economiser or feed-water heater through dirty or scaled tubes can be detected. All economisers should be fitted with thermometers at the inlet and outlet of the flue gases and at the inlet and outlet of the boiler feed water.

Where means are available for determining the evaporation of each boiler, the temperature of the flue gases gives an indication of the condition of the fire-brick baffles. Low evaporation with high flue temperature will indicate that the gases are leaking past the baffles without giving up their heat to the boiler.

When the boilers are known to be in good order, the shift engineers can readily tell by means of the flue temperature readings whether the furnaces are being fired so that each boiler bears its proper share of the load.

Steam Temperature.—When the steam is not superheated a thermometer is not necessary in the boiler header, as the temperature of the steam has a fixed value corresponding to every value of the pressure. Accurate pressure gauges are required by law, and from them the temperature can be deduced. The use of superheated steam in electrical generating stations is now almost universal, however, as the efficiency of the steam turbine increases with increase of superheat. From the standpoint of efficiency it is quite as important accurately to maintain the steam temperature as it is to maintain the steam pressure, yet in most stations a recording pressure gauge is considered a necessity, while the steam temperature readings are taken most casually. The efficiency of a boiler is the ratio of the heat units imparted to the steam to the heat units taken from the fuel. Unless a means of measuring the temperature of the steam is available the efficiency of the boiler cannot be determined.

Generator Windings.—Temperature readings of great importance, more particularly with reference to the safety of the plant, are those of the windings and cores of generators and transformers. It is impracticable to take temperature readings of the rotor of a loaded generator, but those of the stator can always be determined. It is fortunate that in turbo-alternators the rotor is seldom subjected to a pressure exceeding 100 volts, and carries a current fluctuating within comparatively narrow limits, so that the danger of an excessive rise in temperature is negligible, if the ventilating arrangements are in order. Some interesting comparisons of different methods of measuring stator temperatures were given in a paper presented under the auspices of the Standards Committee of the American Institute of Electrical Engineers, and were recorded in the *Proceedings* of that Institute for February, 1913. The method recommended is the insertion of exploring coils in the hottest part of the machine. The authors found that the temperature rise at the hottest part might be as much as 60 per cent. greater than was indicated by mercurial thermometers placed against the core or in the ventilating slots. If suitable provision is made in designing the generator, an exploring coil in the form of a distance thermometer element can be placed in any part of the core. Without this provision the electrical thermometer will still give higher readings than can be obtained by mercurial thermometers, because it is not subject to the restriction that it must be placed where it is easily accessible. The mortality caused among mercurial chemical thermometers by poking them into ventilating slots is very high, and if they are left in the machine after it is shut down they will inevitably be broken by the cleaners.

In a modern turbine it is of great importance that an adequate supply of air for ventilating the generator should be maintained. Should a thermometer not be provided in the core of the machine itself, the temperature of the inlet and outlet air should be taken. Although this does not give the true temperature of the machine, an increase in the difference of temperature between the inlet and outlet air will indicate that the temperature of the generator has increased, or that the supply of air has been interrupted. It is the temperature rise that limits the load capacity of the machine, and manufacturers' rating of load capacity may be largely discounted by the conditions under which it is operated. For example, in some parts of India there is a difference of 50° between the minimum and maximum shade temperatures.* It is obvious that a machine can be run at an overload for a much longer time when the atmospheric temperature is 40° than when it is 90°.

The writer has been struck by the diversity of opinion among the shift engineers of his acquaintance as to when a machine is sufficiently loaded; and he would suggest that after the maximum permissible temperature has been carefully determined, shift engineers should be guided by the thermometer as much as by the ammeter. The thermometer gives a steady reading, whereas the ammeter, particularly on traction generators, often varies so much as to make it a matter of some difficulty to determine what the load actually is. It is desirable that the thermometers should be placed in the centre of the air trunk, where the wind velocity is highest. The ventilating trunks are very often difficult of access, and to take the readings with mercurial thermometers it is often necessary that the attendant should go into them bodily. The advantage of distance thermometers in this section of the plant is obvious.

Bearings and Oil Supply.—In a steam turbine the temperature of the oil gives an indication of the temperature of the bearings, provided, of course, that the rate of flow of the oil is clearly visible. However reliable distance thermometers may be, it is not suggested that they can displace or reduce appreciably the amount of attendance that is required on an important piece of plant like a steam turbine, and it would be unwise to put distance thermometers where close personal attention is required, but where very accurate determination of the temperature is not necessary. f the bearings are not readily accessible, as in a vertical steam turbine, then separate resistance elements might be placed in each of them, but ordinarily, in the opinion of the writer, it is sufficient to know the temperature of the suction and discharge pipes to the oil tanks. The oil suction temperature reading enables the supply of cooling water to the coils in the tanks to be controlled so as to maintain the desired temperature of the oil supplied to the bearings.

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* The use of wet air filters reduces the temperature variation of the air available for cooling very much, because with this type of filter the air is delivered to the machine at the temperature indicated by the wet-bulb thermometer. The variation of the dry-bulb thermometer is always much greater than that of the wet-bulb thermometer. The wet-bulb reading seldom exceeds 80° F. in any part of the world, while the dry-bulb reading may reach 120° F., or even higher. 80° F. is a very high wet-bulb reading, and only in very humid tropical districts is that figure approached

Condensers.—Temperature readings at the condensers are economically of great value, particularly when the cooling water is discharged to cooling towers. For every value of the vacuum, saturated steam has a corresponding temperature, and the injection water and condensate discharge should as nearly as possible approach the steam temperature. It is the function of the condenser to take only the latent heat from the steam, and if the condensate or injection water discharge temperature is below the temperature corresponding to the vacuum (or more correctly the absolute pressure), it means that unnecessary work is being done in the condenser. With jet condensers it is practicable to keep the water discharge within 3° or 4° F., and with surface condensers within 8° F., of the temperature of the exhaust steam. The advantages of maintaining high-water temperatures are :—(1) Less water is circulated through the condenser and the power consumpt of the circulating pumps is thereby reduced ; (2) if the condensate is used for boiler feed water there is an obvious economy of fuel in keeping the temperature high ; (3) if the water is discharged to cooling towers the latent heat of the steam taken up by the injection water is much more readily dissipated when it enters the tower at a high temperature.

Four thermometers should be fitted to each surface condenser, namely, in the exhaust steam pipe, the condensate discharge, the injection water suction, and the injection water discharge. In a jet condenser, of course, the condensate discharge thermometer is not required, as the condensate is carried off with the injection discharge water.

In the opinion of the writer, the advantages of the electrical distance thermometers in this connection are very marked. The time that is required to take condenser temperatures with mercurial thermometers is too great to permit of their being taken very frequently, and as the conditions in the condenser change with every variation of load it is essential that they should be taken frequently.

Coal Bunkers.—With certain classes of bituminous coal there is considerable danger of spontaneous combustion, particularly if the coal has been stored when wet. Coal in a finely-divided state, such as slack or dross, is more liable to ignite spontaneously than large coal. It is possible for combustion to go on for a long time with very little emission of smoke, and often it is not observed until the fire has a good hold. A case is on record in an Indian colliery where the first indication that a large stack was on fire was the total disappearance of two coolies who attempted to cross over it. The weight of the men broke through the upper crust of the stack and plunged them into a burning crater, in which no trace of them was ever found. The danger of spontaneous combustion is well known to marine engineers, and the law demands that the temperature of a steamship's bunkers must be recorded in the daily log.

Various methods have been suggested for preventing spontaneous combustion ; and some diversity of opinion exists as to the efficiency of the common practice of ventilating the interior of the coal stacks. Storage in an atmosphere which does not support combustion, carbon dioxide, for example, has been suggested, but there are few electricity supply stations where the danger is sufficiently great to justify the expenditure which would be necessary with such an arrangement. In most cases it will be sufficient if means are available for locating and extinguishing an outbreak as soon as it occurs.

A crude form of thermometer which is sometimes used for this purpose is simply an iron rod thrust into the centre of the stack. Any increase of temperature in the body of the coal will be readily conducted along the rod and become apparent to the touch. The method commonly used on board ship is to have an iron pipe built into the bunker and opening on to the deck, down which a maximum thermometer can be lowered and the temperature at the centre of the coal registered. This method can be used in a supply station, although the bunkers are usually more inaccessible than on board ship. A valuable application of the electrical distance thermometer is to indicate the presence of spontaneous combustion. Readings can be taken with far greater frequency than is possible with any other form of thermometer, and the elements, completely enclosed in an iron pipe, can be placed without risk of damage in the most inaccessible part of the coal heap or bunker.

In the opinion of the writer, to make it practicable to take frequent readings in a large power house, it is necessary to install a system of electrical distance thermometers, particularly if it is situated in a country where subordinate employés who have a sense of responsibility are difficult to find. Many of the points at which observations must be made are of necessity awkwardly situated, and if the observer is required to visit each in turn it requires some strength of character to debar him from supplying many of the readings from his imagination.

A 30-point distance thermometer can be installed for approximately £150, or including depreciation and maintenance, an annual charge of about £20. For a similar installation using ordinary glass thermometers, with careless handling the annual bill for renewals may approach or even surpass this figure. The advantage of the electrical thermometer is more apparent on a large installation, however, and for fewer than 10 points might hardly justify the expenditure under ordinary circumstances.

In a power-house electrical thermometer installation it is desirable that the switchgear should be mechanically strong, and that the switch contacts should be large. Variations in the resistance of the circuits from other causes than variations of temperature at the thermometer elements are fatal to accuracy, therefore the necessity for good connections cannot be over-emphasised.

The writer has experienced a good deal of trouble with a well-known make of distance thermometer on account of the lightness of the switchgear. The design gives a wonderfully neat appearance, and, provided the contacts are all tight, is perfectly satisfactory in operation. However, with careless handling, the instrument and switches are easily deranged, and they are so delicately constructed that considerable skill is required for their readjustment.

REVIEWS.

Boilers, Economisers and Superheaters. Their Heat: Power and Efficiency. By Robert H. Smith. London Crosby Lockwood & Co. Price 7s. 6d. net.

This book, like the earlier works of its author, fills us with mixed feelings, in this instance we are glad to say somewhat different from those of previous occasions.

We marvel at the author's indefatigable industry, at his mathematical genius and his determined application of mathematics to problems of engineering which, we think, have never been really suitable for such treatment.

But to begin with, is not the author wrong in supposing that steam engineering writers have not perceived, or have neglected, the fact that the radiation from the hot fuel on the grate is far more effective than any other part of the boiler ? A Lancashire boiler gives, say, an evaporation of 6 lb. of water per sq. ft. of surface per hour, but it is always understood that the work over the fire grate is several times this average, and in water-tube boilers has not radiation from the fire always been credited with the bulk of the abnormal evaporation of the first bundle of tubes ?

The author, indeed, admits this; his quarrel is with text-books, presumably with those rules which are based on the mean effect of heating surface. If we remember rightly, many years ago such rules did estimate fire-box surface separately from tube surface or other surface.

This book aims to correct the omission by reducing the complex laws of heat transmission to diagram form; such diagrams, if enough are asked for, will be supplied in full size, their photographed reproductions being too small for drawing office use. In reading the author's remarks we exclaim: "Is Saul also among the prophets?" for the author has endeavoured to treat of an engineering subject on what he calls simple lines, avoiding pedantic exactitude never justified by the degree of closeness with which the data of boiler practice are known. We feel that this distinct break from the author's former methods will greatly enhance the value of his present work, and as a sample let us cite what he says on the calculation of calorific capacity of coals.

The author takes the percentage of carbon in coal as actually fired on the grate, be it dry or wet, that is to say, not the percentage of carbon as obtained in the laboratory for really dry coal, but the percentage of carbon in the more or less watered coal actually fired. Then he multiplies this percentage by 17,200, and the product is the calorific capacity of that pound of coal, including its hydrogen effect and its water effect. Taking five British coals, for the rule is only given for British coals, viz, Welsh, Newcastle, Lancashire, Derbyshire and Scotch, the following figures are found:—

	Welsh.	*N.C.*	*Lanc.*	*Derby.*	*Scotch.*
Calculated heat of combustion ...	14,070	13,840	13,030	13,020	13,120
Per cent. of C. 17,200	14,120	13,710	13,000	13,290	12,970
Diff.	+ 50	− 130	— 30	+ 270	— 150

The results are certainly creditably close.

But whose figures are 4,320 and 14,400 for the calorific capacity of carbon burned to its two familiar oxides? Berthelot's figures are 4,415 and 14,647, while Thomsen gives or accepts 4,350 and 14,544, which are the figures of Fabre and Silbermann. It is a pity that engineers cannot agree on the calorific capacity of both carbon and hydrogen. Why not accept Berthelot's values until there appears good reason to revise them?

Anyhow, the author's very simple formula will be welcome if we can rely upon the calculated heat of combustion as found from the constituents of the coal being really comparable with possible results.

For oil fuel the author deduces a formula 22,200 × % C., and for samples of various oils prints the following comparisons:—

	Amer.	*Russia.*	*Burma.*	*Borneo*	*Texas.*
Actual bomb values	19,600	19,400	18,800	18,800	19,200
% C. × 22,200 ...	18,800	19,200	19,200	19,500	19,000
Difference ...	− 800	− 200	+ 400	+ 700	− 200

The weight of gaseous products per pound of fuel is $13{\cdot}45\,c + 1$ where c is the percentage of carbon. This is the actual chemical requirement.

If the air used is n times the chemical amount the equation become $13{\cdot}45\,c \times n + 1$, omitting any steam from fuel wetness or from steam blowers. And so the value of n is found to be $n = 27{\cdot}3 \times \%$ of $CO_2 - 0{\cdot}1$, and is to be used when the percentage of CO_2 has been found by, say, an automatic recorder.

The author next takes up the question of the specific heat of the flue gases, or the value of h = heat given up by a fall of 1° of temperature. He finds $h = 0{\cdot}3 + 3{\cdot}2\ C\,n$ for both British and metric measures. The subject is further developed, and the author applies his formula to the same five British coals. The various other problems of a boiler are similarly treated.

We note that in his studies for this book the author has met with efficiencies greater than unity, in no fewer than our official tests; in one case as much as 15 per cent.

This book is extremely interesting; the best we have seen from the author's pen, and one which gives one much to think about. But we wish the author would eliminate firstly and nextly from his vocabulary. Neither word is English, and the author in the past has employed a sufficient stock of long words without adding syllables that do not belong to these English monosyllables.

Drawing for Electrical Engineers. By G. W. Worrall. London: G. Routledge & Sons, Ltd. Price 2s. net.

A book of this type describing the mechanical construction of electrical machines has long been sadly needed. In many electrical designs produced to-day lack of knowledge of mechanical details on the part of the designer is apparent. Methods of electrical design are now more or less standardised and uniform; it is the mechanical construction which distinguishes the products of one manufacturer from those of another. It is, therefore, surprising how little attention has been paid in text-books to the subject of mechanical design. An average second or third year student in a technical college may be fairly well acquainted with electrical design as well as with engineering theory, but ask him to design a motor end bracket with details of bearing and shaft journal—the result is generally distressing.

Electrical text-books have given the subject most superficial and often worthless treatment. Those professing to deal with mechanical construction have been treatises on engineering theory, throwing very little light on modern methods of construction.

The advent of this book setting forth features of modern construction will, therefore, probably be very welcome, both to technical students and to draughtsmen and engineers. The author admittedly does not attempt to deal with the general principles of engineering construction and drawing, but only to impart to the "young electrical engineer" an "elementary knowledge of the construction and proportions of the chief types of electrical machinery." He should at least succeed in doing this, and probably not a few "old" electrical engineers will glean some of this elementary knowledge.

The book is essentially a collection of some 70 working drawings, most of them fairly recent, by the leading manufacturers in this country, with a simple description of the principles involved in each. Bearings, shafts, A.C. and D.C. rotors and stators, and collector and brush gear, constitute the list of subjects discussed. It is rather a pity that the important subject of windings is conspicuous by its absence. One or two of the drawings shown are somewhat out of date, and the original sketches at the beginning of the book are hardly representative of modern practice. There is a contrast, too, between the detailed description of brush gear and the scanty treatment in the last chapter of slip rings. The book would probably have been of greater value had the drawings been reproduced to a much larger scale.

On the whole, however, the drawings are good and well described, and the book is well worth its low price.

Principles of Electrical Measurements. By Arthur W. Smith. London: Hill Publishing Co. Price 8s. 4d. net.

Strictly speaking, this is a laboratory text-book, and it bears the marks of careful preparation by one who has met and appreciated the many difficulties encountered by students in the early stages of experimental electrical engineering. It is similar in many respects to the books produced for similar purposes and under like conditions on this side of the Atlantic; it is certainly no better and, perhaps, no worse than the usual type of text-book in common use in the electrical laboratories of our English Technical Colleges and Universities. But it has some important features that are well worth consideration, and even emulation, in this country.

An introductory chapter deals with units and definitions, and incidentally startles us with the following unusual definition :—"Unit resistance is that resistance in which one erg of heat is produced each second by the passage of unit current." Although unusual, this definition is, of course, exactly equivalent to the one commonly derived from the statement that "one erg of work is done when unit electromagnetic quantity of electricity falls through unit of potential difference." The specifications of the international ohm, ampère and volt are also included in this chapter, together with notes on the use of Weston cells, current balances and standard coils for standardisation purposes.

The author does well by beginning with the use of ammeters and voltmeters in the measurement of current, E.M.F., resistance and power. He also does well to use a paragraph to explain the application of Ohm's law to the simple circuit, and the difference between available E.M.F. and the potential difference over the whole circuit. Dr. Smith is also a humorist, for he follows up a neat and sound treatment of the subject of useful power from a cell by this problem :—"How much power is expended in an ammeter of 0·01 ohm resistance if it is connected to a storage battery of 10 volts and 0·01 ohm internal resistance? Why is it best not to try this actual experiment in the laboratory?"

The second subject treated is ballistic galvanometer and condenser methods, and all the usual experiments on E.M.F.'s and capacities are fully dealt with here and in Chapter IX. The current galvanometer is considered in the third chapter, and this naturally leads up to Wheatstone's bridge and potentiometer methods, to both of which subjects admirable chapters are devoted. The calibration and use of the simple slide-wire bridge are first described, then the "decade" bridge box (which is the American form of our Post Office box), and its use in the location of faults, and finally the Kohlrausch bridge for resistance of electrolytes and Carey-Foster's bridge for comparison of nearly equal resistances. The lack of any reference to the P.O. box is, of course, a regrettable feature from an English standpoint.

Chapter VI, on the Measurement of Current, gives some account of hot-wire, moving-coil and electrolytic methods, as well as of the Kelvin balance and electrodynamometer, while Chapter VIII deals with the application of the latter instrument to the measurement of power.

Considerable space is devoted to magnetic measurements, and a whole chapter to the theoretical considerations of the magnetic circuit. The various standard methods for obtaining B-H curves and hysteresis loops by Hopkinson's bar and yoke, double bar and yoke and step-by-step methods are described, but a curious omission is made in that there is no reference to the magnetometric method.

There are two chapters on Self and Mutual Induction, and the multitudinous methods of measuring them, and then a final chapter, mainly of a theoretical description, on alternating currents.

An interesting point is that the author uses the calculus quite freely throughout the book. He also misuses the word "data" throughout the book, but otherwise there are very few errors either fundamental or incidental. As we have said, this book is not unique in any respect, but it can, perhaps, claim some merits, and perhaps a few defects that are not possessed by similar books already in use in this country.

COMMISSIONS.

[Communicated.]

This does not treat of matters military; it is a brief discussion of the *pros* and *cons* of a commercial custom which has prevailed, with variations, practically ever since England boasted a commercial system.

In encyclopædic language, we are told that a commission is a pecuniary consideration, given by a principal to an agent, or to an employé, in respect of business secured by the said agent or employé, for and on behalf of the said principal. Assuming that such business proves unprofitable to the principal and the agent or employé in no way compromises or jeopardises the negotiations, the commission cannot be withheld. This form of remuneration is founded upon an express or implied contract between the parties concerned, and such a contract may be implied from trade custom or usage.

Leaving the encyclopædic for the commercial aspect, we find that, not only in the engineering world, but in almost all fields of commercial activity, the commission problem is one of more than ordinary interest; it is, furthermore, one in which it is essential to have at the outset a clear and amicable understanding between the parties most intimately concerned, for it is easy to conceive that friction is likely to be caused by any misunderstanding arising in the absence of a definite agreement.

It is possible that this fear of petty friction is to an extent responsible for a certain chariness exhibited by some employers in regard to the wisdom of embarking upon a commission system with their salesmen.

It is sometimes argued that if one salesman is paid a fair salary without commission, and another is working partially or wholly upon commission, the individual results of the two men, other things being equal, will be approximately similar. This may be very plausible in theory, but it does not take into consideration that very natural faculty—the human element. I do not maintain that the practice is at all common, but surely there are occasions when the non-commission man has an "easy" after a good spell of business; so, of course, will the commission man upon occasion, but there is an incentive here which tends to make such a relaxation of effort more infrequent.

Again, the commission system does not appear to be so prevalent in this, our engineering industry, as in others. Why this should be so is a little difficult to imagine, but in part it may be due to the more complex and varied nature of the "lines" the engineer salesman has to sell, in contradistinction to the relatively confined scope of the commercial traveller selling tea, &c. And for this reason, that, whereas the commercial in the grocery or "soft goods" business is very frequently in the happy position of having a large proportion of his turnover provided by a more or less standardised clientèle, this rarely holds, and even then to a far less proportion, in the case of the engineer. Moreover, in any given town, the former can visit many times as many grocers and drapers, as the engineering establishments that the latter can visit, while the former has also the decided advantage of being engaged in a business where it is an old-established trade custom for orders to be given to the traveller upon the occasion of his periodical visit.

Per contra, the engineer salesman is very seldom so fortunately situated; if engaged solely upon the smaller specialities of the industry, such as lamps, in which there is a certain element of "bread-and-butter" trade, he may do so, but more often the aim of the true engineer salesman is to perform some spade-work in the discussion of alternative propositions, or sometimes, it may be said, his labours are of an educational and missionary character.

But, given the essential features of a sound working system, one which will overcome the difficulties indicated, there is no doubt that the commission system possesses advantages not to be lightly ignored. A cynic once said that "an open mind is but a polite definition of ignorance"; without going as far as this, I think it is frequently true that an open mind signifies indifference. On this subject of commissions, however, any man in a commercial position, even if connected with an establishment where commissions are not in vogue, is bound to discard, sooner or later, whatever feelings of indifference he may have had, and is forced to come off the fence, on one side or the other. This necessarily means that he examines the situation with a view to seeing how the commission system affects the first person singular.

A man in employment may be paid :—

(*a*) A fixed salary.
(*b*) A fixed salary plus commission.
(*c*) Commission only.

Some brief comments on these, and certain of the attendant pitfalls to be avoided, may be of interest.

The first (*a*) needs little further comment here other than that which has already been made, but must not be dismissed without mention of the consolation of the assured salary to a traveller who is prevented from obtaining business through external causes entirely beyond his control, and in no way reflecting upon his salesmanship and ability. Such external causes will readily occur to everyone.

In regard to (*b*) and (*c*), commissions are almost invariably paid as a percentage in one or two forms, viz., on *turnover* or on *profits*, whilst further considerations are whether a certain initial volume of business be exempt from carrying commission, and how travelling and similar out-of-pocket expenses are to be borne. Settlement of these questions must be left to individual judgment in each case, and it should not be difficult to evolve an equitable solution.

If the commission is paid upon profits, the first question which arises is: "What are profits?" Profits may for this purpose be variously termed profits upon factory cost, with, or without, establishment charges; or they may be said to exist in the abstract, but not in the concrete, as in the case where normal profits are shown, upon the balance-sheet, but dividends are conspicuous by their absence. A more satisfactory method is to ignore profits. To some this may seem suspiciously like heresy, but the suggestion is to adjust the commission scheme upon some other basis than any which employs the elastic term "profits." This may be done by fixing a fair market price for a product, and giving the salesman discretionary powers to reduce the price within whatever limits may be arranged, but inserting a proviso that such reduced quotation bears no commission; here, again, it will be obvious that much hinges upon the "fair market price," and that, once more, is essentially a matter for amicable agreement.

Mention is made above (see Par. 2) of an employé possibly jeopardising negotiations, a possibility which indicates the necessity for a safeguard against some such condition of affairs as is suggested by the following:—Through bad engineering upon the part of one of the technical salesmen, a manufacturing establishment may find later that it is put to some considerable additional expense to complete a job in a sound and workmanlike manner, or less tangibly, for "reputation's" sake, a position which may be peculiarly exasperating, and even intolerable, if a commission to the erring salesman is also involved.

Proceeding to other aspects worthy of discussion, a common practice is to parcel out the country amongst various agents or salesmen, which is likely to cause dissension, unless the difficulties are foreseen and provided against. In the first place, it may be suggested that a salesman should reap the benefit of any and every order received from clients in his district; as it stands, this may be too one-sided, for it is readily conceivable that many orders may be received which are the result of some purely external forces, such as a trade journal reference, or a recommendation from another source. Should the salesman benefit? This is one of the most difficult problems of all, but a reasonable suggestion is that the salesman should be entitled to benefit or otherwise, according to the condition of his report book, which should contain a constantly up-to-date record of visits made, concisely tabulated and indexed.

The last problem suggests another, one very similar and possibly more difficult of solution. This is the case of a subsidiary establishment in the provinces, doing its own preliminary buying, but, for internal reasons, placing the final instructions through its head office in London. At first glance, it will be remarked that the provincial salesman should benefit, and this seems to be reasonable, assuming that the London salesman is never called upon to spend any of *his* time on the job. But if, perchance, the London representative were obliged to render assistance, a Solomon could not always administer justice.

In conclusion, the writer would say that the foregoing remarks are in no way intended to comprise a survey of the whole of the points involved, from either aspect. Such a survey would be impossible in the space available, but if interest is aroused, he feels sure that an investigation, no matter what the result, will prove of more than ordinary interest and value, and, finally, repeats his opinion that, if only for the above-mentioned "human element," the commission system has much to commend it, notwithstanding the difficulties and problems with which it bristles.

ELECTRIC COOKING.

Mr. W. R. Cooper's paper on "Electric Cooking," was discussed by the Birmingham Local Section of the Institution of Electrical Engineers, on March 17th. An abstract of the paper appeared in our issue of March 19th.

Mr. F. S. Grogan maintained that the figures published were those of a special case, and were not at all representative of the general results obtained. As to hot water, he admitted that for large quantities it was much cheaper to install a coke boiler, and only in a few special cases would it be advisable to put in an electric boiler. If an electric boiler was installed for convenience, then a 6 to 10-kw. boiler should be used, with thermostatic control attached to the hot storage tank. As to the annual consumption for cooking, 3,500 should be the average result as against the author's case of 5,000 odd units. He could quote an actual case of eight in a family where they consumed 65 units per week against 110 quoted by the author. This showed that the author could not deduce general results from his special case. The outlay of £23 15s. 6d. was very high, and included 30s. for nickel plating, 70s. for switchboard, 35s. for connections, and 10s. 6d. for thermometer. Although the switchboard was included, the author paid £9 odd extra for wiring; this was a ridiculous price. The outfit was further inflated with £10 6s. 4d. for a coke boiler, which must have included £4 over list price to cover piping and erection. Why add this to the already much too high figure for the electric cooking stove when it must be granted that an infinitely better supply of hot water had been obtained than ever before from a coal fire? This boiler with its increased economy would pay for itself in a very few months' use. Over 30 authorities and companies were already hiring out cookers to their consumers; this had encouraged the class of consumer who appreciated the benefits of electric cooking, viz., that class where the lady herself either cooked or closely superintended the cooking. The author admitted a saving of 10 per cent. for electric cooking of meat against coal cooking, but he did not state whether the original weight included the weight of bone, which for this joint represented 20 per cent. of the whole weight. If the weight of the bone was not included, the percentage figures under the "loss" column were all too high for comparison with other public results. Also had he followed instructions instead of cooking at between 250° F. and 300° F., he would have had a less percentage loss in the electric oven. Let him consult an elementary cooking book, and he would find that after sealing the meat at a temperature of 250° F. or over for a short period, meat should be cooked at about 200° F. to get the best results. The proper place for a thermometer was in the test room, and instructions should be given to control the heat based upon the manufacturers' tests. Central-station engineers took care to see that cookers were earthed. His experience with various tariffs showed that the fixed charge plus low running costs was most useful to encourage cooking loads, but let the low running charge be high enough to allow a part of the revenue to be set aside to meet deficits in the charges for hiring apparatus. The latter charge must be a low one to meet competition.

Mr. T. Smith said that if the paper had not been a mischievous one he would have considered it somewhat amusing. The author had taken a very unfair, he might say artificial, case, and it looked almost as if he allowed himself to be misled into believing that the results he had obtained were representative of the results obtained with electric cooking generally. He purchased a £23 outfit, when apparently the joints to be cooked were only about 5 lb. in weight. He must have been aware that he could purchase several outfits which would have met his requirements for less than half this amount—*e.g.*, the Carron and the Jackson. Also utensils to the value of £2 5s. were given; an absurd figure even for good aluminium utensils. The information given as to the loss of weight of meat in the process of cooking was certainly in favour of the electric cooker, although the author wished them to believe that it was not worth considering. The surprising part was, with such small joints and the heavy consumption of energy, that any saving at all was shown. The tests had been taken with ribs of beef only; if mutton, veal and pork had been included the results would have shown more in favour of electric cooking. A good cook could easily make the loss 10 per cent. on all-round cooking. The question of plugs was an important one, but the trouble would be overcome when a reliable interlocked switch and and plug was brought out. The design shown would aggravate the trouble which it was supposed to remedy. For flexible cords, no doubt the "cab tire" type was the best at present on the market. He considered that the rateable value method, with its necessary modification in special circumstances, was the best tariff that could be offered at the present stage of our development. That it was not equitable was true; no system of charging for any commodity was. The author referred to the impossible load factor of over 100 per cent.; in practice it was possible for a consumer to have a load factor which was better than 100 per cent. from the generating station point of view. He considered the author had ignored the good points of electric cooking, but had pointed out and exaggerated all its defects. Not being satisfied with the defects which became apparent to the consumer, he had gone into technical details, even outside the scope of cooking, to find defects. In his experience nothing more damning to electric cooking than this paper had been put forward, and he could confidently expect to be put up against quotation from it for some years to come.

Mr. E. P. Hollis said he thought that every oven should be provided with some form of temperature indicator, preferably, a cheap pyrometer. Domestic cooking and "wholesale" cooking, by which he meant cooking in restaurants, hotels and so forth, were in totally different categories. At an hotel on the South Coast the hotel manager said that he paid for the whole of his electricity used in cooking by the extra money he received for his dripping. Bakers' ovens were affected by a number of factors which did not enter with the domestic oven. A large firm in Oxford Street, wishing to increase their output, found this impossible with the ordinary oven; they were pursuaded to replace the old ovens by electric ovens, with the result that four times the output could be obtained from the same space. Previously, owing to the fact that certain forms of pastry, which were cooked after bread had been baked and removed, required particular temperatures for their cooking, the firm were not always able to decide exactly which pastry should be made until a short time previous to the taking of the bread out of the oven. With the electric oven and its easily controllable temperature all such difficulties were removed.

Mr. J. H. C. Brooking said that information received by him from central-station engineers all over the country showed that the flexible cables appeared to be the weakest point in connection with portable heating appliances. The well-known C.T.S. type was well ahead of the other types mentioned as a protection against the three chief troubles of kinking, abrasion and corrodibility.

Mr. G. S. Cattell said that from the paper it would appear that the author used a cooker to cook for nine people, which was probably capable of cooking for a larger number, possibly 15. On this account the consumption per person per day came out much higher than had been found to be the average amount required. It would surely be possible to provide a complete equipment to do all the work required at a cost under half the amount shown. Switches for the heating elements were much better if double pole, and this particularly applied to griller switches if the heating element was exposed. A thermometer might give some indication of the time when the oven was hot enough to commence cooking, but failed entirely if it was desired to assist the operator when requiring to change the temperature of the oven. An intelligent cook would rapidly become sufficiently well acquainted with what the oven would do, so that a thermometer in any case was not of lasting value. The question of earthing was one which could not receive too much attention, and in this direction he would endorse all of the author's remarks. So far as the general design of cookers was concerned, manufacturers at present were working under a great disadvantage, inasmuch as the opinions of the engineers, who were the principal purchasers, differed widely. If domestic cookers could be reduced to fewer types as a result of agreement between engineers as to what was best, not only would they arrive at something more nearly approaching the ideal, they would also be able to manufacture under such conditions that the price to the ultimate user could materially diminish.

Mr. C. O. Silvers (communication) said that during the last 15 months he had had an opportunity of watching very closely an electric cooking and heating installation in a commercial hotel in the Midlands, which for many years had had a great reputation for good cooking. Electricity replaced gas in this case with the following results:—

Up to the end of 1913 electricity for lighting was paid for at the rate of 2½d. per unit (flat rate). The price of gas was 2s. 6d. per 1,000 cb. ft. With the installation of electric cooking the tariff was readjusted as follows:—·5d. per unit used, and a fixed charge based upon £8 per kw. demand with a diversity factor for occasional lights, heating and cooking. The apparatus consisted of:—

1 double oven of the Bright unlagged type	3,200 watts
3 800-watt hot-plates	2,400 „
1 double grill	3,000 „
1 fish fryer	2,000 „
4 2,000-watt electric fires	8,000 „
11 light points	350 „
	18,950 „

This apparatus replaced gas, but the following new plant was added:—

1 hot cupboard and carving table	3,000 watts.
2 hot water urns	1,600 „
1 electric fire	2,000 „
11 light points...	450 „
	7,050 „

The actual cost of electricity, coal and gas for the two years preceding the cooking and heating installation and for the first year of electric cooking and heating was as follows:—

	1912.	1913.	1914.
Coal	£35 10 2	£26 16 1	£35 5 0
Gas...	47 12 2	53 0 10	13 0 2
Electricity ...	27 15 2	32 0 2	66 13 3
Total... ...	£110 17 6	£111 17 1	£114 18 5

The above figures included no capital charges, but the electricity charges for 1914 included £7 2s. for the hire of apparatus. It must also be remembered that the 1914 figures included additional heating facilities, amounting to at least 2,000 units per annum. On the other hand, they had the installation of an up-to-date coal range for heating water, boiling vegetables and heating plates, &c. The 1912 and 1913 figures were obtained from meter readings taken before December 31st, so that the actual costs were greater than the figures shown. The electricity units for 1914 were taken from January 1st to December 31st, and he might add that the amount of food cooked in 1914 was greater than in either of the preceding years. In his opinion *all* heating and cooking apparatus—in fact, all apparatus which was in any way handled—should be properly earthed, whether in the kitchen or anywhere else. He might say, as a consumer, that the results obtained during a year's working, in which 21,391 units were used at an average cost of 673d. per unit, were eminently satisfactory from a commercial standpoint. The only capital expenditure that had been necessary for these results was that to cover the wiring of a few flat-bottomed pots and pans.

Discussion at Manchester.

Mr. Welbourn said that as the result of about three years' experience of electric cooking he agreed with many of the author's recommendations. Regarding energy consumption, 1½ to 2 kw.-hours per person per day according to season was the average. It was very desirable to mount control switches on the wall, and if the supply was from a three-phase A.C. system a double-pole switch should always be used to isolate the apparatus entirely. Not only cooking apparatus, but every power circuit such as for radiators, &c., should be so arranged that the appliance itself could be earthed. He had used flexibles of various types domestically for about eight years, and had discarded rubber-insulated flexibles entirely and adopted flexibles insulated with asbestos and bound with thread; these were entirely satisfactory after 18 months' use, and withstood heat and ill-usage much better than rubber flexibles. Accurate accounts of the heat bill for a family of eight were kept for two years, which showed a total difference of 25s. between the electric cooking year and the coal year. Electrical energy was supplied at 1d. per unit flat rate with 2½ per cent. discount, and coal cost 17s. 6d. per ton average. The apparatus installed by the author appeared much larger than actually required by the household and would probably accommodate 50 per cent. more persons. The speaker's apparatus had a maximum demand of 4 kw., whereas the author's maximum demand was apparently about 7½ kw. The cost per meal served was heavy when the apparatus was larger than was required. In his opinion the time was near when domestic consumers would be charged on the contract basis involving maximum demand.

Mr. W. Cramp could not understand why electric ovens should not be mounted at a reasonable height. The plan of putting a thermometer on the oven door seemed useless; the proper place was inside. The author seemed very optimistic regarding the question of earthing, when he stated that possibly in those towns where the supply undertaking had a wiring department this part of the work received proper attention. The speaker's experience showed that it did receive proper attention by the wiring department if it was contractors' wiring, but if the wiring department carried out the work, anything would do. A case was recently discovered where a circuit carrying 500 amperes was earthed by Corporation workmen. A No. 18 wire was twisted round a loose nut on one of the switches, and then soldered to the end of a lead water pipe which was hanging loose from a roof. Three contractors were engaged on this installation besides the Corporation, and whilst the former put in enclosed fuses, the latter installed bare wire.

Mr. Alderman Walker thought the electric cooking load was one to be sought after. About a year ago Manchester adopted a new tariff in order to attract the cooking load, viz., 12½ per cent. on the rateable value, plus ½d. per unit metered. It was also stipulated that houses under £30 rental should install 2 kw.; £30 to £50 houses 3 kw.; and over £50 4 kw. The response to the tariff was very poor, and after considerable investigation the cause was found to be the inadequate wiring of the houses originally. A prospective user of cooking plant would not entertain the idea of rewiring his house, involving the destruction of plaster and fittings. A note had been prepared by the department for circulation amongst architects, builders and house owners requesting steps to be taken to ensure sufficient copper being put into new premises to admit of radiator and cooking loads. The capital cost given by the author for the family mentioned seemed excessive.

Prof. E. W. Marchant said the best cooks were the most stupid and he did not believe thermometers to be of any service to such persons. Regarding small electrical appliances, the weak spot was certainly the flexible. The time taken for repairs was usually much too long, and easily replaceable elements were to be advocated. The secondary charge should be kept down in order to induce consumers to use energy. It seemed grossly unfair that the primary charge should have any bearing upon the amount of garden attached to a house: a charge based upon the cubical contents or floor space of the house would surely be more reasonable. The cooking consumer was evidently a very desirable one for the electrical engineer.

Mr. Hollingsworth said that at St. Helens with a rateable value system and a secondary rate of ¾d. per unit they had been fairly successful. The initial outlay on apparatus and wiring was the chief drawback, together with the competition of gas cookers with gas at 2s. per 1,000 cb. ft. There would be no difficulty in meeting the gas competition successfully were it not for the cost of installing and unreliability of large cookers. A large works employed electricity for cooking for 18 months with every success excepting in the matter of reliability. In the hands of experienced cooks the results were far more satisfactory with thermometers than without. The author did not say too much about the necessity of earthing cooking apparatus. The three-pin plug was a very satisfactory device, and it was hardly possible for a negligent wireman improperly to earth apparatus fitted with such plugs.

He advised engineers who had not yet adopted a rateable value or double-charge system to do so, as the half-watt lamp would doubtless arrive and place them in a worse position than when the metallic-filament lamp was introduced.

Mr. W. Eccles gave details of equipment and costs in the case of his own house, assessed at £30, and usually accommodating three adults. The equipment was as follows :—

Electrical—Lighting on a generous scale throughout.
Cooking by means of a cooker comprising oven, grill, hot closet and four boiling plates, also a number of self-contained utensils.
Heating by means of portable radiators.
Power for washing, vacuum cleaning, fans, &c.
Gas— For washing boiler and hot water for house supply when kitchen fire was unavailable.
Coal— During winter only for kitchen and one room fire.
Electricity cost ½d. per unit plus 12½ per cent. of rateable value.
Gas ,, 2s. per 1,000 cb. ft.
Coal ,, 1s. 0½d. per cwt. approximately.

The accounts were :—

Quarter ending—	Sept., 1914.	Dec., 1914.	March, 1915.
Electricity ..	£2 16 7	£2 12 1	£3 4 5½
Gas	0 16 8	0 6 2½	0 4 0
Coal	0 1 9	1 1 9	2 0 7
	£3 15 0	£4 0 0½	£5 9 0½

which represented about £17 12s per annum. There had been a saving in laundry, carpet cleaning, baking and charwomen of about £13 per annum. The advantages derived were—

1. Less of the drudgery of housework and increased cleanliness.
2. Comparative independence of maids.
3. Comforts and luxuries otherwise unattainable at any price.

The author's case, whilst being devoid of the aforesaid advantages, except perhaps a little extra cleanliness in cooking, showed a loss of £8 18s. 9d. This loss was reduced to £1 12s. 6d. if the cost of electricity was adjusted to the speaker's rate. Further, coal at £13 10s. per annum for eight or nine persons was very economical, and probably much below the average. On the whole, the author's apparent results were likely to be discouraging to prospective consumers, as the average layman would not trouble about explanations. It appeared that the maker of electrical ovens followed gas-oven practice by constructing tall, narrow ovens, which was quite undesirable. The fact that the lower 6 in. or 8 in. of a gas oven was only utilised for distributing the heat from the burners seemed to be quite overlooked. An electrical oven should never be less than 16 in. × 16 in. plan area, with a height varying from 12 in. upwards, according to the capacity required. The electric grill was practically perfect, but efficient reliable plate warmers and boiling plates were still lacking.

Mr. H. H. Ratcliff thought electric water heating was an expensive luxury at ¼d. per unit, and only became worthy of consideration on the score of convenience and cleanliness; ⅛d. per unit was a reasonable financial proposition. The most efficient heaters were, undoubtedly, those of the geyser type, in which water flowed through the heater as required, but there were serious objections, one of which was the enormous KW. demand for a few minutes which would not permit of a reasonable tariff. A further disadvantage was the necessity of reducing seriously the rate of flow in order to obtain high temperatures. Tests carried out on a model heater of this type showed a water inlet temperature of 60° F., outlet temperature 110° F., flow 7¾ gallons per minute, efficiency 98·1 per cent. The load on the meter was 7 KW. The efficiency fell as the temperature was increased, and eventually when a temperature of 200° F. was reached the flow became very unstable and slow, about ¼ gallon per minute, and the efficiency dropped to 94 per cent. The solution of the problem was, undoubtedly the thermal-storage system. Regarding electric cookers, there was not much likelihood of progress so long as the consumer had to purchase his own apparatus.

Mr. Alcock considered it a very difficult matter to interest the ordinary householder in electric cooking so long as the hot water problem was unsolved. Houses at £30 to £50 a year rental had a fire in the kitchen for hot-water supply, and the cooking was done on the fire as a by-product. Regarding the design of cookers, hot-plates, &c., the efficiency of the apparatus was largely dependent upon the intimacy of contact between the vessel and heat elements, and in many types of apparatus the surface of the vessel was ground in an attempt to obtain the desired intimate contact. The gas cooker flame impinged on the vessel to be heated, and this was a good lead for the electrical engineer to aim at in getting the heat element in direct contact with the vessel to be heated. Some such arrangement was being exploited, using heating elements laid in troughs of heat-resisting material, the elements almost touching the vessel.

Mr. A. G. Cooper said that cooking vessels, especially those made of aluminium, were liable to warp after a time. Regarding rateable value, he found the most equitable charge to be 12½ per cent. on £15, 15 per cent. on from £15 to £30, and 20 per cent. for anything over £30 rental.

Mr. W. R. Cooper, in reply, said with regard to the size of the apparatus, that one must consider not merely the size of one's family in normal times, but the possibility of having people in to dinner and so on. He thought the high price of cooking apparatus was largely a question of establishment charges and experimental costs, which no doubt would come down enormously if the quantity could be increased. The idea of giving notice to builders was an excellent one and ought to do a great deal of good, because the wiring was undoubtedly the difficulty. His cook was very stupid, but he had had no difficulty in getting her to take on the thermometer. Though she does not speak much about degrees, I believes she does not mind talking about 250 in the least. He had been taxed on several occasions with having a high charge for wiring. He thought it was high himself, but the supply undertaking said it was quite normal. The supply undertakings should take this in hand very carefully and decide how cheaply and satisfactorily wiring could be done; it was a very important point.

Mr. George Wilkinson, electrical engineer to the Borough of Harrogate, has found it necessary to address the following letter to the Editor of the *Journal of Gas Lighting* :—

"Dear Sir,—In perusing your 'Electricity Supply Memoranda' in your issue of the 30th, I find that the writer grossly misrepresents my statement as to water heating made during the discussion on Mr. Cooper's paper at the Institution of Electrical Engineers. Moreover, your writer casts aspersions upon the cleanliness of myself and members of my family which appear to me to be in very bad taste.

"What I actually said was that the electric heater has a cubical capacity equal to 12 gallons, but it is equal to an output of over 60 gallons of water per day at 100° F., which, I think, you will agree is a fair supply for a small household; it is found sufficient for two or three baths per day in addition to the ordinary kitchen requirements.

"I have facilities for the production of ten times this amount of hot water if necessary, but the output of the electric heater is found ample for ordinary every-day demands.

"I hope you will do me the justice to have this matter put right in your next issue.

"Yours faithfully,
"(Signed) Geo. Wilkinson."

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Glassware to Give Sunlight Colour Value.

In response to a number of inquiries for glassware which will ensure artificial light of daylight value, the British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C., are putting on the market a complete range of colour matching pendants and globes. The name "Trutint" has been given to this glassware, and it is available in various compositions to ensure different sunlight values.

In Group I, the composition of the glass is such as to ensure accurate matching in colour comparison work; this particular unit is not intended for general room lighting, and is only available as a pendant reflector unit, without cabinet, for use where there is little extraneous light to interfere with colour matching. Group II is for general illumination, and gives a light of "noon" sunlight value; it is particularly suitable for lighting in paint shops, lithographic plants, art galleries, &c. The watts per candle efficiency of Mazda half-watt lamps when fitted with this particular type of globe is practically equivalent to that of standard Mazda lamps in a white opal globe.

Group III is also for general illumination, and gives a light of "afternoon" sunlight value. The purpose of the Trutint globes in this case is to furnish a light that is slightly more efficient in watts per candle than Group II, and necessarily somewhat yellower, as is the case with afternoon sunlight. The Trutint globes in this group, therefore, compromise between colour and efficiency, and their field will be found in the general lighting of dry goods and clothing shops, or in other positions where daylight quality of light is desired. They are made of Trutint glass cased over by a light opal, or a very light opal body in which Trutint has been mixed, and are known respectively as "Trutint Cased" and "Trutint Opal." The cased glass appears white when unlighted, while the other units appear bluish. When possible complete installations of Trutint glass should be obtained, so that the yellow light of other lamps may not be present.

Trutint glassware is not made for use with ordinary Mazda lamps; it has been specially compounded for Mazda half-watt lamps, which, owing to their high intrinsic brilliancy, are more like sunlight in colour than previous incandescent lamps.

A Parsons Paraffin Motor.

The Parsons Motor Co., Ltd., of Southampton, have recently built a number of 90-H.P. six-cylinder paraffin engines, both for commercial and Government orders.

The type of engine is a regular pattern 90-H.P. six-cylinder set, having cylinders 6½-in. bore and 8-in. stroke, and running at 550 R.P.M.

The leading features of the design are that the pistons and connecting rods are removable through crank chamber doors, without detaching the cylinders or separating the crank chamber. There is a complete system of pump lubrication, combining an oil cooler on the engine, and including the usual relief valve, pressure valve and level gauge, and in order to keep down heat from the external surfaces of the vaporisers they are water cooled, and are arranged for starting by blow lamp or petrol. The engine has its own pumps for circulating the water through the cylinder jackets, &c., and these jackets are carried right down to the base, keeping the engine very cool; a centrifugal high-speed governor is mounted at one end, and controls the speed within close limits.

These engines are supplied with or without compressed-air starting, and it will be seen that there is a chain turning-over gear at one end; in the example shown there is a separate air compressor driven by a friction clutch, which can be disengaged by a foot lever.

At the fly-wheel end of the engine there is a distributing valve which admits pressure air to all six cylinders in turn, thus ensuring a quick start, the cylinders, of course, being fitted with non-return valves.

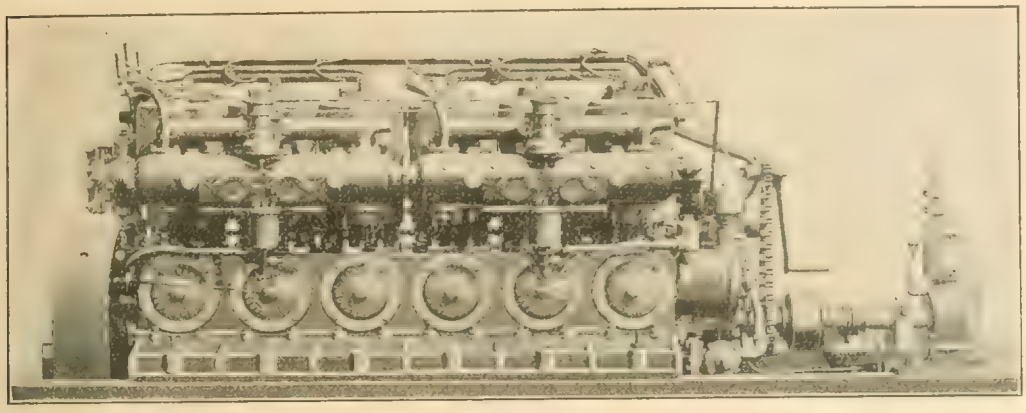


Fig. 1.—Parsons 90-h.p. Paraffin Engine with Compressed-Air Starting.

A good point about these engines is that any fumes venting from the crank chamber are not allowed to pass into the engine room, but are drawn through and consumed.

Several of these engines have recently been put down for the generating stations at various military camps throughout the country, and a number are in use also by the Admiralty in different types of craft.

The weight of the engine shown approaches a couple of tons.

PRIVATE GENERATING PLANT.

On taking the chair as the first President of the Association of Supervising Electricians, Mr. A. H. Dykes delivered an address on "Private Generating Plants," of which the following is an abstract:—

The voltage of supply, and therefore the number of cells, depends on the length of main to the light farthest from the battery room. In a case where an installation on completion did not give satisfaction, I found that the battery was a 50-volt one, and that owing to the house being a long, straggling one, at the far end there was a blink in the lights every time other lights were turned on or off. The remedy was obvious, especially as the battery was small for the work—it was to double the number of cells and raise the voltage to 100.

In several cases where the lights were spread over a large area, and the dynamos were situated a considerable distance from the cell room, I have wired the premises on the three-wire system, with two batteries of 100 volts each, the two batteries being charged in series at 200/260 volts, with a change-over switch, so that the cells are changed over each day from one side of the system to the other, in order to ensure that each half of the battery gets approximately the same amount of use. This plan enables one to use small candle-power 100-volt lamps, whilst obtaining the economy in the mains and sub-mains due to 200-volt distribution.

Experience tells me that the owner of a house never complains that his cells are too large, but does very frequently blame somebody because his cells were not put in large enough in the first place. A safe rule to follow is to decide the maximum number of ampere-hours likely to be taken from the battery on the longest winter's day, and then make the capacity of the battery double this, thus enabling the supply to be given from, say, Saturday morning till Monday morning, without having to run the engine. In summer time it will only be necessary to charge once or twice a week.

By capacity I mean not the capacity of a new battery, but the capacity the makers will guarantee under a maintenance policy, which with some makers is only 80 per cent. of the listed rating of the cell.

Since the introduction of the metal-filament lamp the capacity of the cells required for lighting has been very greatly reduced, but, on the other hand, the use of small motors and heating appliances is becoming much more general, and a few radiators used for some hours every night need a considerably augmented battery power.

Wherever possible I prefer to have the cell room as near as possible to the house, putting the engine and dynamo in a separate house far enough away to avoid annoyance from smell or noise. If the battery and engine room are together, it generally means that they are some distance from the house, and as the maximum current of the battery is generally in excess of the dynamo current, the mains from the engine room to the house have to be larger, and consequently more costly, than they need be.

To give good regulation also, the drop from the cells to the end light must be small, which again means increasing the cable to the house.

By putting the batteries up at the house, the size of the mains from the engine room can be kept down merely to the size necessary to carry the charging current of the battery, and, if necessary, quite a considerable drop in voltage may be allowed in them.

A battery regulating switch, suitably enclosed, with merely a regulating handle projecting, can be fixed in the wall of the battery room looking into a passage, and any one of the indoor servants can be told off to move the handle one way or the other, so as to keep the pointer of the voltmeter fixed over it at a definite point.

I generally fix the size of the engine to give the specified charging current at about 2·2 volts per cell, which means that at the end of the charge, when the voltage has risen to, say, 2·6—2·7 volts, the current falls off, thus giving an economical rate of charge.

In only a very few cases in this country is there water power of practical use available; and in most cases some form of heat engine is employed. In certain special cases where steam is required for heating, and the exhaust steam, after passing through the engine, can be utilised, the steam engine is the most economical source of power, but such cases generally arise only in works or business premises where little or no light is used in the summer, but only in the winter, when steam is wanted for heating as well.

Where town gas is available, a gas engine, with belt-driven dynamo, makes a good combination, especially as the engine can be always run at its most economical load when charging the battery. Taking an average figure of 35 cb. ft. per unit generated by the dynamo, with gas at, say, 3s. 6d. per 1,000 cb. ft., the cost of fuel per unit generated is 1·46d.

Not more than 60 per cent. of the total energy generated by the dynamo can be obtained from the battery, and thus the cost per unit actually used in the lamps will be 2·43d. for fuel alone.

Where town gas is not available, a suction gas producer is frequently used, consuming anthracite, or, in some cases, coke. The actual consumption per unit generated during last year of such a plant put in to our specification at a large country house was 2·2 lb. of anthracite at 26s. = 0·31d. Such plants are simple and easy to work, but like the steam boiler, are not so economical when worked only intermittently as when they are in regular use all day long. This difficulty is overcome by the different forms of oil engines, none of which consume any fuel except when they are actually at work.

The engines which are most generally used are horizontal single-cylinder oil engines burning paraffin. They are very simple, quite reliable, easily started to work, and can be safely left in the hands of any intelligent gardener. The consumption of paraffin is about 1 pint per unit generated, which, at 7d. per gallon, costs 0·875d. per unit.

The petrol engine, direct-coupled to its dynamo, has been largely used for country house lighting. It makes a very neat, compact set, and is easily understood by the chauffeur, who is mostly to be found on large estates. The consumption of petrol per unit generated is about 1½ pints, which, at 1s. 9d. a gallon, costs nearly 4d., so that as regards fuel costs these sets do not compare favourably with paraffin engines. There is more risk of fire, due to the use of the inflammable petrol instead of the heavier paraffin oil, and the electric ignition certainly gives more trouble than the hot-bulb ignition. Whereas one of the horizontal paraffin engines can, and will, run for years with nothing more than ordinary cleaning and attention by a more or less unskilled attendant, the petrol engine must have constant supervision.

The Diesel engine burns the cheapest of oil fuel—the crude or residue oil of about the consistency of treacle.

The consumption of crude oil is only about 0·7 lb. per unit generated. At an average price of 60s. per ton, the fuel cost per unit generated works out at 0·225d., but the first cost of the Diesel engine is very high, and very skilled attendance is necessary, so that except in special cases, where the plant is worked very long hours and the cost of fuel is therefore very important, it is not suitable for private lighting plants.

Questions on various points were dealt with by the author. With many reservations, he thought the average life of a battery was probably seven years, but he could point to cases where batteries were in existence after 15 years of working, and they were at the present moment up to full guaranteed capacity; that was because a maintenance contract had been entered into with the makers, and the plates renewed by them from time to time as necessary. The extra cost of petrol over paraffin in very small sizes was negligible, and direct-coupled petrol sets were very satisfactory for small power generators if not run at too high speed. In practice it was generally found that automatic plant required frequent skilled attention. A maintenance contract with the makers of a battery relieved the owner of a great deal of responsibility, and the amount paid for upkeep was really depreciation as well, as the makers would guarantee to keep the battery up to its full capacity.

BRITISH ELECTRICAL PATENTS APPLIED FOR OR COMMUNICATED BY RESIDENTS IN GERMANY, AUSTRIA OR HUNGARY.

The following list of British patents, applied for or communicated by residents in Germany, Austria and Hungary will be found of interest to manufacturers or others desiring to avail themselves of the provisions for Compulsory Licence under the new Patents Act. Intending licensees should, however, not assume without further enquiry that any patent in the list is not already assigned or licensed or that the applicant is an "enemy subject."

The list is specially compiled for the Electrical Review by Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and 6, Lord Street, Liverpool.

1905.

14,320.—Siemens Schuckertwerke Ges., Berlin. Electric motors.
[illegible].—M. Kallmann, Berlin. Electric motors.
16,300.—Siemens Bros. & Co., London (communicated by Siemens Schuckertwerke Ges., Berlin). Dynamo-electric machines.
18,264.—W. & H. Heraeus, Hanan/Main. Electric lamps.
19,138.—Allgemeine Elektricitats Gesellschaft, Berlin. Dynamo-electric machines.
19,379.—Deutsche Gasgluhlicht A.G. (Auer. Ges.), Berlin. Electric lamps.
25,147.—Elektrizitäts A.G. vorm. W. Lahmeyer & Co., Frankfurt/Main. Dynamo electric machine.
25,393.—Elektrizitäts A.G. vorm. W. Lahmeyer & Co., Frankfurt/Main Electric motors.
26,094.—Allgemeine Elektrizitäts Ges., Berlin. Dynamo-electric machines.
27,251.—P. Müller, Friedenau. Electric lamps.

1906.

16,818.—Allgemeine Elektricitäts Ges., Berlin. Measuring electricity.
18,486.—Allgemeine Elektricitäts Ges., Berlin. Electric switches.
19,239.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
20,808.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
21,348.—H.P.R.L. Porscke, Hamburg. Galvanic batteries.
21,585.—Siemens & Co., Geb., Charlottenburg. Electric conductors.
22,323.—F. Münz, Stuttgart. Magneto electric machines.
22,605.—Siemens Schuckertwerke Ges., Berlin. Dynamo-electric machines.
23,309.—I B [illegible] Telephon Fabrik A.G., vorm., J Berliner, Hanover). Telephone systems.
24,973.—A. Lederer, Vienna. Electric lamps.
25,306.—Siemens Bros. & Co., London, and W. Dieselhorst (communicated by Siemens & Halske A.G., Berlin). Electric conductors.
27,318.—K. Schaffler & D. Weiss, Vienna. Dynamo-electric machines.
27,318a.—K. Schaffler & D. Weiss, Vienna. Dynamo-electric machines.
27,318b.—K. Schaffler & D. Weiss, Vienna. Dynamo-electric machines.
27,499.—Siemens & Co., Geb., Berlin. Dynamo brushes, electric contacts.
28,562.—F. Krupp A.G., Essen. Dynamo-electric machines.
28,775.—Deutsche Gasglühlicht A.G., Berlin. Electric lamps.
29,647.—F. Merk, Berlin. Telephone systems.

1907.

633.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
1,242.—Siemens Schuckertwerke Ges., Berlin. Electric motors.
1,267.—G. Stühgen & J. Stühgen, Erfurt. Lamps.
1,662.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
2,499.—Siemens Bros. & Co., London (communicated by Siemens & Halske A.G., Berlin). Telephone systems.
3,174.—Siemens & Halske A.G., Berlin. Tungsten filaments (reg.).
3,938.—Consortium fur Electrochemische Industrie Ges., Nurnberg. Electric lamps, bending metals (reg.).
6,527.—Allgemeine Elektricitäts Ges., Berlin. Measuring electricity.
6,715.—Siemens Bros. Dynamo Works, London (communicated by Siemens-Schuckertwerke Ges., Berlin). Dynamo-electric machines.
6,929.—Siemens & Halske A.G., Berlin. Electric telegraphs.
7,320.—Salpetersaure-Industrie Ges., Gelsenkirchen. Electric furnaces.
8,364.—Ges. Für Drahtlose Telegraphie, Berlin. Wireless telegraphy.
[illegible].—Deutsche Gasglühlicht A.G. (Auerges), Berlin. Electric lamps.
9,499.—Deutsche Beckbogen-lampen Ges., Frankfurt/Main. Electric lamps (reg.).
10,024.—Farhwerke vorm. Meister Lucius Bruning, Hoechst/Main. Electric endosmose.
10,356.—W. G. Schmidt, Dortmund. Dynamo-electric machines
10,452.—Allgemeine Elektricitäts Ges., Berlin. Electric traction.
10,972.—Porzellenfabrik Kahla Filiale Hermsdorf-Kloster Lausnitz, Hermsdorf. Sachsen-Altenburg. Electric insulation.
11,549.—Allgemeine Elektricitäts Ges., Berlin. Electric motors.
11,594a.—Allgemeine Elektricitäts Ges., Berlin. Electric motors.
11,716.—Siemens & Halske A.G., Berlin. Electric lamps; tungsten compounds.
12,090.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
13,071.—Siemens & Co., Geb. Charlottenburg. Electric lamps.
14,440.—Allgemeine Elektricitäts Ges., Berlin. Electric switches.
14,725.—Siemens Bros. Dynamo Works, London (communicated by Siemens Schuckertwerke Ges.). Regulating electric currents.
15,020.—C. Thâmer, Danziglangfuhr. Dynamo meters.
15,510.—Deutsche Gasglüglicht A.G. (Auerges), Berlin. Electric lamps.
16,489.—Siemens & Halske A.G., Berlin. Tungstates.
16,503.—Deutsche Gasglühlicht A.G. (Auerges), Berlin. Electric lamps.
16,529.—Allgemeine Elektricitäts Ges., Berlin. Electric motors.
16,867.—H. Süssmann, Berlin. Lamps.
18,043.—H. Schmidt, Cologne. Electro-deposition metallic hollow ware.
18,163.—Siemens Bros. & Co., London (communicated by Siemens & Halske A.G., Berlin). Telephone systems.
18,480.—H. Schmidt Cologne-on-the-Rhine. Electrolysis.
19,562.—Deutsche Gasglühlicht A.G. (Auerges), Berlin. Electric lamps.
19,672.—Ges. für Verwertung Chemischer Produkte, Berlin. Electric lamps.
20,229.—Allgemeine Elektricitäts Ges., Berlin. Electric switches.
20,300.—Allgemeine Elektricitäts Ges., Berlin. Electric traction.
20,372.—V. Scholz, near Berlin. Electric lamps.
20,867.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
21,460.—Siemens Bros. Dynamo Works, London, C. Altmann, Stafford & W. Lan, Nurnberg. Dynamo-electric machines.
21,860.—Siemens Bros. Dynamo Works, London (Siemens Schuckertwerke Ges., Berlin). Electric insulation.
23,448.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
24,028.—Wolfram Lampen A.G., Augsberg. Electric lamps.
24,135.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
25,744.—Felten & Guilleaume-Lahmeyerwerke A. Ges., Frankfurt-Main. Electric distribution.
26,084.—W. Meyerling, Charlottenburg. Measuring electricity.
26,436.—R. Bosch, Stuttgart. Sparking plugs.
26,530.—Ges. für Drahtlose Telegraphie, Berlin. Wireless telephony.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

4,483. "High-tension protective device." F. B. Dehn. March 22nd. (Schweitzer & Conrad, United States.) (Complete.)

4,524. "Electric candle lamps." C. Damey. March 23rd.

4,560. "Dynamo-electric machines." British Westinghouse Electric and Manufacturing Co., Ltd. March 23rd. (Convention date, March 23rd, 1914, United States.) (Complete.)

4,561. "Electric switches." Igranic Electric Co., Ltd. March 23rd. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

4,564. "Electric motors." F. Hornby. March 24th.

4,575. "Electrolytic process for the production of iron tubes, sheets, and the like, with an incorrodible surface." S. O. Cowper-Coles. March 24th.

4,576. "Process for the electro-deposition of lead." S. O. Cowper-Coles. March 24th.

4,577. "Process for the electro-deposition of iron." S. O. Cowper-Coles. March 24th.

4,582. "Telephone systems." A. B. Smith. March 24th. (Convention date, March 25th, 1914, United States.) (Complete.)

4,585. "Protection of electric cables." J. H. Bowden & H. F. J. Thompson. March 24th.

4,588. "Rheostats." L. Kamm. March 24th.

4,595. "Protection of alternating-current electric systems. British Thomson-Houston Co., Ltd., & E. B. Wedmore. March 24th.

4,600. "Electric heating element for kindling." R. K. Hearn. March 24th.

4,604. "Receiving instrument for wireless telegraphy." F. L. Field, C. L. [illegible] & B. S. Gossling. March 24th.

4,606. "Imitation candle lamps." W. J. Owen, C. M. Escare & P. F. Escare. March 24th.

4,615. "Purification of tungsten and tungsten compounds." P. Perrino and G. Sisti. March 24th

4,625. "Production of zinc by electrolysis." M. Perreur-Lloyd. March 24th. (Convention date, May 28th, 1914, France.) (Complete.)

4,658. "Electrolytes for the electro-deposition of zinc." S. O. Cowper-Coles. March 25th.

4,663 "Electric torches and other forms of electric hand lamps." A. H. Rose & T. A. Rose March 25th.

4,664. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. March 25th.

4,675. "Mine and other signalling systems." Sterling Telephone and Electric Co., Ltd., & H. W. Barclay. March 25th.

4,681. "Apparatus for the electrolytic production of metals." M. Perreur Lloyd. March 25th. (Convention date, May 28th, 1914, France.) (Complete.)

4,696. "Sparking-plugs for internal-combustion engines." A. E. Lamkin. March 25th.

4,697. "Testing means for sparking-plugs." A. E. Lamkin. March 25th.

4,706. "Process for coating metallic articles with lead." S. O. Cowper-Coles. March 26th.

4,719. "Magnetic clutches." M. Walker and Smith & Coventry, Ltd. March 26th.

4,722 "Electric arc lamps." A. Rolinson & J. G. Wilson. March 26th.

4,738. "Protection of alternating-current electric systems." British Thomson-Houston Co., Ltd., & E. Basil Wedmore. March 26th.

4,747. "Electric motor controllers." Igranic Electric Co., Ltd. March 26th. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

4,748. "Circuit controllers." G. R. Radley. March 26th. (Convention date, March 30th, 1914, United States.) (Complete.)

4,761. "Improvements in electrical cables, specially applicable to cables having a protective sheathing of rubber." British Insulated & Helsby Cables, Ltd., and J. Brotherton. March 27th. (Complete.)

4,766. "Electric switches." Electric & Ordnance Accessories Co., Ltd., and J. Etchells. March 27th

4,776 "Manufacture of filaments, rods, and other bodies consisting of, or containing, graphite-like carbon." Siemens & Halske Akt. Ges. March 27th. (Convention date, March 28th, 1914, Germany.) (Complete.)

4,795. "Phase advancers for dynamo-electric machines." G. Kapp. March 27th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free 9d. (in stamps).

1913.

28,277. Line of Wireless Telegraph Systems. W. H. Shephard & A. E. M[illegible]. December 8th.

28,278. Line of Wireless Telegraph Systems W. H. Shephard & A. E. M[illegible]. December 8th.

1914.

3,181. Electrochemical Treatment of Liquids. C. P. Landreth. February 6th. (February 21st, 1913.)

5,321. Railway Signalling Apparatus. J. F. Wolff. March 2nd. (Fielding.)

5,639. Automatic Electric Regulators. British Thomson-Houston Co (General Electric Co.). March 5th.

5,662. Suspension of Electric and other Lamps and other articles. G. A. Hughes. March 5th.

6,070. Electric Switches or Circuit Breakers. F. B. Holt. March 10th.

6,077. Method of Synchronising a Moving Picture Machine with a Talking Machine or with Music, and a Film to be used therewith. E. S. Donisthorpe. March 10th.

6,162. Electric Switches. Western Electric Co. (F. T. Woodward acting for Western Electric Co.). March 11th.

6,173. Electric Light Reflectors. G. A. Allom. March 11th.

6,180. Electric Switch Apparatus for use in connection with the Electric Lighting and Heating Equipments of Railway and other Vehicles. Electric and Ordnance Accessories Co. & J Etchells. March 11th.

6,209. Electrical Impulse Transmitters and the like. Betulander Automatic Telephone Co, & W. Aitken. March 11th

6,575. Leyden Jars and like Condensers. E Rousseau. March 16th.

7,900. Controlling Switches for Electric Circuits. A. E. Joyce and Spagnoletti, Ltd. March 28th.

8,052. Recording Mechanism for use with Electric Measuring Instruments. J. S. Withers (Sander). March 30th

8,286. Safety Devices for Electrical Winding Mechanism. H. Wauchope and Stothert & Pitt, Ltd. April 1st.

10,895. Electrical Condensers and the manufacture thereof. G. Giles. May 2nd. (May 29th, 1913.)

THE

ELECTRICAL REVIEW.

VOL. LXXVI. APRIL 16, 1915. No. 1,951.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: April 16, 1915. [No. 1,951.

Page
The Status of the Engineer 533
The Marketing of British Goods Abroad 534
Lead 535
Restraint of Trade 536
Wire Manufacturers and Development of the Overseas Trade 536
The Case for the Electrification of Portland Cement Works, by E. P. Hollis (*illus.*) 537
Wireless Control of Public Clocks, by A. E. Ball (*illus.*) ... 539
Notes from Canada... 541
Indian Notes 541
Correspondence—
  Electric Vehicles 542
  Electric Cooking 542
  Preferential Rates 542
  Water Heating by Electricity 542
Electricity Extensions at Carlisle (*illus.*) 542
New Electrical Devices, Fittings and Plant (*illus.*) 544
Legal... 545
War Items 545
Business Notes 546
Notes 552
City Notes 556
Stocks and Shares 557
Market Quotations... 558
The French Electrical Engineering Industry and its Future 559
Reviews 560
Telephone Troubles in the Tropics 561
Correcting Errors in Power Measurement by the Two-Wattmeter Method (*illus.*) 562
Russian Customs Duties on Electrotechnical Products and on their Raw Materials 563
Main-Line Signalling on Railways, by W. C. Acfield (*illus.*)... 565
Electric Cooking 567
Foreign and Colonial Tariffs on Electrical Goods 568
New Patents Applied for, 1915 568
Abstracts of Published Specifications 568
Contractors' Column ... ... Advertisement page xx

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos: Holborn 938; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.

DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LAUNCESTON: Gordon & Gotch, Cimitiere Street.

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Trèves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto I 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

NOW READY.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

THE STATUS OF THE ENGINEER.

AT the "mid-year convention" of the American Institute of Electrical Engineers, which was held in New York on February 17th, a number of papers were read on the subject above-named—a subject of perennial interest, which is well worthy of the attention which is periodically drawn to it both in America and in this country.

The paper read by Dr. E. W. Rice, jun., president of the American General Electric Co., is reproduced in the current issue of the *General Electric Review*, together with an excellent editorial on the matter under discussion.

The author of the latter draws a striking contrast between the ship-of-the-line of 1815 and the "super-dreadnought" of to-day, pointing out that in the former there was hardly a single mechanical appliance, except the pumps and the capstan, whereas the modern battleship is equipped with engines of 60,000 H.P. and upwards, and is a gigantic aggregate of engineering devices—"a most highly developed organism with man-made organs." He might have added that the very latest type, the U.S.S. *California*, is to be propelled and operated by electrical power; but for the purpose of his argument the definition of engineering is framed in the broadest sense, embracing not only the various branches of engineering as commonly understood, but also all scientific work in which educated men are engaged. At once this fundamental fact stands out—that whereas the admiral of old was himself well versed in every technicality of seamanship, the modern commander is absolutely dependent upon his engineers in the handling of his ship, the feeding, training, and firing of his guns, the discharge of his torpedoes, and every other major operation that takes place upon the ship in peace or war. Yet the admiral now, as then, is in supreme command, and it is only in recent years that the engineer has been accorded the rank of an officer—indeed, in the British Navy he has only been given full executive rank since the outbreak of the great war in which he is playing so essential a part.

The same general condition, the author continues, exists in all our industries; inception, development and successful operation are due to the engineer, who is the one indispensable factor without which progress would cease. "Yet he neither controls them nor dictates the policies of the thing of his own creation, and what is of more importance, he apparently is constantly seeing others reap the harvest for which he has so diligently sown." What is the cause of this phenomenon?

By way of explanation, the author suggests that when the engineer is really successful in the material sense, besides doing engineering work he becomes active in organising the work of others, and thus in time becomes a successful manager or business man, with greater financial rewards, and is lost sight of as the engineer. Again, in many fields his work has been so well done that other less skilful can carry on the routine that he has laid down, and "the engineer has displaced himself by the product of his own brains. Indeed, in the field of operating engineers this is particularly noticeable, where the perfection of mechanical and electrical devices has been brought to such a state that the engineer holds much the same position as a lifebelt—for the greater part of the time he is not wanted, but when he is wanted his services are imperative if a disaster is to be avoided." Thus many men of good engineering training have to perform work which those with a less costly preparation could perform almost as well, and the result is necessarily dissatisfaction, not because the work is not congenial, but because the material reward falls so far short of that which corresponds to the expensive education and self-sacrificing labour of their younger days.

The author sees in this a danger for the future; if the feeling prevails that it is not worth a young man's while to enter the engineering profession, we are not going to progress in the future as in the past. "The engineering profession is giving more to the world than any other profession, and it is essential that it should be attractive to the young man of the future."

On the other hand, it is pointed out that there is another side to the question: in one sense the rewards in the engineering profession are far above those in most other professions. The engineer has the immeasurable joy of achievement. "It is the intense interest in striving for accomplishment that makes the engineering professions what they are, and has made the engineer the man of courage and resourcefulness, of patience and determination, of self-sacrifice and unending work." "The engineer must often have the idea that he is being exploited by others because of this very loyal devotion to work rather than to self-interest, and undoubtedly this has been the case in many instances," but the author sees hope for the future in the very fact that the engineer has changed the world to such an extent that nowadays commercial men have to know more of the engineer and his work, and this should lead to a more perfect understanding and a better material reward for the engineer. "Any factor in our great scheme of life that is so absolutely indispensable to our future progress must surely hold an enviable position in years to come."

Undoubtedly there is much truth in this analysis of the position of the engineer in the world's activities. That his merits are now beginning to be recognised by the public, we think, is as certain as it is that he is developing a divine discontent with his present position, and a healthy disposition to claim more adequate recognition of his rights. Both these tendencies are salutary and worthy of encouragement. The upper value of a man in the world's eye is usually limited by the value that he places upon himself; on the other hand, he must live up to or beyond his standard of value, if he wishes to maintain it. In the past, the engineer, as a class, has done the latter whilst meekly accepting the valuation placed upon him by the layman, who, being a business man, has not hesitated to take full advantage of his opportunities. It is for the engineer to remedy this state of things, and to assert his claim to an honoured position in the ranks of modern civilisation.

THE MARKETING OF BRITISH GOODS ABROAD.

The question of how to market British goods abroad formed the subject of an address which was delivered at the Holborn Restaurant on April 9th by Mr. C. Hamilton Wickes, H M. Trade Commissioner in Canada, who is Home on another of his welcome and profitable visits to this country, at a meeting of the Sales Managers' Association.

Mr. Wickes stated that British trade to-day was largely permeated with the leisurely ideas which prevailed in the eighteenth or nineteenth century, and these conditions were affecting the trade and commerce of this country at present. Changes had taken place in the meantime, but we had only recently recognised the necessity for reorganisation, without having, however, a clear conception of what we wished to reorganise and what we desired to effect by reorganisation. It was impossible for us to see ourselves as others saw us, because we spent the greater part of our commercial life in these small islands, whereas, in order to obtain a true conception of our shortcomings, we ought to pass more time in overseas markets, studying how our goods were selected in competition with foreign merchandise of the same character. It was essential to approach the problem with open minds, and prepare to discard our preconceived notions, and to start anew. As to the criticism passed on British manufacturers that they did not make articles to the particular design, stamp, or pattern required in a particular market, he mentioned that the last thing the Americans would do was to alter their patterns to suit anybody. But in the case of many articles made in the United States, it was found that they were also adapted to the requirements of other countries. The speaker had experienced great difficulty in getting information from those who complained of British firms not producing according to particular patterns; but where he had been successful in doing so, it turned out that the order had been offered either to a manufacturer who was months behind with his deliveries, or to one who was already working at full output. If the people who complained were asked why they did not approach other firms, they gave various reasons, including the assertion that other firms did not know the conditions in the Canadian market, and that they did not wish to approach an export agent. The reports of some of the United States Trade Commissioners attributed a great deal of the success of British trade to the credit which was extended to customers, but that applied to the merchants and not to the manufacturers.

Proceeding to consider the problem of the transportation service, the Commissioner asked whether it was not a fact that prior to the war Continental shipping companies could enter British ports and obtain as much cargo as they could carry, provided the rate was 6d. per ton less than the British rates. If a British company went to a Continental port could it get cargo on the same terms and conditions and have the same facilities for securing wharfage space? Perhaps that was one of the reasons why our shipping companies made arrangements with their Continental competitors to keep to the carriage of their goods so long as they did not come into British ports to transport British goods to foreign ports. The system of production in Great Britain was labouring under many artificial restrictions. For instance, Australian buyers obtained a quotation f.o.b. from a British firm from a British port and a quotation from a Continental firm from a Continental port, but they wanted to know the cost laid down in Australia. Could they go to a British steamship company and ascertain the freight rate to Australia? They could go to any German firm and get a quotation for any commodity at once. Why did not the railway companies and the ocean steamship companies publish their rates? Why were German freight rates used in this country from German ports to oversea ports? The quotation for freight from Antwerp to Melbourne on a certain commodity by a German shipping line would be more or less approximately the same as from an English port to Australia. After referring to the control by foreigners of raw materials in our Colonies, as, for example, thorium, lead ores in Australia by Germans, and nickel deposits in Canada by Americans, Mr. Wickes suggested that it would be of advantage if a reform were made by the disclosure of the real names of the importers and exporters of goods where trade was entered in the names of agents, this being a measure of protection, as also was our system of weights and measures, against foreign competition in the home market, tariff or no tariff. It would also be of advantage if foreigners who commenced business here were registered as well as those who acted as agents or branches of foreign manufacturers.

If they proceeded from business done through retailers and dealt with articles which required demonstration, they entered upon a class of commodity which needed expert selling. If they took the view that there were no manufacturers who could compete with the British in quality, the necessity for expert salesmanship became more apparent. Approximately 70 per cent. of the goods exported from the United Kingdom passed through the hands of merchants; from 1 to 2 per cent. was distributed in foreign markets from the offices of British firms in this country, whilst the balance devolved upon oversea representatives. The merchants did not cover all the markets in the world: where they had no connection our foreign competitors—the Americans and the Germans—had had it all their own way. Where the merchant connection was small our trade dwindled or barely held its own, whilst that of foreign rivals rose to an astonishing extent. The conclusions arrived at were—(1) British goods reached a certain volume and value in a certain limited number of markets overseas by the help of the merchants; (2) the other markets were very slightly worked where there was not a connection, and few British goods reached them; (3) the larger volume of trade done in the markets with which merchants traded, obscured our weakness in relation to other markets; and (4) the merchant system had operated to enfeeble and atrophy the British manufacturer's power to sell.

The speaker proceeded to remark that unless British manufacturers sent out representatives to other countries they could not acquire the necessary knowledge of invoicing, freighting, packing, exchange, &c. They were in about the same position as foreign manufacturers held in the eighties of the past century when they started to undertake an export business. The question was, how they could get the information which their rivals secured and upon which they had since built up their businesses. If no attempt was made to travel, how could they get salesmen travellers? Perhaps the Americans were most advanced in that direction. The technical students in Canada were welcomed by the works over the border, where, after two years, they were transferred to the sales departments, and when they left the works they went away with the idea that no other firm could touch the manufactures of the works concerned. The Canadians said that if the British wanted their business they must go to them; if they did not go over the Canadians presumed that the British did not wish for their trade. If the volume of business transacted by one British firm was insufficient to warrant a representative proceeding to Canada, several firms should co-operate in appointing a joint agent to justify his devoting his whole time and attention to the business. That, again, presented difficulties from the standpoint of how the overhead expenses of running the office were to be paid by the firms using the agent, and a further obstacle existed where the agent was dealing with machinery and equipment, a business which ran into a considerable sum of money. The agent might be a good one who could secure a fair number of orders, but a limited capital of £15,000 or £20,000 only covered a few transactions in machinery.

Mr. Wickes, in conclusion, referred in detail to the suggested establishment in London of a general commercial staff—a Ministry of Commerce—and he suggested that the Admiralty, the War Office, the India office, the Crown Agents for the Colonies, &c., should come to some arrangement whereby periodical meetings could be held at which the Board of Trade might offer its experience, and at which an interchange of views might take place in regard to the purchases of materials and stores by these departments, the requirements in which were enormous. The proceedings concluded with a resolution urging on the Government and the Board of Trade the desirability of increasing the number of Trade Commissioners and pointing out the advantage to British trade to be derived from the frequent interchange of views between these representatives and business men in this country.

We trust that this expression of opinion will receive attention in the proper quarter. It seems to us that in any effort that the Government and the Board of Trade make to modernise and increase the efficiency of their relations to the trade of this country, they have at hand a particularly strong man in Mr. Hamilton Wickes.

Lead. UNTIL the beginning of this week the Lead Market had held up pretty well, although the best point reached in the latter portion of last month had not been fully sustained. There had been a pretty fair inquiry which, in conjunction with the comparatively restricted offerings, partly owing to the stiff attitude of American holders, and to the shortage of tonnage available for moving lead from Spain to centres of demand, contributed to prevent much of a relapse in prices on the London market, but this has given place to a reluctant attitude on the part of buyers, and as soon as sellers showed a determination to dispose of a portion of their holdings there was a very rapid relapse. There had been a considerable amount of lead held by speculators, and this has been rather forced for sale, while the decline was accentuated on Monday, when English desilverisers came into the market. Although these interests did nothing in the way of pushing things unduly, they found it impossible to find buyers except at a very sharp reduction, and the decline compared with the previous trading was not far short of £2 a ton. It would appear that the English refiners had been receiving larger quantities of silver-lead from abroad, and that buyers seized the opportunity of standing out from the market in order to establish a considerably lower level of prices. Under these circumstances the present tendency of the market is one of some uncertainty, and with hardly anything doing for export the tendency will probably remain doubtful until some fresh feature develops. Meantime, however, the price has steadied and a fair upward reaction has been seen, while the feeling is more confident again.

It is a matter of considerable gratification that the absurd premium which was latterly established upon near deliveries should have been cut down to such an extent as has been the case. The reduction in the premium was unquestionably due in part to the refusal of the Government to issue export permits. As soon as it became known that there were instances in which shipping permits had been refused, the market took on an easier tendency, and there can be no doubt that in any further upward manipulation the prime movers will have to reckon upon possible Government action tending to bring about, as far as possible, normal conditions. High premiums on early deliveries are against the best interests of the trade, and this is so in all cases. The frank recognition by the authorities of the position in this respect should act as a strict deterrent upon undue manipulation, and should have salutary effect in directions other than the lead market. It is expected that further heavy buying on Russian account cannot be long deferred, but the relative sluggishness experienced in this direction for some weeks past has been the cause of no little disappointment.

Restraint of Trade.

We have upon several occasions called attention to what is known as the "covenant in restraint of trade" which is to be found in so many contracts of service. For his own protection, the employer is often compelled to demand that those who enter into his service, and incidentally learn the secrets of his business, shall, for a time after leaving his employment, refrain from carrying on a similar business, or from entering the service of those who do so. *Primâ facie*, all such covenants are void as being in restraint of trade, and therefore contrary to public policy; but a long series of decisions in the Courts has modified the law so as to render enforceable, covenants which are reasonably necessary for the protection of the employer and not unduly harsh to the employé. An example of the class of case which often comes before the Courts is to be found in Herbert Morris *v.* Saxelby, which has been reported during its several stages in our pages, and was fully given in the *Times* of April 1st.

The plaintiffs were engaged in the manufacture of very special forms of machinery, including pulley-blocks, runways, and travelling cranes. Their business was a leading one in the United Kingdom in this class of machinery and extended over a large part of the United Kingdom. In March, 1911, the defendant entered into an agreement under which his salary was £3 17s. 6d. a week, and his engagement for two years certain. By Clause 7 of the agreement he covenanted with the plaintiffs that he would not—

> At any time during a period of seven years from the date of his ceasing to be employed by the company, whether under this agreement or otherwise howsoever, either in the United Kingdom of Great Britain or (*sic*) Ireland, carry on, either as principal, agent, servant, or otherwise, alone or jointly, or in connection with any other person, firm, or company, or be concerned or assist, directly or indirectly, whether for reward or otherwise, in the sale or manufacture of pulley-blocks, hand overhead runways, electric overhead runways, hand overhead travelling cranes, or any part thereof, or be concerned or assist as aforesaid in any business connected with such sale or manufacture.

On leaving the plaintiffs' employment the defendant at once went into the employment of Messrs. Derome, the French agents of the plaintiffs, but in March, 1914, he entered the service of Messrs. Vaughan & Son, Ltd., Manchester, who were the principal competitors of the plaintiffs in the manufacture of some of the articles mentioned in the above Clause 7. Thereupon the plaintiffs brought these proceedings, claiming an injunction against the defendant substantially in the terms of this clause.

In these circumstances, Mr. Justice Sargant held that while the covenant was not unreasonable from the plaintiffs' point of view inasmuch as it was necessary for the purposes of their business, it would be wrong to enforce it against the defendant, as it would deprive him and the public of the benefit of the skill and experience which he had acquired while in the plaintiffs' employment, and prevent him using his knowledge. By a majority the Court of Appeal upheld this decision. The Master of the Rolls pointed out that restrictive covenants are usual in three cases:—(i) Where a trade secret requires protection; (ii) where the goodwill of a business is sold; (iii) where the liberty of a former employé is to be restricted. While they must be construed very strictly in (i) and possibly also in (ii) a greater freedom is to be exercised in (iii). In applying the older decisions to the facts of the present case, the Court was animated by the desire to prevent the defendant being deprived of the advantage of all his previously-acquired knowledge, and to relieve him from having to start the world afresh. The case emphasises the importance of consulting a lawyer before any document containing a restrictive covenant is signed.

Wire Manufacturers and Development of the Overseas Trade.

The present incapacity of the German wire-drawing firms to continue their shipments to the British Colonies and the South American States has, in the majority of instances, diverted the inquiries of these countries from German firms to British manufacturing houses, thus accounting in a large measure for the extreme pressure at present existing among wire manufacturers, &c., in this country, particularly in the copper section.

The neglect of the overseas trade in the past, and the great possibilities of development in this section, which the war has been the means of demonstrating, will doubtless result in a far wider outlook being taken by British wire manufacturers in the near future than has hitherto been the case. Until recently, no attention seems to have been paid to the development of the overseas trade, partly through the continued steadiness of home demands, but more particularly through the failure to appreciate to the full extent the enormous possibilities of the foreign markets.

It is interesting to note that of recent years great developments have taken place in the variety of the commodities shipped from the two great hardware shipping centres, Manchester and Birmingham. Until a few years ago the average Manchester shipping house concerned itself with little else but the shipment of cotton goods. Nowadays, practically every shipping house in the city has a hardware department, from which is shipped every description of hardware goods. This expansion of trade interests has been materially stimulated by the enterprise of the manufacturers themselves, who, in adopting the most up-to-date methods before placing their propositions before the shipping houses, have succeeded not only in inspiring the buyers to place the new commodity on their selling lists, but in encouraging them personally to supervise also the sending out to agents and travellers abroad the catalogues and samples submitted by the manufacturers. The catalogues, which become indispensable to the shipping house buyer by reason of the enormous amount of time and labour they save him, are usually printed in three languages, English, French and Spanish, and they bear no manufacturers' name; but the brand or trade mark, by which only the native mind identifies the goods, is a feature of great importance. The more distinctive and picturesque the brand or trade mark for goods sent, say, to the South American States, India, and most of the British Colonies, the better the prospect of the commodity being distinguished from all others by the native buyers, and consequently enjoying a greater preference.

If the manufacturer can stimulate the interest of the shipper, as he is almost certain to do, to send out his samples and catalogues to the agents and travellers abroad, he has accomplished what 99 competitors out of the 100 who do not supply these catalogues, &c., fail to do, without which enterprise no steady overseas trade can be expected to accrue.

In shipping to countries like Brazil, Mexico, and other such distant markets, it has been found, even by the largest manufacturers, that it is most beneficial to trade with these countries through a local shipper, who has his own agents on the spot to safeguard his interests, whereas the manufacturer, in the majority of cases, instead of receiving a 3 per cent. prompt cash settlement from the shipper, has to wait as long as 8 to 12 months for settlement, and very frequently, after having incurred heavy expenses, never gets his money at all.

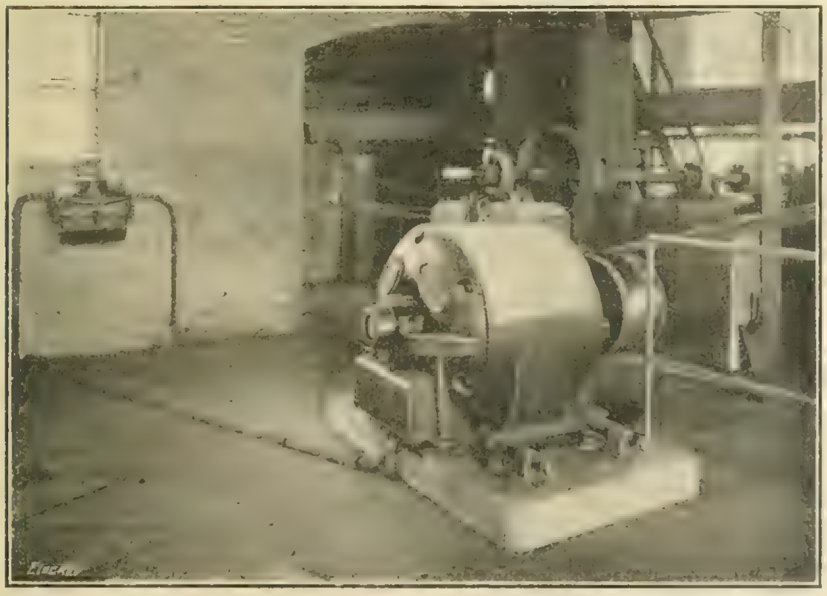
THE CASE FOR THE ELECTRIFICATION OF PORTLAND CEMENT WORKS.

By ERNEST P. HOLLIS.

Portland cement is consumed in increasing quantities every year, and the rapid increase in consumption has induced considerable enterprise into the cement manufacturing world. New cement works are being laid down on every hand, and old ones are being modernised. The prospects for electrification schemes are therefore of the brightest, but the electrical engineer charged with the duty of approaching cement manufacturers with electrification proposals is often severely handicapped by a lack of acquaintance with the conditions obtaining in cement works, and especially the technical processes and terminology of cement manufacture. To the electrical engineer such terms as "kominor," "cylpebs," "silos," "slurry" and "dynamics" come as Greek, and a conversation with a cement works engineer in the vernacular of cement technology would be largely unintelligible to an uninitiated electrical engineer. It goes without saying that, if a cement manufacturer is to be approached on the electrification question, that electrical engineer will be the more likely to succeed who can converse with him in his own technical language, can understand his processes, and be able to convince the cement engineer that he (the electrical engineer) possesses an inside knowledge of the electrical requirements of a cement works.

Such a knowledge is difficult to gain. Even those electrical engineers who have occasion to visit cement works frequently on business bent gain very little insight into the technicalities of the process. Particularly is this so because the arcana of the cement world are usually guarded.

Cement Manufacture.—The primary ingredients of cement made by the wet process are clay, chalk and water, a mixture of which is thoroughly ground, then burnt in a kiln, and finally mixed with gypsum and ground again. Although the process wears a superficial air of simplicity, the technicalities are complicated, and there are very great differences in the qualities of the cements produced by various makers.

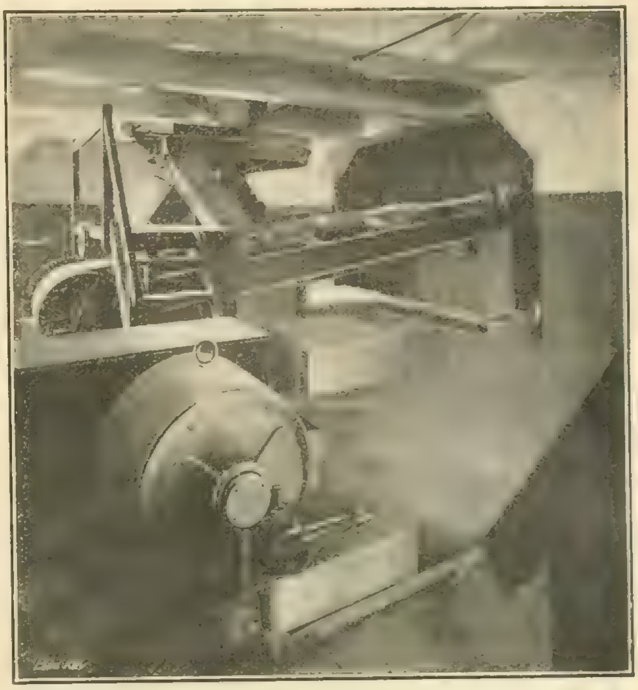


60 H.P. PIPE-VENTILATED MOTOR DRIVING COAL-CRUSHING PLANT.

There is also a dry process, largely used abroad, which is not dealt with here.

Viewing the process more in detail, it can be divided up for a typical modern cement works into four main stages in which the materials are treated:—

(*a*) The wet or raw mill. (*b*) The mixing pits.
(*c*) The kiln. (*d*) The dry or crushing mill.



15 H.P. PIPE-VENTILATED MOTOR DRIVING BAND ELEVATOR FROM SILO TO KOMINORS.

In the electrified mill it is possible to make the process completely automatic, *i.e.*, from the time the ingredients of the cement enter the works to the time the final product leaves it, no occasion arises for manual labour. The functions of the employés resolve themselves simply into supervision and maintenance and no direct labour needs to be applied to the cement throughout the whole course of its manufacture.

That large savings in wages and improvements in the quality of the cement accrue from automatic operation goes without saying, and the elimination of the human element assures a constancy in quality with the same ingredients that enables very delicate adjustments to be made to improve the operation of the plant.

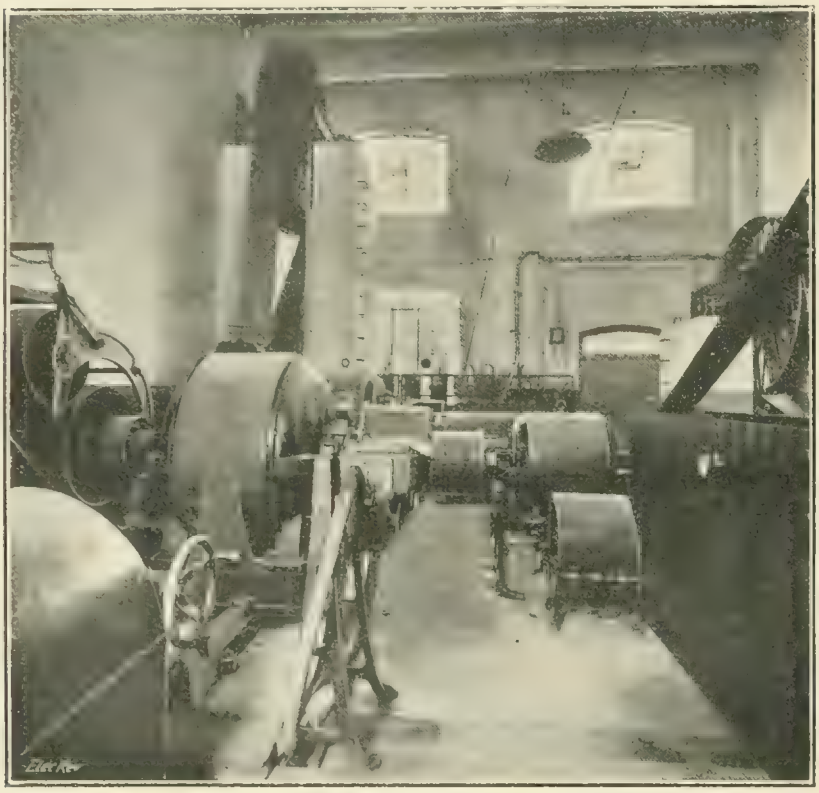
The Wet or Raw Mill.—The four stages can now be discussed more fully for a typical mill. Naturally the details will vary in particular instances, but the following remarks apply to a large modern works.

The chalk is tipped from a railway-siding—after the consignment has passed the scrutiny of the chemical laboratory—into a chalk intake or hopper, where it is met by a band or bucket elevator and lifted to the top of the building. This building is a strong, well-built brick construction, and has three stories. Arrived at the top of the building, the chalk is dropped into a "silo" or bunker. A word with regard to these silos may be opportune here.

In many stages in the cement-making process the silos are met, and their function is purely one of storage. The cement process is a continuous one, and a machine is never shut down except under compulsion. Compelling circumstances, however, arise; the mills need to be "topped up" with the grinding stones or boulders every week; the lining of the rotary kiln needs to be repaired; and so forth. Were there no storage available the stoppage of a single item of the plant would mean the shutting down of the complete unit. To preclude such a happening, arrangements are made for the storage of the material at a number of points. If the wet mills are shut down, the kiln has a stock of slurry to draw upon; if the kiln be cut out of operation, the wet mills can still feed into the slurry storage pits, and the dry crushers can still draw upon the silos for clinkers.

Reverting to the silos, these have at their bottom an outlet which may be closed by a slide. From here the chalk is conveyed by a band conveyor, and, together with a mixture of clay and water, which has been previously mixed in a separate clay mill, it is discharged into the first of the rolling mills. At this stage the mixture is designated "raw slurry."

The mills usually employed are three in number, (*a*) the kominor, (*b*) the tube mill, and (*c*) the cylpebs. There are other types, but the three mentioned are mostly met in modern practice. The mills are usually installed in pairs, the raw slurry passing through them in the order named. A close understanding of the operation of these mills is important, for no matter what be the material to be ground—slurry, dry cement or coal—it usually goes through exactly the same process for crushing.



THE VENTILATED MOTORS OF 250, 175 AND 60 H.P. DRIVING THE WET MILL.

The kominor mill takes the form of a large drum, and contains heavy steel balls about 6in. in diameter. From the kominor the slurry passes on to the tube mill by gravity. The tube mill consists of a long tube some 15ft. long, 4 or 5ft. in diameter, and contains pebbles and boulders. Again by gravity the slurry passes on to the cylpebs wherein the grinding process is finished. These cylpebs are drums some 12ft. in diameter, and containing about 12 tons of short lengths of iron bar about $\frac{5}{8}$in. diameter. After leaving the cylpebs the slurry is kept continually stirred in pits, from which it is drawn by the aid of slurry pumps up to the set of pits in which the mixing process proper is conducted.

Mixing Pits.—On emerging from the wet mill, the slurry, prior to its burning, undergoes a thorough mixing in order to secure a uniformity of consistency that is beyond suspicion. It is not sent into the main mixing pits, but goes first into the "correction basin" or "doctor pits." These pits derive their appellation from the fact that at this point the works chemist takes a lively interest in the composition of the slurry. His analysis lays bare any discrepancy in the constituents, which is remedied immediately in the wet mill. The next lot of slurry that comes along contains a preponderance of that constituent which is missing in the one under analysis, and the mixing of the two remedies the defect.

A mixing pit consists of a number of large concrete basins containing stirrers. Each stirrer is composed of a number of long arms radiating horizontally from a central rotating spindle, which rotates at a slow speed. Between the several pits is an intricate system of locks and sluices, so that any defective batch of slurry contained at that moment in the correction basin can be passed into one of the mixing pits and held up there until what may be called an antidote batch arrives. Between the correction basin and the main pits the slurry is transported by means of inclined screws revolving in concrete troughs. By these the slurry is screwed from one point to another. The mixing process is rather a long one, so that the pits have to have a comparatively large capacity. On the completion of the mixing process the slurry is pumped up and discharged into the rotary kiln.

Rotary Kiln.—The introduction of the rotary kiln, in addition to effecting an immense saving of time over the older burning methods, has opened a further field for the application of electrical power in a cement works. The kiln consists of a long tube, which may be 220ft. in length in the largest size and about 12ft. in diameter at the burning end. The smaller kilns are usually about half this length. It is slightly inclined so that the slurry entering at the top can descend by gravity, while the hot gases originating from the fire at the lower end pass upwards, and ultimately emerge into the atmosphere through a tall brick stack. The slurry and gases therefore pass in opposite directions. The rotating motion of the kiln ensures that every opportunity is given to the slurry to come in contact with the gases. The product of the kiln is a hard substance in fairly small pieces termed "clinker."

One cannot do other than admire the rotary kiln as an example of engineering construction. The stresses induced by the great length must be large, but added to this are the torsional stresses due to driving, to say nothing of those of expansion and contraction due to heating. It is agreeable to find that the design of these kilns has reached such a pitch that no trouble at all is experienced with them.

The kilns are only driven at one point; in the larger kilns this point is at the centre. The speed of rotation is not more than 1 R.P.M., the kiln being driven through belting and gearing, which is often capable of giving two speeds.

For the purpose of driving, a toothed rim is bolted on to the kiln which gears with the wheels. Naturally the latter must have very wide teeth in order to engage with those of the kiln-wheel when running at any temperature, the expansion and contraction being, of course, considerable.

After leaving the kiln, the clinker is passed on to a cooler which works in conjunction with the kiln. It consists of a miniature kiln with the exception that, instead of a fire, a current of cold fan-propelled air is passed through it for cooling the clinker.

As has been said, the kiln is fired by pulverised coal. This coal is blown into the kiln with a blast of air and gives a very high temperature, often attaining 3,000 degrees F. The coal is usually pulverised by a grinding plant exactly similar in nature to that used for the grinding of the cement. There are kominors, tube mills and cylpebs which grind the coal down to a very fine state.

A kiln of the large size described has an output of about 7.5 tons of clinker per hour, and rather less than one ton of coal is burnt per ton of clinker.

Dry or Cement Mills.—Leaving the rotary kiln and its cooler, the clinker, after being sprayed with water to "kill" any remaining uncombined line, next proceeds to the dry or cement mills, the most noteworthy characteristic of which is the immense amount of fine dust with which the atmosphere is laden and the floors covered. The transportation of the clinker from the cooler to the silos is done by a conveying plant.

In the ordinary way the clinker is drawn from the bottom of the silo into the crushing mills, which are an exact replica of the wet mills. Sometimes a kind of mill working on very much the same principle as the pug mills for mortar, which are commonplace to all building operations, takes the place of the kominor. Before passing into the kominor the clinker is mixed with gypsum, and the two are ground together. The final product passes on to the sacking machines which fill the sacks with cement. These sacks, by the way, have to be dried before being filled with cement, and for this purpose are dried by a current of warm air propelled by small electrically-driven fans.

Economy of Electric Drive.—The design of the modern works, scattered as it is over a large area with numerous points at which power needs to be applied, makes electrification eminently desirable. The introduction of the rotary kiln has done a great deal towards making electrification inevitable, for with its arrival the process could be made completely automatic. Generally speaking, the steam drive from a central point would be so inefficient as to make modern cement works operated on this principle commercially impossible. Even when steam is generated at a central point and distributed in an efficient manner to the various mills, the large number of small steam engines, which cannot remain unattended, involve a heavy prime cost and running charges, and raise the operating figures to a far higher point than those of an electrically-driven mill.

In addition to economies in the cost of power which are to be expected for the usual reasons from the installation of electrical plant, electricity offers in addition an easy method of determining the efficiency of the many mills, the power consumption of which up to the present has been shrouded in mystery. Taking as an example the tube mills, it has been found that one of these which had been taking 160 H.P. prior to electrification could have its power consumption, with the same quality of slurry, reduced to 112 H.P. by experimenting with different heights of pebbles in the mill. With steam plant it was impossible to obtain any accurate measurement which could be taken as an authoritative criterion of the power required by the mill. Naturally, in a cement works where dust is so prevalent, line shafting, which is inevitable in great lengths with steam plant, is to be avoided at all costs, and the individual electric drive permits considerable economy in this direction.

A great many of the operations in the cement works involve the transport of material from one point to another by belt conveyers, screws, and other methods. For this class of driving, the electric motor is invaluable, as it can be installed in out of the way places in which it would be extremely difficult to utilise a mechanical drive. A large number of electrically-driven cement works are now in operation, and satisfactory testimonials can be obtained from these works which will convince any cement works engineer in doubt as to the efficiency and convenience of the electric drive.

WIRELESS CONTROL OF PUBLIC CLOCKS.

By ALFRED E. BALL.

Radiographic waves have proved of great service in the distribution of time over extensive areas, and will doubtless be pressed into the service of the horologist in many other ways; one of the most useful will, in the writer's opinion, be the wireless control, or rather supervision, of public clocks.

The scheme advocated, which has been put to a practical test by the writer, consists briefly in fitting each of the main public clocks in a town with a small wireless transmitting set, which would be operated periodically by the clock at definite times, and the installing of an official wireless receiving station, at which the various clocks would be checked daily. By means of this system each public clock would report its time-keeping, and in the case of any clock having an error greater than a certain small pre-determined value, steps could be taken at once to have it corrected.

The working of the scheme would be as follows:—

It is assumed that eight of the principal clocks of a town have been fitted with the automatic transmitting apparatus, which will be described later.

At the sound of an "attention" bell (arranged to ring shortly before 10 a.m.), the person deputed to "listen in" at the wireless receiving station (which we will assume, is installed at the Town Hall) receives the Paris time signal, from which he checks a standard clock, which should be provided with a seconds hand.

The error of the standard clock is duly noted in the clock rate book. He then moves the tuning slides of his receiving instrument to a position suitable for the reception of a 50-metre wave length which is marked on the coil, and listens for clock No. 1, which has been arranged to send its signal at 10.1 a.m. As soon as he has moved his slides to the required position, he hears clock No. 1 sending a series of short "buzzes," which continue for, approximately, a minute, and terminate precisely when that clock shows 10 hours 1 minute a.m. By keeping his eye on the seconds hand of his standard clock while listening, he is able to note the error of clock No. 1 to a second, and this error is duly noted in the rate book in a space provided against the number of the clock.

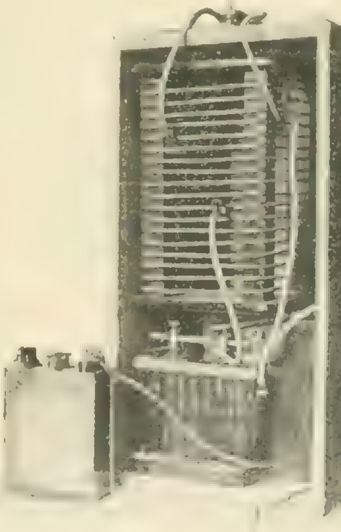


Fig. 1.

No. 2 clock does not commence sending its signal until 10 hours 1 minute 40 seconds. The longer time has been given to clock No. 1 to give the operator ample time to tune in sharply and so get good signals. At 10 hours 2 minutes by No. 2 clock it signals its time by its last "buzz," and its error is also noted in the rate book.

Similarly the remaining five clocks are checked, the entire process occupying eight minutes, or, including the taking of the Paris time-signal, eleven minutes.

Means would be provided to enable the different clocks to be identified. The intervals of 40 seconds between the signals should be sufficient to prevent overlapping, as no public clock should have such an error. The signals can be repeated by the clocks at, say, 3 p.m., so that supervision may be exercised twice daily.

The writer has proved that, for the purpose in view, the wireless aerial may be quite unobtrusive, the apparatus simple and inexpensive, and the power small.

Fig. 1 is a photograph of the transmitting apparatus employed by the writer. This is a simple affair, contained in a box measuring 20 in. × 12 in. × 8 in., and is operated by a small 4-volt ignition accumulator which would last one month or longer with one charge.

Each turret clock to be supervised would require the following:—

(*a*) A transmitting apparatus as shown in fig. 1.

(*b*) Contacts fitted to the clock movement to *break* contact at a certain definite pre-arranged time.

(*c*) An aerial, which may be of an unobtrusive pattern.

(*d*) An "earth" connection, which may be the lightning conductor or a water pipe.

The connections of the apparatus to the contacts mentioned and to the aerial and "earth" are shown diagrammatically in fig. 2; incidentally, the movement shown is an electric "waiting-train" turret movement—now largely used for turret clocks—of which the writer is co-patentee with the makers, Messrs. Gent & Co., Ltd., of Leicester. The aerial in practice need only be a single wire; the one used by the writer in his experiments passed unnoticed up to the time of its removal on the outbreak of the war, and its length was 40ft. approximately. The separate "buzzes" are obtained by means of a contact operated by the pendulum at each swing, and the sudden cessation of the "buzzes" is produced by a contact in series therewith which is broken by falling off a cam fixed to, say, the centre wheel. In the case of a "waiting-train" movement, the spring which makes contact with the pendulum may be a fixed one, and may contact idly when not in operation, because the "interference" could not affect the timekeeping, but in the case of a mechanical movement this spring may be lifted out of the way by a cam when not in use, or brought into action by an electro-magnet only when required.

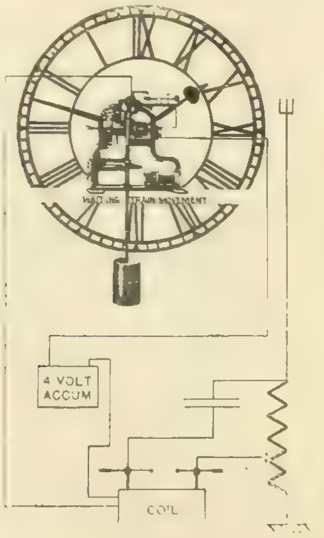


Fig. 2

In the case of a striking turret clock the lifting cams (or pins), or the lifting lever, could be utilised for making the necessary contacts, the last "buzz" in this instance indicating the last blow of the hour struck. In checking the time of such a clock from the last blow, allowance would be made for its striking rate; thus—if the intervals were 3 seconds, the clock's actual time would be 27 seconds in advance of the last "buzz." This method of "contacting" assures that the striking is in order, as well as that the clock is to time. A town which desires to be "well-timed" should decide that, should any of its supervised clocks signal an error of more than 10 seconds, its custodian should be instructed to correct it forthwith.

The transmitting set shown in fig. 1 would be, in practice, completely enclosed in a dust-tight box, and as the only moving part would be the contact-breaker of the coil, little or no attention would be needed. In the event of the contact-breaker being out of adjustment, this would be indicated at the receiving station.

The writer has designed and made an instrument to enable a system of impulse clocks to signal its time-keeping to the receiving station, and therefore be supervised. This instrument consists essentially of a short and light pendulum, which is arranged to operate after the manner of a slow-ringing electric bell. One dry cell operates it, and its circuit is closed at pre-arranged times by contacts fitted to one of the impulse clocks in the circuit. The clock employed by the writer for the purpose was one made by his firm for ringing bells in a factory for the starting and stopping of work. The contact is closed for half a minute, and, in vibrating, the pendulum runs full tilt into contact with a spring at the end of each swing, thereby closing the circuit of the induction coil and producing a series of timed "buzzes" at the receiving station. By using pendulums of varying periodicities, different clock installations could be readily identified.

Fig. 3 shows diagrammatically the connections employed, which are self-explanatory. The relay shown at R is necessary to break the primary circuit of the induction coil precisely at the end of the half-minute, and so terminate the "buzzes," because the pendulum, by its inertia, continues to swing and so touch the contact spring after the clock contact is broken.

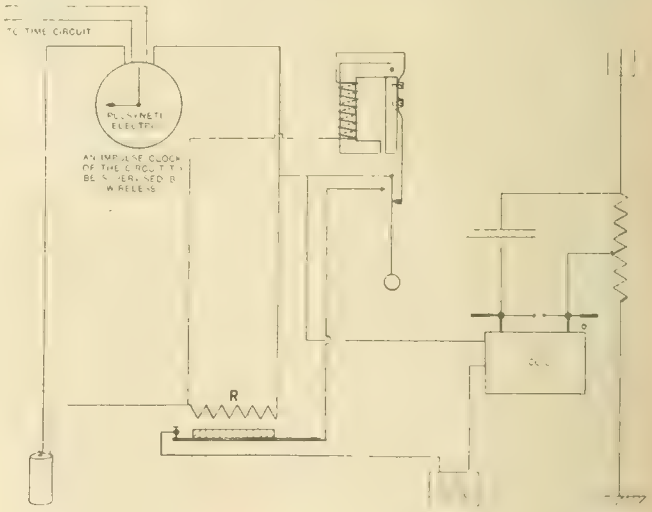

TO TIME CIRCUIT
AN IMPULSE CLOCK OF THE CIRCUIT TO BE SUPERVISED BY WIRELESS
R

Fig. 3.

Identification of individual turret clocks could be secured in many ways. First, the varying pendulum lengths could be taken advantage of when pendulum contacts are used, turret clock pendulums varying from 1 seconds beat up to 2 seconds or more in steps of ¼ second, and so the frequency of the "buzzes" heard would enable the clock to be identified, should it be considerably out of position on the schedule. Also, in the case of "striking" contacts, the frequency of the "blows," or rather "buzzes," would be a means of identification. Coupled with the foregoing features, a variation in the character of the note can be employed by variations in the design of the spark-gap and contact-breaker.

The object of advocating the employment of the short wave length of 50 metres and small aerials is to ensure that the large commercial stations be not interfered with. Interruption or "jamming" would be possible from local amateurs with untuned apparatus, but, as amateurs usually only display their activity at night, trouble would not be experienced on this score.

Fig. 4 shows the receiving station used by the writer.

Before wireless supervision could be adopted, it would be necessary to get a licence from the Postmaster-General, who would specify the maximum wave length which would be permitted, and also the maximum power to be employed. The requirements of this scheme are below the limits usually stipulated for.

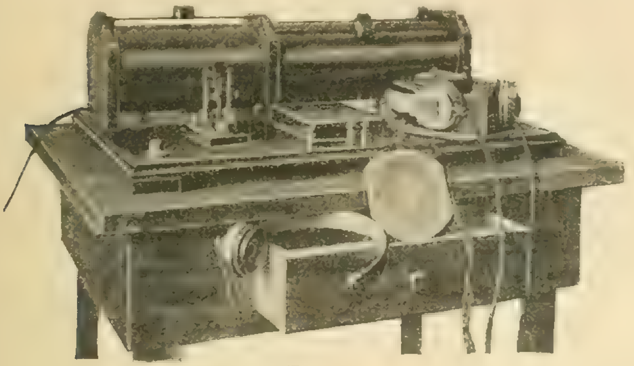


Fig. 4.

An argument against the adoption of the scheme would be that, in the event of another European war, the scheme would be put out of operation by the suspension of the licence during hostilities. The writer ventures to assert that it will be a "long, long time" before Europe will again be brought under the spell of war.

NOTES FROM CANADA.

[From our Special Correspondent.]

In Kamloops, B.C., power to spend $80,000 for hydro-electric work is being sought. Yorkton, Saskatchewan, is noteworthy for the fact that some four years ago the first generator set driven by a Diesel engine in Canada was installed there; a second set, of 500 B.H.P., has recently been put into operation, the first one being only of 150 B.H.P.; provision has been made for three additional 500 B.H.P. sets. In isolated spots out in the West, Diesel oil engines would seem to be very suitable, as coal is very expensive, and under such conditions the advantage of having no stand-by losses for fuel is plain.

Prince Albert, Saskatchewan, has just put into operation recently an automatic telephone system, and in Crystal City, Manitoba, a new telephone company with a capital of $20,000 has been formed.

In Winnipeg, Mr. Leonard Andrews read a paper on "Automatic Electric Lighting Plants" before the Electrical Section of the Canadian Society of Civil Engineers a few weeks ago. This city has almost 40,000 H.P. installed in generating plant and another 5,000 KW. machine is being erected now. The station output is still growing, in spite of war conditions.

The last two completed turbines (water) were tested a little while ago after a 30-day continuous run. The makers had guaranteed 6,800 H.P. with a net head of 45 ft.; actually it is possible to obtain 7,200 H.P. with 80 per cent. gate opening under a head of 46 ft.

Several fresh places in Ontario have passed by-laws in favour of obtaining power from the Hydro Electric Power Commission of Ontario, and the farmers in various districts are becoming keenly interested in the possibilities of electricity on the farm as already applied by the Commission in a number of cases.

The agitation in favour of the so-called "hydro radials" (electric railways to be owned by the people, built and run by the H.E.P.C.) seems to be as strong as ever. A deputation representing many municipalities went to Ottawa a few days ago to ask for a Government subsidy, but owing to the war it was found impossible to get anything from the Dominion Government; an attempt is, however, to be made very soon to obtain a grant from the Provincial Government. In view of the enormous benefit to the community at large which, it is practically certain, would result from the construction of such lines, it is to be hoped that the deputation will meet with better success from the latter Government, particularly as it is more directly concerned than is the Government of Canada. The Provincial Government has just given the Commission powers enabling them to take over any electric railway in the Province. Tenders will probably be called soon for the installation of cables in certain streets in Montreal, where underground conduit has been laid, and an appropriation of $550,000 has been voted for additional conduit work.

That there are sometimes other causes operating to militate against a continuous supply of energy being given from a station driven by water power, besides transmission line troubles during sleet and other storms, is evident from the experience of the Ottawa Light, Heat and Power Co., which had last year to spend an additional $50,000 on coal owing to a period of exceptionally low water in the Ottawa River. A sleet and wind storm gave the Bell Telephone Co., the Quebec Railway, Light, Heat and Power Co., and the Dorchester Electric Co. a good deal of trouble a short time ago, when wires were brought to the ground and Montreal was without power or electric light for several days.

In spite of the war, the incorporation of new companies, particularly electrical ones, seems to go on much as usual. At the present time most engineering concerns appear to be taking up the manufacture of shells, large orders for which have been placed by the Government with very many firms; this is a good thing, as in many cases there is little or no other work in hand.

There are not many large steam generating stations in the portion of Ontario surrounding Niagara Falls, but the Dominion Power and Transmission Co., of Hamilton, is building a station designed for an ultimate capacity of 75,000 KW. Although one of the primary reasons for constructing this plant is to ensure continuity of supply, it is noteworthy that the steam plant is designed for continuous operation with a high fuel economy, conditions which add very considerably to the cost of a plant designed merely for stand-by purposes.

According to a statement emanating from the Department of Inland Revenue at Ottawa, Canada exports practically as much electrical energy as she makes use of herself; the figures for exported power and that used in the Dominion are:—

Export.	Home use.
772,597,049 KW.H.	770,867,018 KW.H.

These figures are for the fiscal year ending March 31st, 1914.

INDIAN NOTES.

[From our Special Correspondent.]

Bombay Mint.—The plant in the Mint is to be shortly converted to electric drive and Captain Willis, R.E., is returning to Bombay to deal specially with this. He has been in control of the Calcutta Mint for some time back, where electric drive has been very successfully in operation for several years. The plant was provided by the G.E. Co., through their Indian agents, Messrs. Octavius Steele & Co., and has given extreme satisfaction.

Calcutta Port Trust.—The installation of [illegible] in and around the docks and jetties of the Trust is one of the finest in India; but for the supply of carbons for the ensuing year—about 130,000 pairs—the Commissioners are in a quandary. As usual, tenders were invited early in January, 1915, but no satisfactory estimates were put forward; no firm would bind itself by the very strict conditions of supply required, and prices put forward were about double those of the previous years. It is believed, however, that a compromise has been effected and a tender has been accepted without binding penalties. If a satisfactory supply of carbons cannot be ensured the only alternative will be to substitute half-watt lamps of high candle-power later on.

Electrical Engineers.—[illegible] the European electrical men in India [illegible] sort or another, although there are very few, if any, on active service. The Electrical Company of the Calcutta Port Defence Volunteers have been [illegible] the able direction of Captain Stovold, of the B.I.S.N. Co., by way of manning the searchlights [illegible] Their work has [illegible] *Emden* got her quietus; but while this aggressive little gunboat was roving about Indian waters the engineers, electrical and others, in charge of port [illegible] particularly anxious and trying time. Madras was without a port searchlight when the city [illegible]

The Secretary of the Institution of Electrical Engineers sent out post card [illegible] members on military service. Some misapprehension exists as to whether [illegible] active service or not. [illegible] the idea that [illegible] military operations either in [illegible] Gulf [illegible]

Ban Kipore.—This new capital of the recently constituted province of Behar and Orissa is growing rapidly in size and importance. Messrs. Gifkins & Co. are said to have got the concession for the electric lighting of the city and cantonments. Government House has already got its own installation, and the High Court and Post Office are both being installed with electric lights, fans, and lifts. Contractors are asking one another how it is that no tenders were called for when it was decided to give the work to a firm of Calcutta builders who are managing agents for a well-known electrical home firm. Such, however, is the way things are often done in India, and this very reprehensible practice is one which is growing, and one which should have the attention of the higher P.W.D. authorities. The amount of the contract in this particular case which was given away without asking for competitive tenders was approximately £5,000.

War Effects.—From the point of view of electrical engineering business the war has made but slight difference up to the present. Contractors have their hands fairly full and there have been very few instances of firms diminishing their staff or workmen because of shortness of work. In fact electrical firms may be said to be more busy this year than for some time, and inquiries from Government P.W.D. and from military works departments have been very brisk indeed. Probably, however, a period of slackness may set in from April, 1915, as Government budgets run from April to the following March, and it is usual to expect a rush of inquiries and orders so that amounts previously budgetted may not lapse. As the current budget was passed in pre-war days and was fairly liberal, P.W.D. engineers are able to put through anticipated works. In the face of things at present, the coming Indian financial year is almost sure to be barren of important electrical or other works which are not an absolute necessity, and hence contractors who depend much on Government contracts can scarcely look forward to the year 1915-1916 as one with a rosy outlook.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electric Vehicles.

A propos of your recent article on this subject, and of all current discussion, I failed to observe any suggestions and remarks regarding the application to that unostentatious vehicle known as the "Steam Roller." It would be interesting to hear of any investigation, municipal or otherwise, in this direction, and the conclusions derived therefrom.

Running and initial cost, also low radius of operation, may be points of discussion, but I think we can safely anticipate lower depreciation charges, and here at last is an instance in which the weight of the modern lead battery would stand as a decided advantage to the designer.

L. G. Toplis.

Glasgow, *April 12th*, 1915.

Electric Cooking.

In a leaderette in your issue of March 19th you refer to my remarks at the I.E.E. on Mr. Cooper's paper, and I think your observations call for a reply from me. In stating that the matter goes beyond the scope of the Sub-Committee of the Engineering Standards Committee, of which I am chairman, you are, I think, unaware of the constitution of the particular Sub-Committee or "panel" dealing with this matter. On this panel are representatives of the I.M.E.A., Public Supply Companies, the B.E.A.M.A., the Electrical Contractors' Association, and the fire offices, so that it is difficult to see how it can well be more representative. I altogether fail to grasp on what grounds you apparently advocate the setting up of the I.M.E.A. as the proper authority to deal with the question; I should think that the supply companies, among which are to be found some of the most active workers in connection with electrical cooking, would have something to say on this matter. You are quite mistaken in supposing that the panel are in the least degree inclined to let the matter rest; on the contrary, they are actively at work on it, and they have the cordial co-operation of each one of the Associations which I have enumerated above.

Like most questions of standardisation, that of electric cooking apparatus lends itself to light and airy generalisations; but it is only those who have applied themselves to the actual work of evolving definite standards who appreciate the real difficulties encountered.

C. H. Wordingham.

London *April 5th*, 1915.

[We think it can scarcely be denied that, as the result of its extensive experience, and the fact that the great majority of our electricity supply undertakings are under municipal control, the I.M.E.A. is the most competent body to evolve a scheme which will enable consumers generally to obtain electric cooking apparatus on reasonable terms.

We fully appreciate the efforts that are being made by the Standards Sub-Committee, of which Mr. Wordingham is the chairman, and if they result in the consumer obtaining standardised and cheaper apparatus, so much the better. But it will be remembered that Mr. Wordingham, in discussing Mr. Cooper's paper, said with regard to the Sub-Committee that there seemed to be a great diversity of opinion as to the desirability of any standardisation whatever in connection with electric cooking apparatus, and that the manufacturers were not very eager for standardisation, from which we may justifiably assume that progress will not be very rapid.

On the other hand, Mr. Wordingham said he was strongly of opinion that there were certain things which might well be standardised, and in this we cordially agree with him.

Whether a representative Sub-Committee of the Engineering Standards Committee or a single-minded Committee of the I.M.E.A. brings about the desired result is immaterial, so long as that result is attained.—Eds. Elec. Rev.]

Preferential Rates.

Referring to your leading article in the current issue of the Electrical Review *re* "Preferential Rates," I should like it to be distinctly understood that it is not I, as the acting engineer and manager, that will not accept photographic work at the lowest possible price. I am out for all the day load I can get, at the lowest remunerative price, and what is more, I am getting it, for, as a matter of fact, our output for the past four weeks has been greater than for the corresponding four weeks in any year since the commencement of the undertaking, notwithstanding the fact that the Shop Hours Act has recently been put into force here, and the licensed premises are closed at 9 p.m. instead of 11 p.m. as formerly. Moreover, Ilkeston is not a town which is being blessed with war orders.

G. H. Browne,

Acting Engineer and Manager.

Ilkeston Tramways and Electricity Department,
April 10th, 1915.

[We hope we did not convey the impression that the engineer was in any way responsible for the trouble at Ilkeston; our previous report indicated that the Committee was divided on the point. We congratulate Mr. Browne on his progressive policy, with which we are heartily in sympathy.—Eds. Elec. Rev.]

Water Heating by Electricity.

In view of the publication in your columns last week of a letter from Mr. George Wilkinson, in which he says that the *Journal of Gas Lighting* "grossly misrepresented" his recent statements on the subject of electric water heating, I shall be glad if you will kindly publish in your next issue the editorial note which was attached to Mr. Wilkinson's letter when it appeared in our columns.

The Editor,

Journal of Gas Lighting.

London, E.C., *April 9th*, 1915.

[In the note referred to, Mr. Wilkinson is described as "uncharitable and thin-skinned," and the reports of his remarks in the electrical Press are quoted in support of our contemporary's criticism. We do not consider the matter of sufficient interest to reproduce the lengthy note in full.—Eds. Elec. Rev.]

ELECTRICITY EXTENSIONS AT CARLISLE.

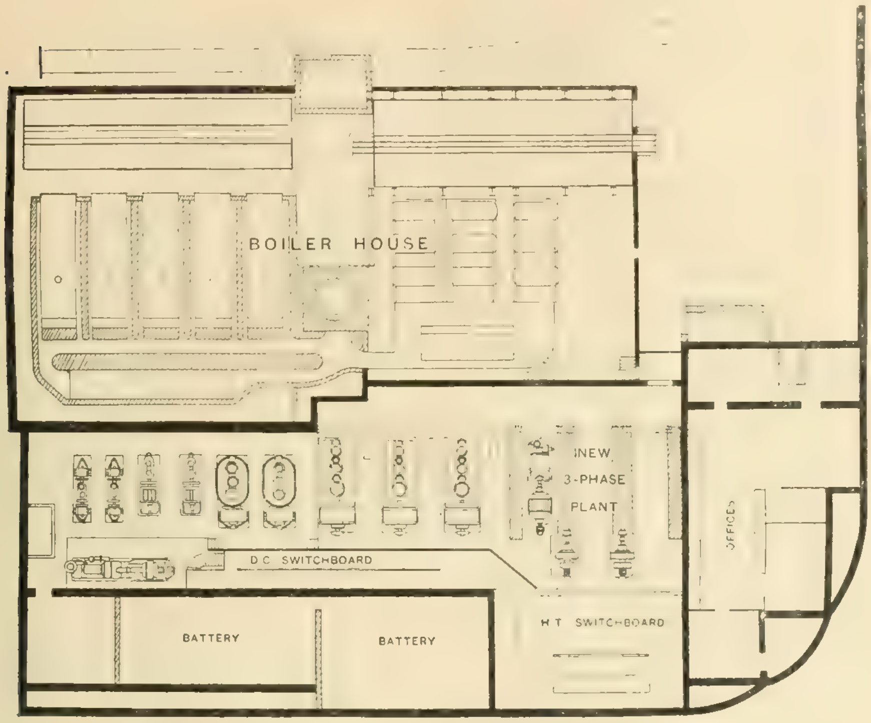
The municipal supply of electricity in Carlisle dates from 1899, when the original scheme, costing some £30,000, which was installed under the direction of Prof. Kennedy, was opened.

From time to time extensions have been carried out on the direct-current system, but within the last year or two, owing to the extended distribution in prospect and the growth of the power load, and the fact that the next plant required would be of the high-speed turbine type, it was decided to introduce three-phase alternating-current supply, and to meet immediate requirements by installing two motor-generators to supply beyond the economical limits of the original direct-current system. This initial scheme was followed by a more comprehensive one, involving loans of £23,940 for plant and £6,000 for mains, and necessitating the extension of the engine room and provision of a 1,250-kw. turbo-alternator, with surface condenser and wet air filter, two 600-kw. rotary converters, H.T. and L.T. switchgear, circulating water piping, &c., a new boiler, and additions to the lighting battery. All the available building space has now been covered, and space is provided for two additional 1,250-kw. turbine sets, while foundations have been laid down for a fourth water-tube boiler.

The station now affords accommodation for generating plant sufficient for some years to come, and the boiler power can be increased by substituting water-tube boilers for the older Lancashire boilers; the only difficulty appears to be a possible shortage of cooling water for condensing in the summer, when the adjacent River Caldew is very low.

In 1911 the Council was empowered to supply any place within two miles from the centre of the city, and in 1914 a further special order was made allowing supply to certain houses in the Scotby district; the Stanwix area has been changed over from direct to alternating supply, and all new large power consumers are to be supplied on this system.

The principal features of the new plant are as follows :—



Plan of the Extended Carlisle Electricity Works.

The turbo-alternator was supplied by the Oerlikon Co., and is of the Rateau type, running at 3,000 r.p.m., and of 1,250 kw. capacity, for supplying three-phase 50-cycle 3,000/3,300-volt current. A steam-driven stand-by oil pump is provided for lubrication purposes at starting, the ordinary pump for this and for supplying the oil-controlled relay governor being direct-driven from the turbine shaft.

A separate exciter is direct-coupled to the alternator shaft, and an Oerlikon automatic pressure regulator is mounted on the switchboard.

The wet air filter for the alternator is of the Heenan and Froude type, while the main condenser is of Worthington rectangular pattern ; no isolating valve is fitted between it and the turbine, but arrangements have been made for flooding the condenser so as to permit of temporary exhausting to the atmosphere. Motor-driven circulating and rotary air pumps are provided, driven from the d.c. bus-bars and arranged for automatic change-over to the battery in case of emergency.

The two 600-kw. rotary converters were supplied by the British Westinghouse Co., and are of the six-phase type running at 750 r.p.m. The converters are arranged for direct-current starting only, and are available for giving either direct-current lighting or traction supply or for running inverted from these supplies and delivering three-phase current.

A special exciter and a synchronous booster are mounted on the shaft of each machine, and each of the latter is supplied through a 660-k.v.a. British Westinghouse oil-insulated self-cooled transformer.

The new switchgear, which has been supplied by the same firm, is situated on a gallery in a recess on one side of the extended engine room.

The recess backs on to the street, and the h.t. feeder cables are brought direct into the switch cubicles.

The switchgear consists of an operating board with panels for two rotaries, two turbines and two feeders, and spare panels for an additional rotary and turbine set ; behind are the moulded stone cubicles containing the bus-bars, oil-switches, instrument transformers, &c., the cells being arranged back to back.

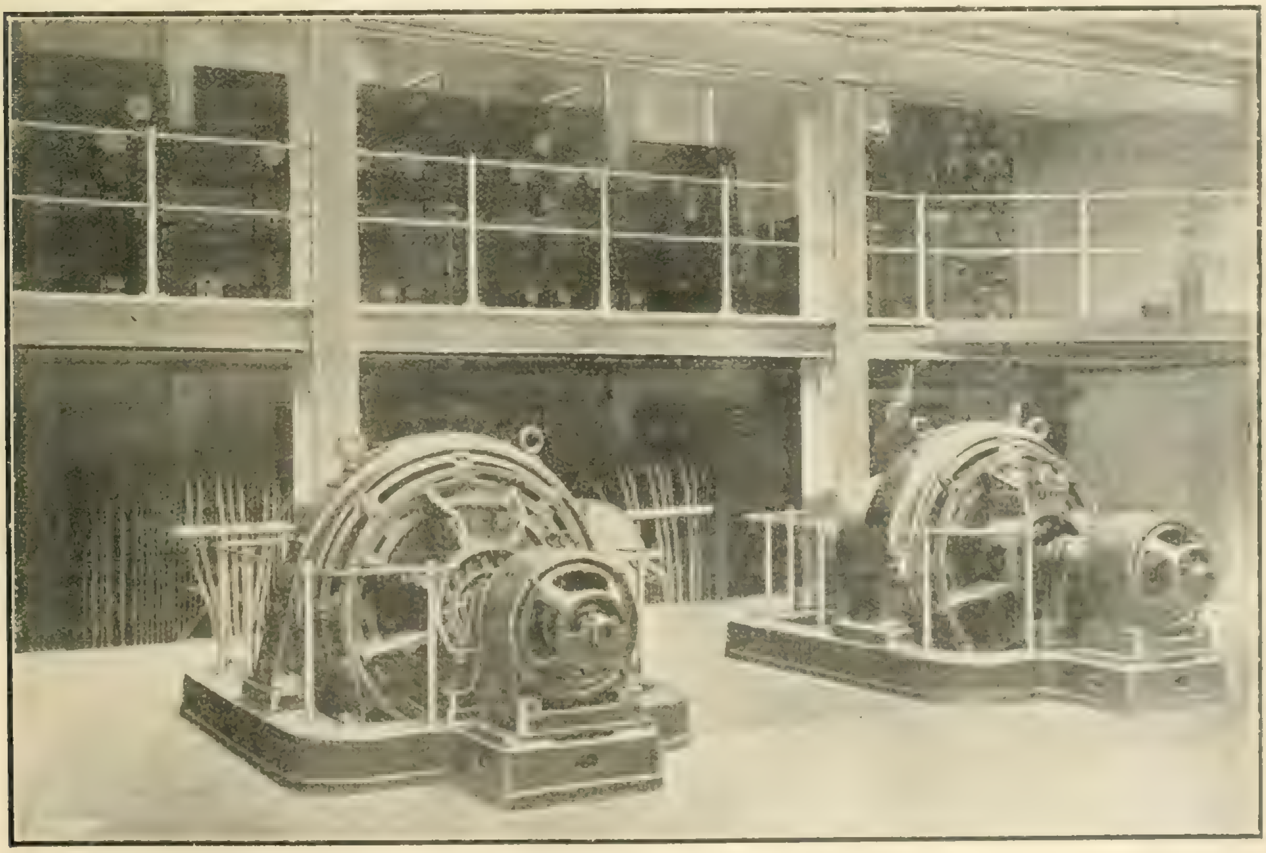
The direct-current board for the rotaries is connected to the old switchboard by bare copper strip, and access to the old switch gallery is also provided.

The cost of the original plant at Carlisle, some £30,000 for 370 kw., was, roughly, £81 per kw. ; the completion of the present extension, giving a plant capacity of 3,920 kw., brings the figure down to £33 per kw., and with the further additions provided for, with some 6,420 kw. installed, a further drop to £23½ per kw. will occur.

During the year 1913-14 the undertaking generated 3,759,645 units and sold 3,140,457, of which some 2,360,000 were for power and heating supplies—the latter to over 3,000 h.p. of motors and about 114 kw. of heating and cooking plant.

There were some 760 consumers, with 55,000 30-watt lamps, connected to the mains ; also 57 public arc lamps, and some 290,000 units were supplied for traction purposes.

Ever since the Corporation supply of electricity commenced the revenue has steadily grown, and prior to 1913-14, when there was a small deficit on the working, considerable net profits were earned for many years. It may be noted, however, that during the years 1912-13 and 1913-14 over £5,000 was expended out of revenue on



Westinghouse Rotary Converters and H.T. Switchgear, Carlisle Electricity Works.

ent and alterations, and the results must be judged accordingly. In conclusion, we are indebted to Mr. F. W. Purse, the City Electrical Engineer, for the particulars here given.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Vacuum Tubes for Telephone Line Protection.

Carbon lightning arresters protect against voltages above 3,000. To protect telegraph and telephone lines against lower voltages, vacuum tubes are used and are of excellent service for protection against voltages above 300. In the *E.T.Z.*, F. Schroeter describes a new form of vacuum tube which is effective down to 130 volts. The construction is shown in fig. 1. The anode *a* is an aluminium pin surrounded by a protective tube *b*. The lower end of the anode *a* is at a distance of a few millimetres from the cathode *c*, which is a fused alloy of potassium or sodium. Current is supplied through platinum wires *d* and *e*. The tube is filled with helium, neon, argon, or a mixture of these gases at a pressure of from 1 mm. to 3 mm. The life of the tubes is practically unlimited. A tube will withstand thousands of breakdowns without change of its critical voltage. This vacuum tube may be used with the connections of either fig. 2 or fig. 3. In the first case, the fuse C (operating at about 0.5 amp.) is inserted between the telephone transmission line A and the exchange line B. The vacuum tube D is inserted in an earth connection as shown. If the telephone transmission line should by accident get into contact with an energy-transmission cable charged to more than 130 volts, or if voltages of this amount should be produced by induction in the telephone line, an arc is formed in D and the fuse C melts, whereby the exchange line B is separated from the transmission line. In the second arrangement (fig. 3) the telephone transmission line A is separated from the exchange line B by a relay consisting of three parts, E, F, G. The winding E has a high resistance, say, 8,000 ohms to 15,000 ohms. When a dangerous voltage occurs, a brush discharge takes place in the vacuum tube D (because the high resistance of E prevents the currents reaching an intensity sufficiently high for the evaporation of the cathode which would produce an arc). The current passing through E excites the relay and attacks the armature F, so that the contact between A and B is broken. The interruption lasts as long as the dangerous voltage in A, and stops automatically when the dangerous voltage disappears. By artificial means it is possible to devise vacuum tubes which will operate below 110 volts. For instance, if *a* is used as the cathode, the surface being covered with a layer of potassium, and a distance of 5 mm. is employed between *a* and *c* with a gas mixture of two-thirds neon and one-third helium at a total pressure of 2 mm., the break-down E.M.F. is 104 volts. A variation in the width of the vacuum tube has an effect on the critical voltage.—*Elec. World.*

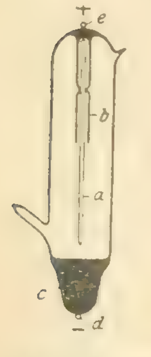
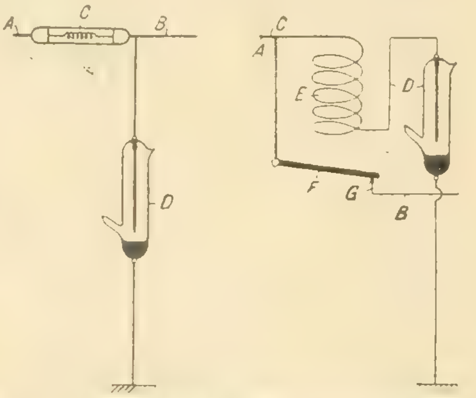


Fig. 1.—Vacuum Tube.



Figs. 2 and 3.—Wiring Connections in Vacuum-Tube Protective System.

Higgs Motors.

In a new list Messrs. Higgs Bros., of Sherbourne Road, Balsall Heath, Birmingham, describe a range of standard D.C. motors and generators which they are building. We illustrate the component parts of one of these in fig. 4. The machines are of the protected type, with armature cores of Stalloy, and former-wound coils. The brush-holders are of the sliding-box type, of neat and compact design, and Hoffmann ball-bearings are used throughout. The machines are designed to carry 25 per cent. overload for one hour, and to have a high efficiency; they range in size from $\frac{1}{16}$ H.P. to 25 H.P. An ingenious system of listing shunt generators is employed, which enables a purchaser to select a machine to suit his requirements exactly, the output of a given frame being ascertained by multiplying the desired speed by a constant.

The firm has been established about three years, during which time it has turned out upwards of 3,200 motors, and it is now building them at the rate of 2,500 per annum; the very first machines made are interchangeable with those it is supplying to-day in every respect. We understand that the firm has had very few complaints indeed, while the actual number of rejections has been only three. Owing to their using a special material in the manufacture of commutators, the makers have never had a single complaint as regards the mica giving trouble; they have never had a bearing complaint, and have not yet replaced a single bearing, although some of the machines have run as fast as 7,000 R.P.M. They now fit terminal blocks on all their machines, a feature which is not mentioned in the list They regularly have in stock or progress 300 to 400 motors.

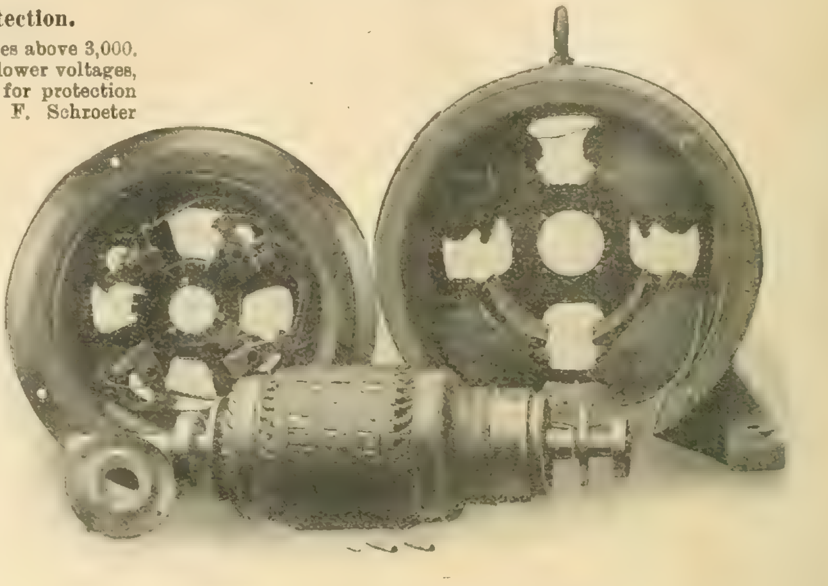


Fig. 4.—Component Parts of Higgs Motor.

The firm has already had to extend its premises twice, making them three times the original size, and further large extensions are anticipated in the near future.

High-Power, High-Pressure Water Rheostat.

In testing modern generating sets, it is frequently desirable to provide a large artificial load, conveniently regulable over a wide range and, particularly when it is desired to test prime mover, generator and transformer as a complete unit, suitable for use in high-pressure circuits. Where pressures of 10,000-20,000 volts or higher are concerned, special care in design is required to secure a reasonably compact rheostat, safe to handle while in use and offering sufficient resistance to provide 1,000-2,000 KW. or greater load. Water rheostats offer the best solution to the problem, long water channels of small section being used to provide resisters of sufficient resistance and current-carrying capacity. Electrodes placed at the points of a triangle in a cooling pond do not form a convenient equipment, and, moreover, the water constitutes almost a short circuit, unless it be exceptionally pure or the electrodes are very far apart and the pond is shallow. The accompanying illustrations, reproduced from the *Electrical World*, show the construction of a water rheostat found suitable for 250 to 2,500 KW. three-phase load at 20,000 volts, using water of exceptionally low specific resistance, viz, 100 to 200 ohms per inch cube. By modifying the proportions of the water channels, adhering to the same general design, wide load variation can be provided at almost any voltage.

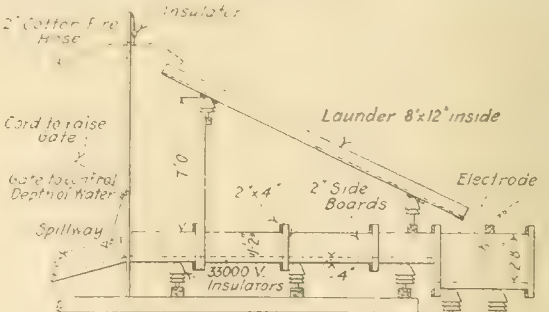


Fig. 5.—Water Rheostat, Side Elevation.

As shown by fig. 6, this rheostat consists electrically of two Y-connected water circuits, with earthed neutrals at N N and high potential phase points at A, B, C. Each leg of the rheostat is supplied with water through 50 ft. of two-inch cotton fire hosing, discharging into a steeply inclined open launder as shown in fig. 5. The pipe header supplying the cotton hoses is fed at each end by a two-inch service pipe, and is provided with a separate valve on each outlet. This header is earthed, and the water resistance between it and each of the points A, B, C is about 8,000 ohms, even using water of only 200 ohms per inch cube specific resistance. The converging rheostat troughs are 21 ft. by 18 in. square, ample depth being provided to prevent water boiling over and thus establishing an earth fault. Since the water boils or nearly boils in service, the troughing must be of fairly heavy timber and firmly strapped together. For the same reason, evaporation and consequently changes in density and specific resistance are apt to be high, hence the water supply valves in the pipe header should be kept open as far as possible and load balancing effected by adjusting these valves, and thus the water density and resistance in each rheostat channel individually. The load as a whole is varied by means of the cord and hinged gate in the discharge weir from the neutral electrode box (see fig. 5). In the rheostat as illustrated, provision is made for load balancing by adjusting the positions of the electrodes A, B, C, but control by regulating the water supply is preferable and perfectly satisfactory. The water hose and flume are insulated; the whole rheostat is carried on 33,000-volt, pin-type insulators, and the only two points needing to be handled during operation (viz., the water valves and discharge gate) are permanently earthed. A cord can be carried from the discharge gate to the meter house test bench, and the water control valves can be located at the same spot. Only a limited supply of water is required; it may be rich in salts and therefore of low specific resistance, and can be used again and again with only the loss due to evaporation. Knowing the resistance of the water, the circuit voltage and the required load, it is easy to calculate the necessary rheostat trough and supply pipe dimensions to meet other conditions than those to which apply the data given in the above illustrations.

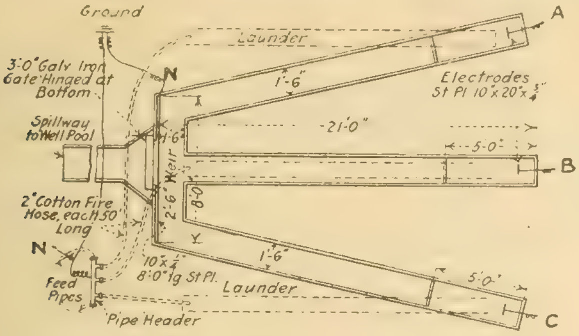


Fig. 6.—Water Rheostat, Plan.

LEGAL.

Noise and Vibration caused by Electric Plant.

In the Chancery Division, on Tuesday, before Mr. Justice Eve, the Worksop and Retford Brewery Co., Ltd., moved for an injunction restraining the Worksop Palace, Ltd., from creating a nuisance by the noise and vibration caused by the electric plant on their premises. Mr. Jessel, K.C., said the plaintiffs were the owners of licensed premises adjoining the defendants' property. He understood the motion was now assented to by the defendants, and he asked that it should be treated as the trial of the action and a perpetual injunction granted. Mr. Dighton Pollock, for the defendants, agreed. His Lordship granted a perpetual injunction against the defendants.

Cunningham, Ltd.

In the Companies' Winding-up Court, on Tuesday, Mr. Justice Astbury heard the petition of W. T. Henley's Telegraph Works, Ltd., for a compulsory order to wind up Cunningham, Ltd., electricians and electrical engineers. Counsel stated that creditors for considerably over £2,000 had agreed to an arrangement in the matter, but creditors for an amount of about £100 were now standing out. It was possible that they might also agree to the arrangement, and he therefore asked that the petition be allowed to stand over for another week.

Counsel for the opposing creditors consented to the adjournment, and his Lordship directed the petition to stand over for a week.

War Maps.—Messrs. W. T. Henley's Telegraph Works Co., Ltd., of Blomfield Street, London Wall, E.C., have issued a pocket war map booklet illustrating the various war areas in Europe. Copies will be sent to electrical readers on application.

WAR ITEMS.

U.S. Electrical Exports in January.—The following data on the electrical exports of the United States for January are published by the American "Electrical Review and Western Electrician" from the government report on the foreign commerce of that month issued by the Bureau of Foreign and Domestic Commerce. The total value of electrical shipments in January was the highest since last May, but was nearly 10 per cent. below the total of the corresponding month a year ago. In the four classes for which numbers of articles exported are given, there were shipped in January: electric fans, 1,278; arc lamps, 35; carbon-filament lamps, 51,825; metal-filament lamps, 189,848. In the following table are given the detailed figures for the various classes reported. Corresponding figures are given for last January and for January, 1914:—

	Jan. 1915.	Jan. 1914.
Batteries	$ 100,946	$ 43,892
Dynamos or generators	309,868	199,046
Fans	17,221	43,236
Insulated wire and cable	83,728	174,321
Interior wiring supplies, etc. (including fixtures)	72,104	46,452
Lamps—		
Arc	759	9,204
Carbon-filament	5,802	13,910
Metal-filament	38,504	21,840
Meters and other measuring instruments	40,556	—
Motors	205,140	346,782
Static transformers	57,122	128,788
Telegraph instruments (including wireless apparatus)	17,326	12,788
Telephones	184,556	70,265
All other	640,306	837,122
Total	$1,773,938	$1,947,646

An Austrian Company and the War.—The report for 1914 of the Felten & Guilleaume A.G., of Vienna, states that the working results were unfavourably influenced by the consequences of the war, although sales considerably declined in the first half of the year owing to the restriction to a minimum of the orders placed both by the government and municipal authorities as well as by industrial undertakings. After the war broke out a complete stoppage, except for orders for army purposes, took place in the cable department, but in the further course of time a demand was again manifested, the Vienna Municipal Council in particular having given large orders. The difficulties in the way of procuring raw materials, and the dearness of these, largely increased the cost of production and diminished the earnings. On the other hand, the iron and steel works in Styria found ample compensation in the great requirements of the Army authorities for the deficiency in the normal class of business. The accounts show gross profits of £106,000, as contrasted with £144,000 in 1913, and net profits of £57,000, as against £92,000. It is proposed to pay a dividend of 10 per cent. on the ordinary share capital of £354,000, as compared with 15 per cent. in the previous year. The directors state that, although no definite opinion can be formed as to the business prospects for the current year, they believe that after the termination of the war exceptionally large requirements will be experienced for the re-establishment of destroyed values and the replacement of stocks which have been entirely exhausted.

Opportunities for Manufacturers in Russia.—A correspondent of the "Electrical World" states that the opportunities for electrical trade are great in Russia, but it is not a simple matter to secure and develop the trade. The most densely populated parts of Russia, starting from the Gulf of Finland, are the cities of Revel, Riga, Windau, Libau, and Mittau. Most of the people are of German and Scandinavian descent, and prefer to talk German rather than Russian. The people living between Mittau and Warsaw are of Lithuanian and Polish descent, and do not like to talk Russian at all, because they hate Russians and the Russian language, so that one must use German if he wishes to transact business with them. Most of the apparatus in service is operated at 110 volts or 220 volts direct current, except the street railways which are 500-volt systems. A small part of the apparatus is of English make. American goods are considered superior, but the people know very little about them. For American manufacturers wishing to open offices for consulting engineering or sales work in Russia the best location is Riga or Petrograd. The office should be put in charge of a Russian-American who is familiar with Russia and her people and with American advertising.

Rifle Shooting.—Like most other districts, Merrie Islington has its Civic Guards, and a site for their rifle practice has been offered, free of charge, by Messrs. A. P. Lundberg & Sons, adjacent to their works, which are practically in the centre of the borough.

Board of Trade Assistance.—The Commercial Intelligence Branch of the Board of Trade has issued its weekly list to April 3rd (No. 15), of inquiries for sources of supply of goods.

Munitions of War.—The following are the terms of a resolution, passed by the undernoted societies on Sunday last, with respect to the production of munitions of war: "We, representing the trade unions in the shipbuilding and engineering trades of the North-East Coast, welcome most heartily the establishment of a committee on which the working men, the employers, and the Government departments are represented. We do not want any more speeches about the failings of the workers, the employers, or the Government; we want to pull together and get on with it. You may tell Lord Kitchener that we shall deliver the goods. The working man of the North-East Coast will do his bit." The societies concerned are:—Associated Blacksmiths, Boilermakers and Iron and Steel Shipbuilders, United Brass Founders and Finishers, Amalgamated Cabinetmakers, General Union of Carpenters and Joiners, Northern Enginemen's Association, Amalgamated Society of Engineers, Electrical Trades Union, Gas Workers' and General Labourers' Union, National Amalgamated Union of Labour, United Machine Workers, National Amalgamated Union of Painters and Decorators, United Patternmakers, United Operative Plumbers, Ship Construction and Shipwrights' Association, Sheet Iron Workers' and Light Platers' Society, United Kingdom Society of Smiths and Strikers, Amalgamated Society of Woodcutting Machinists, Ironfounders' Association, Steel Smelters, and Amalgamated Society of Carpenters and Joiners.

Municipal Workmen for Armament Factories.—The appeal of Lord Kitchener for the Birmingham Corporation to release as many men as possible from its services, in order that they may be employed by the Government in the manufacture of munitions and other war requirements, has received full consideration, as a result of which the Lord Mayor of Birmingham has issued a statement in which he shows that, while speedy compliance is not easy, seeing that a large number of the Corporation's employés are already serving with the Colours, it can, by the exercise of care and the re-organisation of duties, spare 1,062 men, taken from the following departments:—Public works, 233; gas, 200; water, 57; electric supply, 5; lighting, stables and refuse disposal, 165; parks, 48; public health, 20; estates, 9; asylums, 1; tramways, 311; education, 13. Of the large number already serving with the Colours (2,615 out of 15,267, or 17 per cent.). 155 (out of a total of 701, or 22 per cent.) are from the electric supply department, and 895 (out of a total of 3,430, or 26 per cent.) are from the tramways department.

Germans at Shanghai.—The "Times" correspondent at Shanghai states that British shareholders there are making a determined effort to unseat all German directors of British companies. "The feeling is strong that in order to uphold British prestige the Government should definitely declare trading with enemy subjects in China illegal."

Enemy Goods for Australia.—An Australian paper just to hand states that about the middle of February a large quantity of machinery, addressed to the Sydney Municipal Council, was detained by the Customs authorities on the ground that it was enemy goods. The machinery was taken to Sydney in the "Annam" from Copenhagen.

Roll of Honour.—Private Geo. Riley, of the 4th Liverpool Regiment, who has died from wounds received at Neuve Chapelle, was formerly employed by the National Telephone Co., at Stockport. He was 19 years of age.

Intelligence has reached St. Albans of the death at the front of Mr. Frederick Vicary Smith, who was an electrical engineer at the North Metropolitan E.P. Supply Co. at Camp Field, St. Albans. Deceased, who was in his 23rd year, went to France on Christmas Eve with the Herts. Regiment. He was buried in the town cemetery of Bethune.

Personal.—Mr. W. E. Miller, one of the representatives of the electrical cooking and heating department, of Carron Company, has been granted a commission in the 16th Battalion Highland Light Infantry. Since the war commenced, about 60 per cent. of the staff of this department have enlisted.

BUSINESS NOTES.

Catalogues and Lists.—Messrs. Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, E.C.—Pamphlet No. 623 (reprint), describing the firm's new push-button system of control for printing machinery.

Mr. G. Braulik, 8, Lambeth Hill, Queen Victoria Street, London, E.C.—Leaflet describing the "Express" electric lamp fixer for changing metal-filament lamps from 10 to 100 c.p.'s in their sockets by a patent grip, which works in conjunction with a special wooden support.

The British Thomson-Houston Co., Ltd., Rugby.—Descriptive list No. 2 213 on B.T.H. type D.H. continuous-current generators up to 150 kw.

Messrs. Hollings & Guest, Ltd., Thimble Mill Lane, Birmingham.—40-page catalogue containing brief descriptive notes concerning, and illustrations of, their hydraulic presses, pumps, accumulators, valves, &c., for all purposes.

Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—Illustrated leaflet No. 124 gives particulars of paraffin-electric welding plants.

An Australian Exhibition.—A scheme is on foot for holding an Empire Trade Exhibition in Sydney next September.

Bankruptcy Proceedings.—A. Whiteley, electrical and mechanical engineer, Llandudno.—Last day for proofs for dividend April 28th. Trustee, Mr. L. Hugh-Jones, Official Receiver, Crypt Chambers, Chester.

Liquidations.—Premier Lighting and Engineering Co., Ltd.—A meeting will be held on May 14th, at 4, Charterhouse Square, E.C., to hear an account of the winding up from the joint liquidators, Messrs. J. P. W. Goodwin and E. H. Hawkins.

Metalite, Ltd.—A meeting will be held on May 20th at 9/10, Pancras Lane, E.C., to hear an account of the winding up from the liquidator, Mr. G. S. Clarke.

Pure Lubricating Oil Co., Ltd.—A meeting will be held on May 15th, at 125, High Holborn, W.C., to hear an account of the winding up from the liquidators.

Book Notices.—*The Universal Electrical Directory* (J. A. Berly's). 1915. London: H. Alabaster, Gatehouse and Co. Price, complete "B," 21s.; "A" (British and Colonial only), 12s.—The electrical trade has come to regard the Red Book of the electrical industry as one of the most essential parts of its office equipment. Though the work of checking and revision of names and addresses on so large a scale in all parts of the world has been exceptionally difficult owing to the war, the contents have been rendered as complete and accurate as could well be expected. The entries in directories, like everything else British, European and Colonial, must inevitably be affected by present international occurrences, seeing that many electrical men in many countries are still young and of military age, and that colossal death-rolls and changes of occupation will yet ensue before hostilities come to an end. These unfortunate circumstances, however, in no way lessen the need for this publication; indeed, it may be said that the Colonial and foreign trade aspects of the position render it more necessary than ever, for British electrical manufacturers and traders are particularly anxious to secure information respecting undertakings in other countries which, under the anti-German and anti-Austrian sentiment of the times, want to secure British machinery and apparatus. The book itself is so well known, now that it has reached its 34th year of publication, that it is needless to detail its contents. It is a directory pure and simple, of electrical and allied men, companies, and systems, and is divided up into suitable sections covering respectively British, Colonial and foreign countries, Continental countries, and the United States. The alphabetical sections in each case are followed by classified trade sections, and, as usual, there is the well-tried British geographical section which travellers and others so highly value. The information regarding systems of supply at home and abroad is another department in which the Red Book has thoroughly established its reputation for usefulness. For the convenience of those who require only the British and Colonial sections these are published separately as Vol. "A."

British Standard Specification for Portland Cement. A new edition of the British Standard Specification for Portland Cement (No. 12), one of the most widely adopted of the Reports issued by the Engineering Standards Committee, has just appeared. Increased fineness of grinding of cement has been legislated for, and the minimum tensile strength at seven days of both neat cement and cement and sand has been raised. The clauses dealing with the preparation of the briquettes have been amplified, the procedure being described in greater detail than has previously been done. In the case of both neat cement briquettes and cement and sand briquettes, ramming or hammering is expressly prohibited. The growth of tensile strength at 28 days, both for neat cement and for cement and sand, is now given in the form of a formula in place of the fixed percentages which have been specified hitherto. All the plates have been entirely re-drawn, and two new plates have been added to the specification, which can be obtained from the Committee at 28, Victoria Street, S.W., price 5s. net.

The *Telephone Review* of the New York Telephone Co. has brought out a "Triumph of Science Edition" to commemorate the completion of the Trans-Continental telephone line on January 25th; the issue is worthy of the great occasion, and contains a number of interesting illustrations and articles bearing upon the work which first enabled the human voice to be conveyed over a distance of 4,500 miles. We extend our congratulations to the company both on the achievement itself and on the memorial which it has published.

"*Journal* of the Institution of Mechanical Engineers." No. 4, April, 1915. London: The Institution.

"*Journal* of the Röntgen Society." No. 43, Vol. XI. April, 1915. London: Smith & Ebbs. Price 4s. net.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXX, Part 7. March, 1915. Newcastle-on-Tyne: The Institution. Price 5s.

"Electrical Engineering." Vol. I. By T. C. Baillie. London: Cambridge University Press. Price 5s. net.

"Circular of the Bureau of Standards." No. XXXVII. Electric Wire and Cable Terminology. Washington: Government Printing Office.

"*Bulletin* de la Société Internationale des Electriciens." Vol. V, 3rd series. No. XL. March, 1915. Paris: Gauthier-Villars. Price 3 fr.

"The Post Office Electrical Engineers' Journal." Vol. VIII, Part I. April, 1915. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

Our Trade with Australia.—In the course of an interview printed in a Sydney newspaper, Mr. G. T. Milne, British Trade Commissioner in Australia, after condemning rash generalisations respecting the conservatism of the British manufacturer, and showing that United Kingdom trade was in a stronger position than ever before, stated :—"The whole problem of how to get trade is changed from the days when orders to a very large extent filtered through the hands of the London merchant, and it was not necessary for the manufacturer to personally engage in the hunt for markets. Nowadays, the latter method must be practised, or the manufacturer will be left at the post. This is the point up to which the English makers must be brought—the systematic and persistent seeking of markets, and I hope to see English firms establish responsible representatives in Australia, so that the most satisfactory amount of trade may be done between this Dominion and the Old Country. Small firms could combine to be jointly represented here. It is in this matter of being thoroughly represented on the spot that the English manufacturer can hurry up with advantage, and, where it is found that the tariff makes it advisable, branch factories could be established in order to cope with the trade that has been secured by nursing the local market and studying its requirements."

Trade Announcements.—Messrs. Chiswell & Co. announce that their offices are at Imperial House, Kingsway, London, W.C., and all communications should be addressed there.

The Harper Electric Piano (1910) Co., Ltd., has changed its title to the Harper Piano Co., Ltd., as, while it will still continue the electrical side of its business, it will do a bigger business than formerly in ordinary pianos.

LIGHTING and POWER NOTES.

Australia.—The Sydney (N.S.W.) city electrical engineer has submitted a report of the probable expenditure by the electric lighting department for three years ending December, 1917, beyond what has already been approved by the Sydney Municipal Council ; this includes for the power house £200,000 ; new sub-station and showroom, £90,000 ; mains and alternating-current sub-stations, £300,000 ; new buildings for stores and testrooms, £25,000 ; making a total of £615,000.—*Tenders.*

Bacup.—Market Rates.—The T.C. has adopted a flat rate of 1½d. per light for electricity supplied to occupiers of shops and stalls in the market on market days, and a further charge of ½d. per light per hour on other nights.

Belfast.—Large Diesel-Electric Plant.—What is stated to be the largest Diesel engine so far constructed has recently been installed at the shipbuilding yard of Messrs. Harland and Wolff. The engine, which was built by Messrs. Sulzer, is employed for the generation of electrical energy for lighting and power purposes in the shops ; it is of the single-acting two-cycle type, and comprises six cylinders, 29·5 in. bore × 39·4-in. stroke, and has been designed to develop 3,750 H.P. at a speed of 142 R.P.M.

Burton-on-Trent.—Rate Relief.—The T.C. is now recommended to appropriate £5,000, instead of £4,000, from the gas and electricity departments in aid of the rates for the ensuing year.

Canada.—The Ontario Hydro-Electric Commission is now supplying current in bulk to three townships, 102 municipalities, and over 800 rural industrial enterprises. It was anticipated that by March over 100,000 H.P. would be distributed. The Chairman of the Commission recently stated that, apart from the benefit of cheap power to industries, the Province of Ontario would soon have 1,000 miles of publicly-owned electric railroads, and those would pay from the day they started operations. Already, in some districts, electric power was being applied to farm work. Farmers were cutting their ensilage and filling their silos by electricity, and were commencing to use electrically-driven threshing machines. The farmhouses, barns and stables were also lit by electricity, and power was used for domestic purposes, such as washing and ironing.

The Ontario Hydro-Electric Commission proposes to place all municipal electric plants under the management of local commissions ; a Bill to this end is now before the Ontario House. In Ottawa and Toronto, which cities both have municipal electric plants, the Commission will be composed of the Mayor *ex-officio*, one member appointed by the City Council, and one member by the Hydro-Electric Commission—a Board of three. At present the municipal plant is managed by the four members of the Board of Control and the Mayor.

Carnarvon.—Proposed Loan.—The T.C. has applied for a loan of £500 for contemplated main extensions. The National Electric Construction Co. has written, suggesting that if, as was anticipated, the L.G.B. refused to sanction loans for further extensions, the Council should agree to the works being transferred to it or to a subsidiary company, on terms to be arranged. It was decided on April 6th to reply that the suggested transfer was *ultra vires.*

Continental Notes.—Norway.—The Odda Electrical Co. was started in 1913, with a capital of £500, to develop a small water-power, and up to the present its working shows a total surplus of no less than £800, or 145 per cent. of the capital. Electrical energy has been supplied for technical uses at such low prices as £3 per H.P.-year. Among the consumers are several farmers, who are using the energy for agricultural purposes, and as soon as the proposed extension of the station is completed, this example will be followed by pretty well all the farmers in the neighbourhood.

The Municipality of Ovre Eker, near Drammen, has under erection a new electrical works, which will derive their power from a waterfall at Hangsund. The station will be completed in the course of the summer, and the energy is partly to be used for industrial purposes.

It is reported from Notodden that the building operations at Rjukan II have been making good progress, and it is expected that the electrical station and the nitrate factories will be completed sometime in the course of the autumn.

The nitrate works at Notodden are to be extended, and four large acid towers provided in addition to those already in use.

The large works for the manufacture of ammonia have been completed, and are now in full use. This product was previously imported, but now the company not only meets its own requirements, but also disposes of a good deal for export.

The new electrical works at Skien have been taken over by the municipal authorities ; energy is derived from a waterfall, which is located in a distance of 5½ miles from the town. The cost of the new works amounted to £34,000, and there are now subscribers to a total amount of 1,200 H.P., of which 600 H.P. are to be employed for lighting purposes. The revenue from this is estimated at £7,000, and the total expenses at £6,300.

Spain.—A concession has been granted for the establishment of a plant to utilise the water-power of the River Molins, near Tobera (Province of Burgos), in the generation of electrical energy for lighting and power purposes in the district.

A further concession authorises the use of the waters of the Rio Mundo, in the Province of Albacete, for the production of electric power.—*B. of T. Journal.*

Holland.—A Special Commission, which was appointed some three years ago in order to investigate the question of the national supply and use of electric current, has recently completed its report. The consumption of electric current for lighting is expected within the next few years to amount for the whole country to 84,787,000 KW.-hours per annum.

The result of the investigation shows that the larger industry should not pay more than 0·4d. to 0·6d. per KW.-hour (and at this price some of the large stations are already able to supply current), whilst the smaller industries probably would use electric energy even at a price of 1·6d. to 2d. per KW.-hour. The annual consumption to be expected is calculated at 170,858,000 KW.-hours for the larger industries, and 12,151,000 KW.-hours for the smaller industries.

The amount of electrical energy likely to be wanted for agricultural purposes is estimated at 3,690,000 KW.-hours, but a considerably larger amount is calculated for the many pumping stations, locks, &c., peculiar to Holland. These installations require a considerable amount of power, which is at present supplied by windmills, steam engines, motors and several electric stations. The former represent an aggregate capacity of 6,700 KW. ; the steam engines, &c., of 18,740 KW. ; and the likely annual requirement of electric energy is calculated at 13,500,000 KW.-hours. This figure would be more than trebled should electric power also be used for the contemplated laying dry of the Zuyder-Zee, inasmuch as this is expected to demand an annual aggregate of energy of about 34,000,000 KW.-hours. At present there is electric traction on the Hague-Rotterdam Railway and on eight tramways, but there is a question of electrifying, perhaps, half-a-dozen other lines where steam traction is used at present.

Crewe.—The Electric Lighting Committee has deferred consideration of an application from the Crewe Tradesmen's Association for electricity meter rents to be dispensed with until after the war.

Dartford.—Owing to the increased cost of coal and to the fact that the new plant is not yet in working order, the Electricity Committee anticipates a deficiency of £1,072 in the working of the undertaking during the six months ending September 30th next.

Dewsbury.—Public Lighting.—The Electricity and Tramways Committee has approved of the electrical engineer's estimate, amounting to £3,460, for lighting the streets in Ravensthorpe by electricity.

Dover.—L.G.B. Inquiry.—An inquiry was held on April 14th into the Corporation's application for a loan of £6,000 for new plant at the electricity works. The electrical engineer states that if the loan is refused other steps can be taken at the works.

Dunfermline.—The contractors for the new reservoir at Glenderon, Messrs. P. & W. Anderson, Ltd., propose to lay down a complete electrical installation for the driving of all the plant required in the constructional work.

Eton.—On account of reduced lighting, the electricity company has allowed a reduction of £5 0s. from the lighting account of the U.D.C.

East Grinstead.—B. of T. Inquiry.—On April 7th an inquiry was held regarding the application of the U.D.C. for a prov. order for electric supply. It was stated that there was a demand for electricity, and that at the present time there were 29 private electric light plants in the town. A private company was registered 19 or 20 years ago for the purpose of providing electricity, and the gas and water company in 1892 obtained power to apply for an order, but nothing had been done in the matter. It was proposed to run the works in connection with the refuse destructor, and the estimated cost was about £10,000. A hurried canvass taken at the request of the B. of T. showed 103 applications in the compulsory area and 74 outside, with only seven refusals. The estimates showed a loss of £182 on the first year's working and £68 on the second, and a profit of £102 on the third. Only seven persons objected to the scheme, and they resided within 300 yards' radius of the proposed site, which had been approved by the L.G.B. for the destructor.

Hale.—Proposed E.L.—The Aldershot U.D.C. has empowered the chairman of the Lighting Committee, the electrical engineer and the clerk to discuss with the Farnham U.D.C. the question of electric light at Hale. The parish is within the area of supply for electricity of the Farnham Gas Co.; and writing to the Aldershot Council on the matter, the chairman of the Farnham U.D.C. says that it appears to his Lighting Committee that it should not be within the gas company's power to sterilise that part of the urban district in regard to the provision of electric supply, and that it may not be impossible to secure the desired supply by other means.

Hendon.—The specifications of work in connection with the installation of electric light, &c., prepared by Mr. H. S. Brackenley, have been adopted by the Guardians.

Holme (Yorks.).—Village Lighting.—An electricity scheme has been promoted locally. It was decided to work it with 800 £1 shares, and the villagers quickly applied for 1,110 shares, and there had to be a process of selection. The company has acquired an old mill with water power, by which it is proposed to generate the current. During the Easter holidays the young men of the village gave their services in making certain desired alterations to the premises. A dynamo is to be purchased. The contract for the wiring has already been let to Messrs. Graham & Co., of Huddersfield. Public and private lighting will be undertaken. For house lighting it is proposed to charge a minimum of 30s. per year for three lights, with an extra charge of 4s. per year for additional lamps.

India.—The electrification of the Bombay Mint will be taken in hand shortly, and Captain Willis, R.E., is returning to Bombay for the purpose.—*Indian Engineering.*

Irish E.L. Schemes.—A Tipperary journal mentions that electric lighting is steadily coming into more general use in the towns of that extensive county. Fethard was the first to try the system; Roscrea is now lighted by an electric plant established at the local bacon factory; Clogheen has replaced oil lamps by electricity for public lighting, and Cahir has taken steps to form a company to supply electricity; Enniscorthy, in County Wrexford, has taken steps, through its Urban Council, to obtain a prov. order to carry out a scheme.

Leigh.—Proposed Loan.—Application for sanction to the borrowing of £2,813 for extension of plant at the electricity works is to be sought by the T.C.

Lincoln.—Rate Relief.—The Electricity and Tramways Committee has decided to recommend that out of the current year's profits the sum of £1,500 be applied in the relief of rates for the year ending March 31st, 1916, and that, if necessary, a further sum of £500 be available.

London.—St. Marylebone.—A statement as to the December quarter's working shows that the gross profit was £39,797, as against £45,143 in 1913, the decrease being due to reduction in income amounting to £6,378, while expenditure fell by £1,032. Some 4,614,801 units were sold, as against 5,391,954 in the same period of 1913. Taking the nine months to December, the gross profit was some £3,740 less than for the same period of 1913. As regards the estimates for the year 1915-16, special charges due to the war figure at £12,000, while capital charges are about £800 higher, and taking all into account a net credit balance of £2,626 is expected.

Loughrea, Co. Galway.—Mr. John Murphy, who has been for some years in charge of the electric lighting plant at Clonmel Asylum, has been appointed manager of the new electric lighting works at Loughrea.

Middleton.—Mill Supply.—The T.C. has made arrangements with the Manchester Corporation for a supply of electricity for Neva Mills, and the laying of the cable will cost Middleton about £3,000. The cable will be big enough to bring electricity to the mill and to supply the borough generally if necessary, and the town will thus have a sort of stand-by. The arrangement with the mill is for 20 years, but may be terminated at the option of the mill company at 7, 10 or 15 years.

Newport (Mon.).—Price Increase.—Owing to the increased cost of coal, materials, and labour, the Electricity Committee of the T.C. has decided to raise the price of current after June by 20 per cent.

Oulton Broad.—Restricted Lighting.—The Electricity Co., having been applied to for an abatement off the public lighting account for the quarter just closed, owing to restricted lighting, has offered 10 per cent. The U.D.C. has replied that it is of opinion that it is entitled to a much larger abatement, if not total exemption.

Portstewart.—E.L. Scheme.—A system of electric lighting was introduced last week and has proved a success. The current is produced at Millbank, where a power station has been fitted up.

Queensbury.—The U.D.C., after considering amendments to the Bill of the Yorkshire E.P. Co., has decided to support the Bill.

Runcorn.—The Mersey Power Co., Ltd., announces that in spite of the present abnormal price of coal, its charges for current are not being increased.

Shanklin.—Restricted Lighting.—The Isle of Wight E.L. Co., having offered a deduction of £37 10s. from the lighting account for the March quarter on account of restricted lighting, the U.D.C. has asked for a further reduction, as only 47 of the 222 lamps are in use.

Shelf.—The U.D.C. has decided to support the Yorkshire Electric Power Co.'s application for lighting powers.

St. Annes-on-Sea.—The electrical engineer reports that lately there has been a gratifying increase in the output of current, the demand for heating purposes being especially notable. The consumers number 1,622.

Stafford.—After having received reports from the gas and electrical engineers and considered the matter, a special Committee recommended to the T.C. on Tuesday that—(*a*) The control of the gas and electricity works continue under one Committee as at present; (*b*) that no change be made in the management of the gasworks; (*c*) that Mr. W. H. Robins be appointed engineer and manager of the electricity works, presenting his reports direct to the Committee; (*d*) that Mr. W. M. Valon be appointed secretary for the electricity works, and countersign all orders exceeding £10 in value.

A proposal was made for placing the two concerns under separate control but was defeated, and the Committee's recommendations carried.

Swansea.—The electrical engineer has forwarded to the L.G.B. a list of employés who could be spared from his department for work on the manufacture of munitions of war.

Sheffield.—The Establishment Committee has approved of the Electric Supply Committee appointing an assistant mains engineer. The Electric Supply Committee has received an application from the military authorities for a supply of current to the South Yorkshire Asylum, Wadsley, outside the area of supply; it is proposed to make application to the B. of T. for sanction to the supply being given.

Torquay.—Proposed Loan.—The L.G.B. has refused to sanction a loan of £1,800 for the purchase of property required for offices and stores in connection with the alterations at the generating station. The Electric Lighting Committee has asked the town clerk to make such financial and other arrangements as may be required to meet the case, and to communicate with the Board expressing the hope that the application would be considered at a future date.

Tunbridge Wells.—Arising out of the recent L.G.B. inquiry into the application of the T.C. to borrow £8,137 for electric lighting purposes, the Lighting Committee has resolved to instruct the engineer to report on the provision of steel headers to two boilers in place of the existing cast-iron headers, and on the running non-condensing of the plant, &c., during the proposed rebuilding of the existing cooling tower; also to instruct the clerk to complete the contract with Witting & Partners for dismantling the existing cooling tower and building the new tower. The Committee has adjourned consideration of the report on the extension of mains until after the extension order has been granted by the B. of T. Application is to be made to the Board for consent to the supply of energy to Rusthall and Southborough, outside the area of supply.

Turton (Lancs.).—A number of applications have been received for electricity at Edgworth, but the D.C. has deferred consideration of them until after the war in consequence of the dearness of materials and labour.

Walsall.—Loan Sanction.—The L.G.B. have sanctioned the borrowing of £16,700 for the purposes of the electricity undertaking, viz., £13,000 for mains, £500 for services, and £2,900 for transformers. In view of the representations made by the Board in favour of reducing capital expenditure, the Committee has decided that any further extensions which are not required by manufacturers for war purposes will, for the present, be only carried out on the applicant providing the cost of the service. The electrical engineer has been given instructions to negotiate for a site in the Bescot district for a sub-station.

Warrington.—The Electricity and Tramways Committee has decided that the rent charged to tradesmen for the hire of outside arc lamps be reduced by one-half owing to the reduced lighting regulations.

Wigan.—PROPOSED LOAN.—Application is to be made to the L.G.B. for sanction to borrow £6,000, the estimated cost of two boilers for the electricity works.

Willesden.—In the course of his speech as to the year's working, Mr. G. H. Hiscocks, referring to the electricity department, said that the 12 months started well in advance of all previous years, and up to the outbreak of war the purchase of energy from the Power Co. showed an increase of 20 per cent. This state of affairs, however, could not continue in view of the large reduction in public lighting since that date, but much new business had been secured, and the probable result of the year's working will be that the purchase from the Power Co. will be about 5 per cent. higher than in the preceding 12 months, while a number of important developments are being put in hand by various firms which, it is hoped, will substantially and permanently increase the revenue of the department.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation Tramways Committee has instructed the manager to report as to the cost of altering the stairs on the cars recently operated on the P.A.Y.E. system, to the ordinary arrangement.

Bolton.—RESTRICTED SERVICES.—In consequence of enlistments—25 men from the department enlisted during the week-end—the Tramways Committee has this week curtailed the car services on five routes, and further curtailments on other routes will be made as and when necessary.

Canada.—The equipment of the Montreal Tramways Co. at Hochelaga power station has been extended by a 2,000-KW., 1,800 R.P.M. turbo-alternator set, to be used for peak loads and as stand-by, and capable of withstanding 25 per cent. overload for 24 hours, and 50 per cent. overload for two hours. The turbine is by Belliss & Morcom, and its moderate speed is claimed as a special feature. The guaranteed steam consumption is 9·8 lb. per H.P.-hour, using steam at 200 lb., 570° F., and with 28 in. vacuum. The blading is of the impulse type, the disk stage comprising two rows of Curtis steel blades compounded for velocity and the drum stage, phosphor-bronze blading compounded for pressure. A Michell main thrust bearing is used with a ball thrust coming into action only if the main thrust fails. Main and emergency governors act through an oil relay system, and a multi-jet ejector condenser is used. The alternator is a standard Swedish G.E.C. machine with 35-KW., 575-KW. engine-driven exciter.

Edinburgh.—The Tramway Committee is experiencing difficulty in getting a self-propelled car for the purpose of experimenting, and at last week's meeting it was suggested that as an alternative, one of the present cars be converted.

A report by the Tramway Committee as to the cost to the city had Colinton tramways been purchased (as suggested by the Commissioners at the recent provisional order inquiry) shows that for the price which the Corporation was asked to pay (£9,000), it would receive nothing of any value to it. The Corporation would have been liable for a sum of probably £12,290. The Tramway Committee has unanimously approved of the action of the Sub-Committee in declining to accept the conditions laid down by the Commissioners.

Manchester.—The Tramways Committee has decided to recommend that steps be taken with a view to an application being made in Parliament in the Session of 1916 for an extension of time for the construction of the Northenden Road (Sale) tramways.

At the meeting of the Tramways Committee, on Tuesday, a statement was issued showing that the number of eligible men in the service of the tramways at August 1st, 1914, was 2,895, but since then no less than 56·31 per cent. have joined the Colours. This number includes 876 married and 753 single men, total 1,629. Two hundred trolley boys have joined the Army. The total liability of the Committee for dependents is £1,113 per week, and since the outbreak of the war £26,924 has been paid.

Oldham.—A report by the general manager that there was not a satisfactory weather-screen device for tramway drivers on the market, was criticised at a meeting of the T.C. on April 7th; it was stated that 70 per cent. of corporations and companies used screens of one sort or another, and that further inquires were being made.

Rochdale.—YEAR'S WORKING.—The gross tramway receipts for the year ended March 31st (excluding Heywood's proportion) amounted to £78,771, or £226 more than in the preceding year. The undertaking is said to be the only one in Lancashire, save Preston, which reports increased takings last year.

South Shields.—YEAR'S WORKING.—The tramway receipts for the year ended March 31st last totalled £39,627, compared with £38,260 in the previous year, an increase of £1,376. The miles run were 927,727, an increase of 29,712, and the passengers carried numbered 10,479,421, as compared with 10,005,164, an increase of 474,257.

U.S.A.—ELECTRIC CABS.—Some trials are being made in New York with an electric taxicab in connection with a proposal to start a service of such vehicles at the principal railway termini. The vehicle is covering a distance of 70 miles per day on a single charge of the battery, plus an hour's boost at mid-day.

Walsall.—The tramway manager has been instructed to proceed with the relaying of a portion of the Walsall Wood tramway extension as soon as the work in connection with the new road from Ablewell Street to Birmingham Road has been completed.

YEAR'S WORKING.—The net profit of the Corporation tramways for the past year amounted to £2,479, of which it is proposed to devote £2,000 to the relief of the rates. It was pointed out that the passenger receipts amounted to £34,310, and they had carried free 81,000 soldiers and 2,000 refugees. In connection with an application by the employés for increased wages, a proposed Corporation bonus of 2s. to 2s. 6d. per week is not regarded as satisfactory, and something in the nature of a deadlock has arisen.

TELEGRAPH and TELEPHONE NOTES.

Post Office Tube Flooded.—A sudden inundation of the Post Office tube, which imperilled the lives of a gang of men working on its construction, occurred about midnight on April 8th. The tube, after leaving the Post Office at Mount Pleasant, runs westwards under the centre of Calthorpe Street at a depth of between 40 ft. and 60 ft. Ten men were working in the head shield, cutting their way through the earth, when the water began to ooze through upon them. At first they tried to keep it out with boarding, but the percolating water gradually gained in volume, and at length the men had to run for their lives. The last man had scarcely got to a place of safety when there was a tremendous rush of water. In a very short time the tube was full. Many days must elapse before work on the tube can be resumed. Shortly after the inundation there was a sudden subsidence of the roadway in Calthorpe Street, leaving a cavity 20 ft. deep.—*The Times.*

Secret Wireless on Board Ship.—Recently the Dutch wireless stations intercepted a message from Zeebrugge in code, which was found to refer to the movements of shipping, and suspicion was aroused that it was addressed to a large German ship called the *Main*, which was lying in the harbour at Flushing. On examination it was found that a secret wireless installation in full working order existed on the vessel, the aerial wires being coiled round the mast and rigging. The incident was regarded as a grave breach of Dutch neutrality, and orders were given to prevent the further use of the installation.

The Telephone Service.—Hitherto it has been the practice to employ only male operators for night duty in the London telephone service, but it has now been decided to call up women operators for this purpose, owing to the large number of men who have enlisted for war service. They will be called upon, for four nights a week, to take up their duties at 8 p.m. and finish at 8 a.m., in conformity with the official schedule of 48 hours a week. Three hours out of the 12 are to be given for rest.

The necessity for the innovation is apparent when it is considered that out of the male staff of 1,500 as many as 440 have gone on active service. All these are paid their full salaries, less Army allowances, and guaranteed their positions when they return.

Ten of the staff have been killed in the war, and in accordance with the arrangements made their dependents have received a year's salary.—*Daily News.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—April 20th. U.D.C. One 400-KW. D.C. turbine set, complete with surface condenser and circulating pumps, &c. One water-tube boiler with chain-grate stoker. See "Official Notices" March 26th.

May 4th. Steam and other pipework. Water-softening plant. See "Official Notices" March 26th.

Australia.—MELBOURNE.—April 19th. [illegible] yards of lead-covered cable, and 13 tons of bare hard-drawn copper cable, for the City Council. See "Official Notices" March 26th.

April 21st. 1,027,900 arc lamp carbons, for the Melbourne City Council. See "Official Notices" April 9th.

June 2nd. Electric lighting material for cars (Contract 28,187). Tender box, Railway Offices, Melbourne. Particulars at Contractors' Room, Spencer Street. Deposit [illegible] per cent. of amount of tender.

June 2nd. Bogie trucks, wheels and axles for 10 cars of the St. Kilda-Brighton electric street railway (No. 28,621) for the Victorian Railway Commissioners.*

June 15th. Four mechanically-fired boilers,* for the City Council. Specifications (£1 1s.) from the City Electrical Engineer.

June 15th. City Council. One turbine-driven boiler-feed pump, two fuel economisers, circulating water pumps. City Electrical Engineer. Specifications for each item, 5s.

QUEENSLAND.—June 1st (instead of March 16th). P.M.G. Switchboard for Warwick. See "Official Notices" March 26th.

SYDNEY.—May 31st. Three electric battery locomotives for Public Abattoirs, Homebush, for the Department of Public Works. Specifications, &c., 5s., from the Accountant, Public Works Department.

The City Council will shortly invite tenders for 2,000 insulators, disconnecting switches and fuses, incandescent lamps, and nitro-incandescent lamps.

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Basingstoke.—April 19th. Corporation. Diesel engine generating set, motor-generator, balancer, underground cables. See "Official Notices" April 9th.

Bradford.—April 17th. (A) 100 tramcar trucks, (B) 200 motors, 200 controllers, 200 automatic circuit breakers, for the Tramway Department. Specifications (A and B) one guinea each, from Tramway Offices, 7, Hall Ings.

Darlington.—April 20th. Corporation. 25-ton overhead traveller and economiser. See "Official Notices" April 9th.

Dundee. — April 28th. Corporation. Centrifugal circulating pumps, and 750 ft. of 42-in. and 30-in. cast-iron pipes. See "Official Notices" April 9th.

France.—Electric traversers, D.C. electric railway motors, multiple unit control equipments, cables and wiring for traction, heating and lighting, for the Administration des Chemins de fer de l'Etat à Paris. Particulars can be obtained in the Bureaux du Service Electrique (3rd div.), 72, Rue de Rome, Paris, between 3 and 5 p.m. on Tuesdays and Fridays, up to April 30th.

Glasgow.—April 16th. Corporation. Cables, meters, carbons. See "Official Notices" April 9th.

Hull.—The Corporation Property Committee has decided that three electric lifts be obtained, for the City Treasurer's Department, the City Accountant's Department, and the Rates Department.

Italy.—NAPLES.—April 30th. Tenders are invited for the supply and erection of a transmission line, with metallic posts, from the hydroelectric generating station at Volturno (Campobasso) to the receiving station at Naples. The estimated cost of the work is 1,131,955 lire, and a guarantee of 30,000 lire is required of the successful tenderer. Profile drawings, models of posts, &c., with other particulars, may be obtained from the Consiglio-Generale dell'Azienda per l'Ente, Volturno, and tenders must be submitted by April 30th.

Lincoln.—Tramway uniforms, for the T.C. The Electricity Works, Brayford Side North.

Manchester.—April 20th. Steel girder tramway rails and fish-plates. Mr. J. M. McElroy, General Manager (£1 1s., returnable).

April 14th. Corporation. Three 1,250 K.V.A. static transformers. See "Official Notices" April 2nd.

Mountain Ash. — April 26th. U.D.C. Sub-station building, E.H.T. underground cables, L.T. overhead lines and public lighting, E.H.T. switchgear. L.T. switchgear and transformers, for Abercynon. See "Official Notices" to-day.

Rhondda.—April 17th. U.D.C. Installation, 83 wiring points, 88 lighting points, at the Council Offices, Pentre. See "Official Notices" April 2nd.

Spain. — The municipal authorities of Valverde de Leganes (Province of Badajoz) have just invited tenders for the concession for the electric lighting of the town during a period of five years.

Wallingford.—April 19th. Telephone installation, infirmary to workhouse, with electric bell, for the B. of G. Mr. G. F. Slade, Wallingford.

CLOSED.

Basingstoke.—The B.C. has accepted the tender of the Electrical Apparatus Co., Ltd., for the supply of three and five-amp. meters for a period of 12 months.

Australia.—The following tenders have been accepted :—

Sydney City Council.—
- Vehicle-charging apparatus.—Australian General Electric Co., £1,711.
- Centrifugal pumps (motor-driven) for power house.—Falkiner, Ltd., £165.
- Travelling cranes for sub-stations Nos. 71 and 72.—Luke Muras, £284.
- C.I. valves and mild steel chutes —William Elder & Co., £110 15s.
- Copper-clad steel cable.—Western Cable Co., £374.

Water Board.—
- No. 1 pumping station, Ultimo.—Centrifugal pumps and electric motors for Third Avenue low-level pumping station. - Zollner, Ltd. (*a*), £1,060 (recommended); (*b*), £957; (*c*), £941; (*d*), £778; (*e*), £939.
- Centrifugal pumps and electric motors for Elliott Street low-level pumping station, Balmain.—Zollner, Ltd., (*a*), £1,014 (recommended); (*b*), £951; (*c*) £941; (*d*), £773 (*e*) £934.

Commonwealth —Postmaster-General's Department.—
- Telegraph Office, Deniliquin. 330 accumulators; Pritchetts & Gold cells, schedule 377a, item 1.—£203, Wm. Adams & Co. (accepted), 175, Clarence Street.
- Erection of telephone line between Boree Creek and Greenvale.—£332, M'Donald Bros.
- Erection of telephone line between Myrtle Creek and Rappville.—£107, H. Lancaster.
- Erection of telephone trunk line between Cootamundra and Junee.—£3,467, M'Donald Bros.

Queensland.—
- 7,500 fuses in fibre tube, schedule 293, item 6.—£281, Western Electric Co.
- 2,000 telephones.—James Paton & Co.

The Richmond Council received the following tenders for a refuse destructor and auxiliary plant :—

Horsfall & Co.		£9,360
Stirling Destructor		9,230
Heenan & Froude	(accepted)	10,217
Meldrum		10,360

The consideration of the tenders turned largely on the question whether a British or Australian engine should be required, and eventually it was resolved that the successful tenderer indicated above be asked to install a Kelly & Lewis engine and feed pumps of Australian manufacture instead of the English-made engine specified by them. As notice of motion for rescinding the resolution was subsequently given, the matter was at the date of our information (February 17th) likely to be re-opened.

Belfast.—Messrs. Venner Time Switches, Ltd., have again secured the contract for time switches for the ensuing 12 months. Messrs. Chamberlain & Hookham, Ltd., have received a contract for meters.

Bolton.—The Corporation has placed a contract for the 12 months' supply of motor starting switches with the Electrical Apparatus Co., Ltd.

The managers of St. Matthew's School have accepted the tender of Mr. J. Morris for installing electric lighting.

Bradford.—The following tenders have been accepted by the Committees interested :—

- John Brown & Co., Ltd.—200 steel tires, £437.
- H. Summersgill.—Iron castings.
- Collinson Bros.—Wiring the East Ward Branch Library, £126.
- Smith & Croft.—Cable extensions, at Technical College, £80.

Canterbury.—The T.C. has accepted the tender of Mr. S. Terry, of Canterbury, for an electric motor and fittings for the sludge-mixing apparatus at the irrigation works, at £58.

Clacton-on-Sea.—The U.D.C. has accepted the tender of Messrs. Fitch for an outlet for the Diesel engine cooler, at £13 4s.

Croydon.—Messrs. Siemens Bros. Dynamo Works, Ltd., have secured the contract for the annual supply of Wotan, Tantalum, and carbon-filament lamps to the Corporation tramways.

Dartford.—The U.D.C. has accepted the tender of Messrs. J. Waddell & Sons for 350 tons of Kirkby rough slack for the electricity works, at £1 1s. per ton, and 150 tons of South Leicester nuts, at £1 2s. per ton.

Dewsbury.—The Electricity and Tramways Committee has accepted the tender of the Mackintosh Cable Co., at £164, for a mile of cable.

Glasgow. — The Tramways Committee recommends acceptance of the following offers :—

- Switchboard, Govan Depôt.—Ferguson, Pailin & Co.
- Roller shutters, Langside Shelter.—A. L. Gibson & Co.
- Adhesive tape.—L. Andrew & Co.
- Trolley wire.—J. Halley Craig.

Hove.—The electrical engineer has reported upon the tenders received for the supply of a turbo-generator and a set of battery accumulators. He finds that the best suited for the Council's requirements are a turbine connected with two generators in tandem. For this type of machine five tenders were received. When instructions were given to obtain tenders, it was contemplated that delivery could be obtained so that the new plant could be working in time for the next winter's load, but the engineer's opinion is that, owing to the war, the plant could not possibly be got to work before the middle of next December. The engineer points out that the prices are higher by 20 per cent. than they were three months ago, but that, in his opinion, the advantage to be gained in economy in working, and the savings to be effected in coal costs, outweigh the disadvantages of the increased first cost of the plant, and that had it not been for the Government's request to defer expenditure at the present time, he would have unhesitatingly advised the acceptance of a tender.

The Lighting Committee, reporting upon the engineer's remarks, states that it has resolved to postpone the installation of the additional turbo-generator plant, and to inform the tenderers accordingly. Nine tenders were received for the battery of accumulators, and the engineer recommends the acceptance of the Tudor Accumulator Co.'s tender, at £701, in respect of which the company also offers to maintain the same for a period of 10 years at a charge of £47 per annum. In conjunction with this battery, the Committee reports that it will also be necessary to have the two sets of battery boosters referred to in the engineer's report of December last. The engineer suggests that separate prices for the dynamos and motors and switchgear should be obtained, which would bring the cost of each unit below £100, and would enable the battery to be ready for work in 12 weeks after the date of the order being given. The engineer strongly advises that the new battery should be got to work as soon as possible, as it would enable the Council to give a better distribution of electrical pressure and also effect a good economy in working. The Committee has therefore come to the conclusion that, notwithstanding the recommendations of the Government to curtail expenditure, the installation of the battery is of sufficient importance to warrant the expenditure, and has resolved to recommend to the Council to accept the tender of the Tudor Accumulator Co. and its offer to maintain the batteries. The Council is also recommended to authorise the Committee to obtain and install the two sets of boosters, &c.

Hull.—At a meeting of the Corporation Telephone Committee, it was decided that either of the two lowest tenders should be accepted for the supply of cables, viz. :—

W. T. Henley's Telegraph Works Co., Ltd.—£575.
Union Cable Co , Ltd.—£547.

London.—BETHNAL GREEN.—The Electricity Committee has accepted the tender of Messrs. Mellowes & Co., Ltd , at £52, for patent roof glazing with wired glass at the new substations.

HAMMERSMITH —The Electricity Committee recommends the B C. to accept the tender of the Electrical Apparatus Co., Ltd., for the supply of ordinary meters for a period of three years, on the understanding that the price of brass rod in March, 1916, is not above 9d. per lb. Should this price increase the company's price to the Council would be advanced 5 per cent. Also tenders for insulating box filling compound, Limmer Asphalte Paving Co., and for the purchase of scrap metal at the electricity works, Messrs. W. & H. Cooper.

Manchester.—Among the tenders accepted for general stores required in the Tramways Department for the ensuing 12 months are the following :—

Connolly Bros.—Cable (power and lighting), bell wire.
F. Smith & Co., Ltd.—Copper cable (wire and strip).
Till & Whitehead, Ltd.—Sheet copper and brass wire rod and strip.
F. Smith & Co., Ltd.—Steel wire for armature banding.
Richard Johnson & Nephew, Ltd.—Galvanised-steel cable, &c.
John Ashton & Sons, Ltd.—Leather belting, &c.
D. Moseley & Sons, Ltd.—Canvas and fire-hose.
British Thomson-Houston Co., Ltd.—Motor and controller parts (B.T.H. equipment), motor cases (B.T.H. equipment), brush holders and spare parts (B.T.H. equipment), half-watt incandescent lamps (tungsten drawn-wire filaments).
D. C. Bate.—Circuit-breaker handles (B.T.H. equipment), pressed asbestos division plates (B.W. equipment) (portion), fibre dust rings.
Dick, Kerr & Co., Ltd —Motor and controller parts (D.K. equipment), motor cases (D.K. equipment), armature and field coils (D.K. equipment), controller fingers (D.K. equipment).
British Westinghouse Electric & Mfg. Co., Ltd.—Motor and controller parts (B.W. equipment), armature and field coils (B.W. equipment), spare parts for brush holders (B.W. equipment), traction lightning arresters.
S. Gratrix, jun., & Bros., Ltd.—Hinge pins, arc lamp globes, &c.
L. Andrew & Co.—Fullerboard and mica tubes, fibre, &c., insulation tape, Chatterton compound, &c.
Electro-Mechanical Brake Co., Ltd.—Resistances (grid type) and spare parts.
H. Wallwork & Co., Ltd.—Grids for resistances.
P. R. Jackson & Co., Ltd.—Assembled commutator segments (B.T.H., D.K. and B.W. equipments), armature and field coils (B.T.H. equipment).
Kay & Co.—Brush holders and spare parts (D.K. and B.W. equipments).
Electrical Supplies Co., Ltd.—Controller fingers (B.T.H. and B.W. equipments) (portion).
Dyer & Young.—Controller fingers (B.T.H. and B.W. equipments) (portion).
Equipment & Engineering Co., Ltd.—Trolley poles, trolley heads, &c.
Drake & Gorham, Ltd.—Incandescent lamps, traction type (drawn-wire filament).
General Electric Co., Ltd.—Incandescent lamps (carbon filaments and 200-volt drawn-wire filaments), switches, bells, lighting material, telephones, &c.
Stella Conduit Co.—Steel conduit tubing, &c.
G. Schultz & Co.—Mica segments for commutator bars, &c.
A. Bates & Co , Ltd.—Asbestos.
Pinchin, Johnson & Co.—Insulation varnish and insulating compound.
Morgan Crucible Co., Ltd.—Carbon brushes for traction motors, crucibles, fireclay material, &c., for tilting furnaces.
Alfred Wiseman, Ltd.—Overhead equipment insulating material.
Estler Bros.—Canopy trolley bases, &c.
Fleming, Birkby & Goodall, Ltd.—Trolley-wheel bushes and spindles.
M. Cummins.—Auto-sanding devices.
John Taylor.—Tubular sanding devices.
Hadfields, Ltd.—Steel tie-bars.
Ibbotson Bros & Co., Ltd.—Steel fish bolts and nuts.
W. J. Ritchie & Co., Ltd.—Ball-races for trolley standards.
West Bromwich Spring Co., Ltd.—Truck springs.
Cammell, Laird & Co., Ltd.—Car axles, car-wheel tires (portion).
J. Brown & Co., Ltd.—Car-wheel tires (portion).
F. W. Rowlands & Co.—Car-wheel centres, gear and pinion wheels (portion).
British Hele-Shaw Patent Clutch Co., Ltd.—Gear and pinion wheels (portion).
J. Marsden & Co., Ltd.—Ordinary grey iron castings, chilled iron brake-block castings (portion)
National Rail and Tramway Appliances Co., Ltd.—Chilled iron brake-block castings.
J. A. Panton & Co. (representing Interchangeable Brake Block Co., Ltd.).—Chilled iron brake-block castings.
Armstrong Oiler Co., Ltd.—Lubricant pads for axle boxes.
J. Carr & Sons, Ltd.—Trolley cord.
Chamberlain & Hookham, Ltd.—Tramcar type ampere-hour meters.
Thermit, Ltd.—Welding portions.

Maidenhead.—The T.C. has received the following tenders for fuel oil for the electricity works :—

	£	s.	d.	
British Petroleum Co., Ltd.	£4	13	0	per ton.
Anglo-American Oil Co., Ltd.	3	17	5	,,
Anglo-Mexican Petroleum Products Co. ..	3	8	0	,,

The electrical engineer has been instructed to make tests with the oil of the Anglo-Mexican Co., and if these are considered satisfactory, arrangements will be made with them for a supply. The last three contracts for fuel oil were placed at £2 3s., £2 7s., and £3 8s. per ton respectively.

Meter Contracts.—Messrs. Chamberlain & Hookham, Ltd., have received the contract from Holyhead for the supply of meters for 12 months. Their tenders for meters for 12 months to Walthamstow and Mansfield have also been accepted.

Rotherham.—The Electric Light and Tramways Committee has accepted the tender of the British Niclausse Co., for two water-tube boilers, at £8,400.

Salford.—The tender of the Pendleton Ironworks Co., Pendleton, for the erection of the steelwork in connection with the central car depôt extension (£1,480) has been accepted.

Sheffield.—The City Council is recommended to accept the tenders of the General Electric Co., at £84, for spares required for the electric light and power plant at the Ewden Valley Waterworks, and for cables, lamps and fittings. The tender of Messrs. A. Reyrolle & Co., Ltd., is also recommended for acceptance, at £236, for one three-phase E.H.T. oil switch and four sets of metering gear.

Sunderland.—The T.C. has accepted the following tenders on behalf of the Electricity and Lighting Committee :—

B.I. and Helsby Cables, Ltd.—Cable, bifurcating boxes.
Ferranti, Ltd —E.H.T. switchgear cabinet; two E.H.T. switch panels.
I.-R., G.-P. and Telegraph Works Co.—Cable.
Sanders, Rehders & Co.—C.O. two recorders.
General Electric Co., Ltd.—Metal-filament lamps.
Brunner, Mond & Co.—Supply of alkali.
General Electric Co , Ltd.—D.C switchboard.

Tunbridge Wells.—The Lighting Committee of the T.C. has accepted the contract of the British Thomson-Houston Co., Ltd., for a 300-KW. steam alternator and condensing plant, at £3,132 instead of at £3,181, authorised on May 18th last.

Wimbledon.—The following tenders have been accepted for annual supplies to the Electricity Department :—

ENGINE-ROOM STORES.

Pryke & Palmer.—General stores (255 items).
S. Peace & Sons, Ltd.—Files (34 items), chisel and tool steel, and shafting (four items).
James Harvey.—Destructor tools (five items).

CABLES AND CONDUITS.

Western Electric Co., Ltd.—Cables.
C. Macintosh & Co., Ltd.—Cable.
B.I. & Helsby Cables, Ltd.—Flexible cables.

JOINT BOXES AND JOINTING MATERIAL.

Dussek Bitumen Co.—Compounds (two items).
W. Lucy & Co., Ltd.—Service and other boxes.
Sykes & Sugden, Ltd.—House fuse-boxes.
Callender's Cable & Construction Co.—Frames and covers (three items).
British Electric Transformer Co., Ltd.—Transformers.
Ferranti, Ltd.—Meters.
A. Duckham & Co., Ltd.—Oils.

Wolverhampton.—The Electricity Committee recommends the City Council to accept the tender of Messrs. Mossay and Co., at £630, for a 2½-ton Orwell electric vehicle and equipment.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, April 16th. At 8 p.m. At Storey's Gate, S.W. Ordinary General Meeting.
Friday, April 23rd. At 8 p.m. At Storey's Gate, S.W. General Meeting.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, April 19th. At 7.30 p.m. At the Mining Institute. Lecture on "Illumination," by Mr. V. H. Mackinney.

Institution of Post Office Electrical Engineers.—Monday, April 19th. At 5 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Annual General Meeting.

Electrical Trades Benevolent Institution.—Monday, April 19th. At 6.30 p.m. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Annual general meeting.

Rontgen Society.—Tuesday, April 20th. At 8.15 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Papers on "Late Radium and X-Ray Burns," by Dr. N. S. Finzi, and "A New Alpha Ray Effect, by Mr. F. H. Glew.

Wireless Society of London.—Tuesday, April 20th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Lecture on "Methods of Measurement of the Strength of Wireless Signals," by Dr. E. W. Marchant.

Association of Mining Electrical Engineers (West of Scotland Branch).—Wednesday, April 21st. At 6.30 p.m. At Royal Technical College, Glasgow. Paper on "Bearings of Electrical Machinery," by Mr. A. Baxter. Discussion on paper on "Some Experiences in the Handling of Electricity," by Mr. M. A. Smellie.

Chemical Society.—Thursday, April 22nd. At 8.30 p.m. At Burlington House, Piccadilly, W. Paper on "Electromotive Forces in Alcohol. Part VI. Absolute Potentials by the Capillary Electrometer," by Mr. E. Newbery.

Junior Institution of Engineers.—Friday, April 23rd. At 8 p.m. At 39, Victoria Street, S.W. Paper on "The Developments of the Navy," by Mr. E. W. Hobbs.

Physical Society of London.—Friday, April 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Paper on "The Self-Induction of Solenoids of Appreciable Winding Depth," by Mr. S. Butterworth.

National Association of Colliery Managers and Association of Mining Electrical Engineers.—Saturday, April 24th. At University College, Nottingham. Joint meeting. Paper on "Protective Devices against Lightning and Surges," by Messrs. E. Kilburn Scott and L. F. Fogarty.

NOTES.

Smoke Nuisance.—At the Manchester Police Court on April 7th, Messrs. Connolly Bros., Ltd., electrical cable manufacturers, Blackley, were summoned for permitting black smoke to issue from one of their chimneys for 6½ minutes on February 27th. The offence was admitted, but in extenuation of the offence Mr. Connolly (one of the directors) pointed out that the firm were completely in the hands of the collieries with regard to coal supplies, and it was utterly impossible at present to secure the right kind of coal for the boilers. They were also handicapped by the scarcity of firemen, and could not get good men even at high wages. He also pointed out that the firm had spent over £600 during the last few months in installing electrical apparatus to combat the black smoke nuisance, and were even now engaged in fitting up additional electric driving plant to take the place of steam. He protested against the action of the Corporation in summoning them at a time when every firm was doing its utmost to keep up Government supplies for all kinds of material. The Stipendiary said the firm were old offenders, and must pay 30s. on this occasion. They had been frequently let off on promising to make alterations which would effectually deal with the black smoke nuisance, but at present that happy state of affairs seemed a long way off.

An Electrical Bridge Over the Blue Nile.—In the course of an interesting article in the *Engineer* for March 19th on the development of the Soudan, reference is made to the new rolling lift bridge across the Blue Nile at Khartoum, which provides direct railway communication with Khartoum, and has made possible the extension southward of the Soudan Government Railway system. This bridge, which has a length between abutments of 1,834 ft., ranks as the longest and most important bridge in Tropical Africa. In addition to two approach spans, there are seven more spans, each of 218 ft. 6 in., and a rolling-lift span giving a clear opening of 100 ft. The rolling span is electrically-operated and fully locked and signalled. The lighting of the bridge is effected by 36 70-volt Osram drawn-wire lamps, run two in series off the three-phase mains. Current is taken from the Khartoum town supply, and is delivered at the signal cabin at 3,000 volts three-phase, where it is transformed down to 140 volts. Electricity was used as far as possible for all power and lighting during the construction.

Russian Copper Production in 1914.—The production of metallic copper in Russia in 1914 amounted to 1,949,720 poods, against 2,095,288 poods in 1913. The difference, 145,568 poods is about 7 per cent. against 1914. The following table shows the production per district, the largest diminution being shown in the Caucasus, due, no doubt, to the military operations there:—

	1913.		1914.	
Ural	1,055,122	poods	1,025,055	poods
Caucasus	610,661	,,	495,388	,,
Siberia...	345,273	,,	342,879	,,
Chemical works and refineries	84,232	,,	86,398	,,
	2,095,288	,,	1,949,720	,,

Power from Sawdust.—Some time ago we mentioned an installation in Sweden of considerable size, in which electrical energy was generated from sawdust; by the courtesy of Mr. F. von Echermany, general manager of the Ljusne-Woxna Co., Ltd., of Ljusne, where the plant is installed, our Norwegian correspondent has been enabled to provide us with the following additional particulars.

The plant is designed for a maximum output of 4,200 H.P., but the first instalment provides for only 2,200 H.P. The fuel consists of a mixture of 80-90 per cent. sawdust and 20-10 per cent. chips, which, as taken from the mill, contains about 50 per cent. water; the mixture will be charged into gas-producers, and provision is made for the recovery of the tar, wood naphtha and acetic acid from the gas. As the result of tests of long duration, it has been found that the consumption of fuel is 1·8 kg. per H.P.-hour; the fuel costs 1s. per ton at the mill, and contains 50 per cent. water.

It is estimated that the cost of production with a plant of 2,200 H.P., including capital charges, and depreciation at the rate of 10 per cent. per annum, will be 0·42 öre per KW.-hour (0·055d.). Water-power in Sweden cannot be obtained for less than 1 öre per KW.-hour, and this only in a very few cases, the average cost of electrical energy generated from water-power being 2 öre per KW.-hour (0·26d.). It is expected that with wood-waste plant of 4,200 H.P. the cost per unit will be reduced to less than 0·046d.

The installation is being built by the Gasmotoren-Fabrik Deutz, of Cöln-Deutz, which, by means of a special experimental plant erected at Cöln, has solved the technical difficulties met with in the utilisation of wood-waste. The order for the plant was placed in December last, and the first of the two large gas engines was tested at Cöln in February; the whole plant is due for delivery, and it is expected that it will be running in July.

It is calculated that the amount of power available from wood-waste in Sweden, after providing for the driving of the saw-mills, is from 70,000 to 100,000 H.P., varying with the output of sawn timber. The Ljusne-Woxna Co. owns waterfalls near the works of 40,000 H.P., but has found it more economical to make use of the sawdust in the first place than to develop the water-power.

Inquiries.—Makers of cases for pocket electric lamps are inquired for by a Continental firm.

Appointments Vacant.—Junior assistant electrical engineers, over 19 (15s.), for Newcastle-on-Tyne Electric Supply Co.; draughtsman and general technical assistant (£120), for Newport Electricity and Tramways Department; switchboard attendant (30s.) for Torquay Electricity Department. Particulars are given in our advertisement pages.

A Too-enterprising Rat.—The accompanying illustration, for which we are indebted to Mr. C. A. Baker, electrical engineer to the London County Council, shows how an unfortunate rat met with an untimely end.

The view shows the back of a sub-distribution board which controls a portion of the lighting of the Rotherhithe Tunnel. At a recent periodical test it was found that the I.R. both to earth and between poles of one of the paper-insulated cables feeding this sub-board had fallen from 100 megohms, which was the usual resistance obtaining, to between ·5 and 1·0 megohm. There was no apparent cause for the fall, but after examination it was traced to the back of the sub-board, which was then disconnected and taken out of the cast-iron case in which it was mounted; the illustration shows that the rat when climbing up one of the bare copper strip connections got its back in contact with the opposite pole, between which there is a difference of pressure of 100 volts A.C., and was electrocuted.

Municipal Stores: The Need for Organised Buying.—The Southport Corporation recently formed a special Stores Committee to organise and control the purchasing of stores common to the various departments. The Committee is composed of the chairmen of various other committees—including the Electricity and Tramways Committees—and it is expected that a great saving will be effected by combined buying. A list showing the varying prices paid for similar articles purchased by different committees gives the following interesting comparisons (among others):—For hacksaw blades, the electricity department pays 34s. 9d. per gross for 12 in. × ⅝ in. blades, and the tramway department pays 30s. per gross; the prices for block tin range from 1s. to 2s. 6d. per lb.; the Highways Committee pays 27s. 6d. and the electricity department 37s. 4d. per cwt. for white lead; for putty the same committees pay 7s. and 9s. 4d. respectively; boiled linseed oil costs 2s. 2d. per gallon to the Highways Committee, and 2s. 6d. per gallon to the Tramways; petrol prices range from 1s. 2d. (less rebate) paid by the Tramways Committee to 1s. 8d. paid by the Highways Committee; scrubbing brushes cost 14s. per dozen to one Committee, and range down to 7s. per dozen, the Electricity Committee paying 8s.; for soft soap, the prices range from 35s. per cwt. in the case of the Watch Committee to 14s., the Tramways Committee paying 15s. 9d., and the Electricity Committee 14s. 2d. per cwt. Schedules of goods common to the various departments are to be issued to contractors, and tenders invited for complete supplies.

The Batti-Wallahs.—The *Batti-Wallahs' Journal* for January-March contains portraits of the executive, chief of whom is the new president, Mr. Haydn T. Harrison, and reports of concerts, the annual dinner, and the annual general meeting. The report of the hon. secretary, Mr. F. Pooley, showed that the membership numbered 261.

On March 31st an informal evening was held under the chairmanship of Mr. Wm. Wyld, and was exceptionally well attended; an excellent entertainment was provided.

Patents and Alien Enemies.—Licences have been granted to Messrs. Pintsch's Patent Lighting Co., Ltd., in respect of patents Nos. 7,049/07 granted to Imray, and 14,950/10, 26,192/10, 19,369/11, 19,370/11, 3,561/13, 8,585/13, and 8,586/13 granted to Julius Pintsch Akt.-Ges.

The I.E.E. Benevolent Fund.—With reference to the appeal on behalf of this Fund, which was published in our last issue, Mr. P. F. Rowell, Hon. Sec. of the Fund, asks us to state that the annual contribution of even the smallest amounts would be greatly appreciated by the Committee of Management.

Russian Architects and Electricity.—At a meeting of the Society of Architects held on March 15th, says a Petrograd paper, M. N. Ph. Savelieff delivered an address on the proceedings of the recent Congress of the Technical Society, which treated of the economic situation of Russia. Deploring, like other Russian authorities, the predominance of Germany in the Russian industrial and mercantile field, he states that French and English products have not much vogue in Russia ; and the only branches of the electrical industry that may be said to be in a satisfactory condition in the country include the production of cables and wire, and some electrical machines. Hitherto such have been imported only in small quantities. But the position is a bad one for fittings, such as the accessories that are required for the installation of telephone and telegraph wires and electric light. An examination on the premises of the Technical Society of samples of fittings of German production showed that these do not give full satisfaction in respect of quality. Their extensive use in Russia is explained by the low prices charged for them. A special Committee of the Society has prepared an album of the most practical electrical fittings. Most of these are of English production. It is much to be desired, he continues, that the makers of fittings now becoming established in Russia should follow closely the models recommended by the Committee referred to.

A great problem for Russian electricity at the moment is fuel. In most Russian central electric stations coal-fuelled steam engines are in use. Till recently all the Northern area of Russia used English coal. Now recourse has to be had to Donetz (South Russian) coal, some of the varieties of which resemble the English mineral. But putting aside the transport difficulties, there is the fact that the Donetz coalmasters are not equipped for supplying coal to the Northern area ; nor are they disposed to accommodate themselves to this new demand from a market that may revert to the English when the war is over. Some of the audience recommended the use of peat, which is so abundant in Russia. But it appears that at the moment Russia is badly equipped for the preparation of peat.

Professional Charges of Civil Engineers.—The Council of the Institution of Civil Engineers has issued a statement to the members with regard to professional charges, with a view to uniformity in the basis upon which such fees are fixed. Engineers with larger experience command fees on a higher scale than younger and less experienced engineers, but the customary remuneration for ordinary professional engineering services, as distinct from remuneration by salary, for the design and superintendence of the construction of works in the United Kingdom is a commission of 5 per cent. upon their cost, which commission, however, is liable to be varied in accordance with the nature and magnitude of works and the character of the services rendered.

The preparation of bills of quantities, payments to resident engineers and inspectors, and also personal travelling expenses, are matters for arrangement depending upon the nature of the work and the circumstances under which it is carried out. Where the works are designed in sufficient detail to enable a contract for their execution to be made or to enable the Local Government Board to hold an inquiry into the propriety of allowing an authority to borrow money for the purposes of the works, but where the carrying out of such works is deferred indefinitely or abandoned, the fee for services up to this stage is one-half of the ordinary commission.

The Council is advised that plans and specifications prepared by an engineer belong, as chattels, to the client, after payment of the agreed fees, but the *copyright* in all original matter contained in such plans and specifications remains vested in the engineer. Neither the client nor any other person is entitled to multiply copies of plans and specifications so far as the original matter therein contained is concerned ; and, further, if such original matter has "an artistic character or design," the plans can only be used for the purpose of the particular structure for which they were prepared by the engineer, or for such other purpose as he may authorise.

The Concentric Wiring Question in the U.S.A.—At New York, on March 23rd, was held the first meeting of a Committee elected by the manufacturers of electrical supplies and materials entering into electrical construction, under the following resolution :—

"Resolved, that a representative Committee of business and technical experts be appointed to investigate the all-insulated system of building wiring as used at present in this country, and coincidently investigate grounded return systems together with concentric wiring.

"First—To determine the relative efficiencies of the two systems (*a*) as to safety of persons, (*b*) as to protection against fire, (*c*) as to the possible provision of methods of wiring at low cost, combined with ease of installation and sufficiently attractive appearance to obtain popular approval.

"Second—To present to the entire industry the results of its investigations in the form of concrete recommendations, including standard systems, standard devices and standard appliances."

In view of the widespread effect of so radical a change in American wiring systems as would result from the complete adoption of grounded returns, the Committee decided to begin its investigations at once by thoroughly sifting the theoretical advantages of that system, and in so far as possible obtaining authentic data of the results obtained in England and Continental Europe, where grounded returns have been used more or less.

Those interested in this subject are invited to address communications to the Committee, care of Mr. Le Roy Clark, chairman, 114, Liberty Street, New York.—*Electrical World.*

Molybdenum from Australia.—The *Times* correspondent at Sydney cables that works for treating molybdenite ores have been established in Sydney, and it is expected that over 100 tons will be dispatched to England before the end of June from New South Wales and Queensland.

Electromagnets in War Surgery.—It seems likely (writes a correspondent) that when the story of war surgery comes to be written, the electromagnet will be found to have played no inconsiderable *rôle.* Hitherto in civil practice magnets have been used for extracting foreign bodies only from the eyeball, but the present war, at least so far as French surgery is concerned, has revealed their wider uses. Already two communications have been made on this subject to the Académie des Sciences of Paris, in both cases by French medical men actually engaged in the field, and the results appear to have been strikingly successful. Not all the projectiles employed in the war, of course, are of a magnetisable nature, and the French copper-sheathed bullets and the French and German lead shrapnel bullets have to be dismissed from the reckoning. It is otherwise, however, with splinters of cast shell, and also with the German bullets which are coated with an envelope of ferro-nickel. One of the French doctors, M. Rollet, states that he employs a giant electromagnet capable of supporting a weight of at least 1,150 kilograms (more than 22 cwt.), and taking 23 amperes at 110 volts. It attracts immediately the German bullet, weighing 10 grammes, at a distance of 11 centimetres, and splinters of shell at a still greater distance. This electromagnet is placed over the part where the bullet, as demonstrated by X-rays, is known to be lodged, and it causes a movement of the projectile. This worker states that, owing to the resistance of the tissues, it is not very useful to employ a small hand magnet, but that these very powerful electromagnets often succeed in bringing the bullet or other projectile nearer to the surface or into a more favourable position, and then an extraction with only a small incision becomes possible.

In a later communication to the Académie, Prof. J. Bergonié, of Bordeaux, states that he has also used an electromagnet with success in many cases. The instrument he employs weighs 40 kilograms (88 lb.), and has a magnetic core of special steel 60 mm. in diameter. The magnetising coil takes 3·5 amperes at 110 volts. This has been employed successfully where ordinary surgical procedure was dangerous. The purely surgical details would scarcely interest the readers of an electrical journal. Suffice it to say, that the electromagnet is kept over the part for 15 minutes or so every day, until after a number of such daily applications, in one case as many as 24, the projectile is brought so near the skin as to cause a cone-shaped raising of the surface at each application of the magnet. When this has happened, extraction by means of the knife is an easy matter. An important point while using the electromagnet is to keep opening and closing the magnetising circuit during the whole of the sitting, and the influence on the foreign body, granted, of course, that it has a magnetisable nature, becomes noticeable on X-ray examination, and ultimately by the sensations of the patient and the raising of the skin.

A Canadian Electric Bakery.—A prominent bakery in Toronto recently installed a Hughes electric oven, which is proving more economical than the furnace type oven which it replaced. Thus, the electric oven with a capacity of 180 1·5-lb. loaves, turned out 15 batches or 2,700 loaves in ten hours, while the brick oven with a capacity of 450 1·5-lb. loaves, turned out five batches or 2,250 loaves, or 450 less than the electric oven. The electric oven occupies 32 sq. ft. of floor space, as against 256 sq. ft. for the brick oven.

The cost of electricity, says the *Electrical Review and Western Electrician*, when used in the "off peak" period at Toronto, which is at night, is ·5 cent per KW.-hour. The maximum energy consumption of the electric oven was 26 KW.-hours, and would cost 13 cents per hour used continuously, or $1·3 for 10 hours' use, during which time 2,700 loaves were baked. *Pro rata*, this is equivalent to 48 cents fuel cost per 1,000 loaves, and this figure shows a saving in fuel over the brick oven of 41 cents per 1,000 loaves. The labour cost with the electric oven was less, the saving per 1,000 loaves being estimated at 22 cents.

We gather that the bread baked electrically has a better colour and will last longer as it is not dried out as in a brick oven ; moreover, the cooking conditions are greatly improved and cleaner. The electric oven is ready to bake in 35 minutes after being switched on ; by its use a considerable saving in first cost of a new bakery is ensured.

Foreign Trade. — THE MARCH FIGURES. — The following are the electrical and machinery figures given in the official returns for March :—

	Month of March. £	*Inc. or dec.* £	*Three months,* 1915. £	*Inc. or dec.* £
IMPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	67,626	− 80,392	193,569	− 36,160
Machinery ...	582,088	− 142,859	1,774,025	− 191,190
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	276,970	+ 25,400	720,733	− 42,776
Machinery ...	1,590,431	−1,978,168	4,539,784	− [illegible]450,161

A Lesson to Photographers.—At the Newcastle-on-Tyne Police Court on Tuesday, Lancelot Edmund Hendry, chargeman electrician, was charged under the Defence of the Realm Act with having taken a photograph in the electric shop at the Armstrong Elswick Works, without permission. Evidence for the prosecution was to the effect that on Saturday last accused was observed climbing down some pipes which cross the turbine shop, and when questioned said he had taken a photograph. He was told that he might get six months if caught, and replied : "Well, perhaps," as he walked away. Shortly afterwards he was placed under arrest and the negatives were developed. Chief Superintendent Bestwick said prisoner had not received permission to take the photographs. He was a native of Stockton and served his time with the Stockton Corporation as an electrician, afterwards going to the Sunderland Corporation. He was married and resided in Sunderland, where witness had examined his house. He appeared to be an amateur photographer, and photographs of machinery in which he was interested were found. The evidence, as a whole, was of a negative character. Defendant admitted he had done a foolish act. Photography was his hobby, and he had tried to keep a record of the places he had worked in. Apart from that he had no interest in the matter. The chairman said the case was a most serious one at a time like the present. Defendant had given no proper explanation of his action, and therefore the least the Bench could do was to impose a fine of £20, or 51 days' imprisonment. They had taken into consideration the defendant's statement that he had no evil intention ; but having regard to the evidence, the fine would have to be paid forthwith.

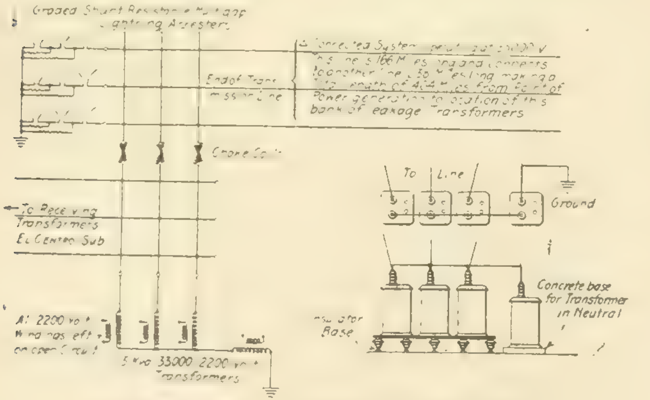
Static Electricity on a long Transmission Line.—Writing to the *Electrical World*, Mr. C. O. Poole, chief engineer of the Southern Sierra Power Co., says with regard to the use of inductive reactance connected on lines to ground for bleeding off the accumulation of static electricity :—

Several months ago, and before I knew anything of this practice, we had a very bad case of static on a 55,000-volt transmission line that we constructed in connection with the Coachella Valley Ice and Electric Co. in the Imperial Valley. This line was built on wooden poles, the conductor being of 3/0 7-strand aluminium. We used No. 351 Locke insulators, the wires being spaced on an equilateral triangle, 72-in. centres, and the length of the line being 166 miles.

We connected this 55,000-volt line at the terminus of a 238-mile transmission system from Inyo County—connection being made at San Bernardino sub-station, this making a total transmission system from our power house at Bishop, Cal., of 404 miles.

The Imperial Valley line is operated delta at 55,000 volts. Shortly after the system was put into operation trouble was experienced by two or three of the pole tops burning off and causing short-circuits on the system. I made a trip over the line at night in the Imperial Valley and found a great number of insulators leaking static badly, which resulted in charring the pole and cross-arms, and I realised that something must be done at once to relieve the condition. I conceived the idea of bleeding the static off to ground, and recommended that the Holten Power Co., at El Centro, the end of the line, install four 15-KW. transformers we had in stock and connect them directly between the line and ground.

These 15-KW. transformers were wound on the primary side for 33,000 volts and on the secondary side for 2,200 volts. Three of these transformers were connected in star on insulated platforms, and the fourth transformer was connected between the star of the three transformers and ground on the primary side, the secondary 2,200-volt windings being left open. The object of using the fourth transformer was to protect the 33,000-volt circuit from over-voltage in the event of ground appearing on the 55,000-volt circuit.


Lightning Arresters
End of Transmission Line
Choke Coils
To Receiving Transformers El Centro Sub
5 kw 33000 2200 volt Transformers
To Line
Ground
Concrete base for Transformer in Neutral
Base

Arrangement of Bleeding Transformers.

The effect of this installation was immediately to overcome all the difficulty with the leaking static, and the line now is as quiet and free from static as could be desired. The sketch herewith shows the arrangement of these bleeding transformers as connected to the system.

Edison to Make Benzol.—It is announced in the *Elecl. Rev. and Western Electrician* that Thomas A. Edison has opened a factory in Johnstown, Pa., for the manufacture of benzol from coal gas, a process never before developed in the United States. Since the war began there has been a great shortage of this product.

Institution and Lecture Notes.—Royal Society of Arts.—In the list of arrangements for meetings during April and May the following appear :—

Wednesday, April 14th, at 8 p.m. T. Thorne Baker, "The Industrial Uses of Radium"
Wednesday, April 28th, 8 p.m. A. S. E. Ackermann, "The Utilisation of Solar Energy."
Wednesday, May 5th, 8 p.m. Dr. A. Vernon Harcourt, F.R.S., on "The Measurement of the Efficiency of Domestic Fires, and on a Simple and Smokeless Grate."
Wednesday, May 12th, 8 p.m. Charles R. Darling, "Recent Progress in Pyrometry."
Thursday, May 13th, 4.30 p.m. (Indian Section.) Sir Charles H. Armstrong, "Indian Trade and War."

The paper by Mr. A. S. E. Ackermann will supplement that given before the Society of Engineers in April, 1914, by dealing with the experiments of other workers in the field.

Illuminating Engineering Society, U.S.A.—The ninth annual Convention of this Society will be held at the New Willard Hotel, Washington, D.C., September 20th-23rd inclusive. Mr. E. S. Marlow, of the Potomac Electric Power Co., Washington, D.C., is chairman of the Convention Committee.

Institution of Electrical Engineers.—At the meeting of the Manchester Local Section, on Tuesday last, a paper was read by Mr. J. H. Rider on "The Power Supply of the Central Mining-Rand Mines Group." The same paper was read at Birmingham on Wednesday and in London last night.

At the annual business meeting of the Scottish Local Section held in Glasgow, on Tuesday last, the following office bearers were elected for the ensuing year :—Chairman, *Mr. David A. Starr ; vice-chairman, *Mr. J. K. Stothert ; chairman of Students' Section, Mr. Archibald Page ; ordinary members of Committee, Messrs. J. S. Nicholson, E. T. Goslin, G. Stevenson, J. E. Sayers, A. S. Hampton, Prof. J. D. Cormack, *Messrs. F. H. Whysall, *W. W. Lackie, *Prof. Magnus Maclean, *A. Lindsay, *A. Wilson ; hon. secretary and treasurer, Mr. Joseph Taylor ; assistant hon. secretary, Mr. Wm. F. Mitchell. *New members of Committee. The annual report showed that the membership was 370, a reduction of 5 per cent. on the previous year, while the attendance at the ordinary meetings averaged 47, about the same as last year.

At the ordinary meeting which followed, Mr. W. M. Selvey read his paper on "Power Plant Testing."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Redditch T.C. has appointed, out of 106 applicants, Mr. Valentine F. Bush, of West Ham, as assistant engineer at the electricity works, at £170 per annum.

Mr. H. C. Ashton has been appointed assistant engineer at the Hammersmith electricity works, at a salary of £175 per annum.

Mr. J. Devoy, mains superintendent at the Tunbridge Wells electricity works, has resigned his appointment. The Committee has resolved to grant Mr. J. E. Pownall, chief assistant electrical engineer, a gratuity of £10 for extra work done since the commencement of the war.

Mr. J. Chisnall, foreman fitter at the Blackpool electricity works, on leaving to take up an appointment with Messrs. Vickers, at Barrow, was presented with a Gladstone bag, a wallet, and other gifts from the staff and workmen. Mr. W. W. Parkinson made the presentation.

Mr. F. Young, electrician on the Dover Corporation tramways staff, who has resigned, has been presented by his colleagues with a silver rose bowl.

Mr. W. W. Lackie, City electrical engineer, is nominated for the Presidency of the Institution of Engineers and Shipbuilders in Scotland.

Mr. J. C. Williams, chief assistant and deputy engineer at the Rotherham Corporation tramways and electric light department, who is leaving to become electrical engineer and manager at Erith, has been presented by the staff and employés with a gold watch, and by the Executive Committee of the Rotherham Municipal Officers' Guild with a set of solid silver *entrée* dishes.

Tramway Officials.—Mr. J. Ellison has been appointed chief inspector to the Darwen Corporation Tramways. Through the war it has been decided not to fill the vacancy caused by the death of Mr. Moses Stokes, superintendent of the line. Mr. Ellison will officiate in the management as deputy to Mr. Hoskens.

Mr. Dugdale, the Oldham Tramways manager, who has been ill for some time, has now resumed his duties.

General.—The vacancy in the chairmanship of the Crewe Corporation Electric Lighting Committee, caused through the death of Mr. Councillor Chapman, has been filled by the appointment of Ald. J. H. Kettell.

The Chairman of the Council of the Society of Arts, Col. Sir Thos. Holdich, on Monday afternoon presented the Society's Albert Medal to Senator Guglielmo Marconi, G.C.V.O., LL.D., D.Sc., "for his services in the development and practical application of wireless telegraphy."

Bailies Smith and Hannay, along with Mr. Wm. Lackie, the chief electrical engineer, are to represent Glasgow T.C. at the twentieth annual convention of the Incorporated Municipal Electrical Association, to be held in London in June next.

Mr. W. E. Pott, late general manager of Messrs. Krupka and Jacoby, Ltd., and British Graetzin Light, Ltd., of Westminster, has been appointed manager of the Electric Novelty Department for Messrs. J. S. Hind & Co., of 6, Eldon Street, E.C., representing the Interstate Electric Novelty Co., of America.

Obituary.—Major S. Flood Page.—The death occurred on April 7th, at Inverness Court Hotel, London, at the age of 82 years, of Major Samuel Flood Page, whose connection with electrical undertakings in London on the commercial and financial side dates back over a lengthy period. From the records in our own pages, it appears that the gallant Major entered the electrical arena in the year 1882, when, in the capacity of manager of the Crystal Palace, he organised the Electrical Exhibition held there. Presumably his connection with that event gave him that commercial interest in electrical affairs which extended over so many years, for it was in the year of the Exhibition that he became general manager of Edison's Indian and Colonial Electrical Co. He left in September, 1882, for a tour abroad to prosecute the company's business in India, Ceylon, South Africa and the Australian Colonies. In some of these Colonies companies were started. In 1882 gas was 12s. 6d. to 15s. per 1,000 cb. ft. at the Cape of Good Hope, and very dear in India and the Colonies, and it was considered that if electricity could compete with gas at 3s. per 1,000 here it would do far better in the Colonies, &c. In this belief the Edison lighting schemes with which he was identified were launched. The Marquess of Tweeddale described Major Flood Page as a "gentleman of great energy," which he undoubtedly was in all his concerns whether we remember his later association in different capacities with the Edison & Swan United Electric Light Co., Ltd., with the London Electric Omnibus Co., Ltd., or with the London Chamber of Commerce. The London Electric Omnibus Co., Ltd., was formed in 1896, with a quarter of a million capital. What happened to that unfortunate concern is now more or less a matter of history—we fear forgotten, or even never known, by many men who are to-day interested in electrical vehicle matters. Briefly, it may be described as a concern born in advance of the times by over-sanguine men, and as one of those companies which make promises with reckless prodigality, but find themselves incapable of carrying those promises out to the stage of performance. In recent years, Major Flood Page had not appeared so prominently as formerly in electrical affairs, owing to his advancing years, but he had for a long time been on the board of three of the Marconi Wireless Companies, and was so at the date of his death. At different times in the course of his manifold activities he was described by others as sanguine, enthusiastic and full of energy, and by himself as a "practical business man."

Prof. W. G. Adams.—We regret to hear of the death, which occurred at Broadstone, Somerset, on 10th inst., of Mr William Grylls Adams, F.R.S., F.G S., Emeritus Professor of Natural Philosophy and Astronomy at King's College, London. He retired from that office about nine years ago. The deceased gentleman, who had reached the ripe age of 79 years, was a past president of the Institution, he having delivered his presidential address before the Society of Telegraph Engineers and Electricians in January, 1884. In following years he was also the author of numerous papers on electrical, magnetic and other scientific matters. Prof. Adams had occupied the presidential chair of the Physical Society, and he attained considerable eminence as a mathematician and an astronomer.

Herr M. Hiller, a director of the Landsberg Kabelfabrik Gesellschaft, of Landsberg, Westphalia, is among the German officers killed in the war.

Mr. L. U. Vignoles.—We regret to learn of the death, which took place on April 6th in Argentina, at the early age of 34 years, of Leonhard U. la H. Vignoles (commonly known as "Toby"). No details are yet to hand, but he was extremely ill some eight years ago, and was believed to have a foreign body in one of his lungs. He then made a marvellous recovery, but was subsequently liable to chronic pneumonia, to which it is to be feared that his early death is due. He leaves a widow and two baby children. Mr. Vignoles served in the South African War, and at different stages in his career was with Messrs. Crompton, the British Westinghouse Co., and Messrs. J. G. White & Co.

M. Jean Annibal Lege.—We regret to learn from a correspondent (Mr. H. L. Joly, A.M.I.E.E.) of the death, at the age of 74, of M. Jean Annibal Légé, a French engineer. M. Légé was associated with the electrical industry in the early days in the shops of Breguet and of Mildé, in Paris. "Later, in 1868," says our correspondent, "he came over to London and started where Mr. W. Mackie's works were, in a yard on the east side of Farringdon Road. There he constructed the first tide-predicting machine for the late Lord Kelvin. There also, I believe, he was associated with the earlier types of arc lamps, the Pilsen—and Mr. H. F. Joel will, doubtless, regret to hear of his death. For many years he was the maker of electric signalling lamps, of 'universal dotters,' targets, &c., designed in collaboration with Admiral Sir Percy Scott; in fact, only recently he was working on some electrically-controlled apparatus for the Admiralty. His inventions range from horological mechanism, somewhat lightly mentioned by Lord Grimthorpe in his book, to a dragged torpedo which anticipated the Brennan, and to petrol motors: his name is attached to a goodly array of patents. I may add that in his earlier days—45 odd years ago—he was in contact with Karl Marx and the Internationalists, and that his works have proved a haven of refuge, a stepping-stone to many a man of ability, either Briton or foreigner, just landed in London. From some 18 years of personal contact, I can vouch that no works could be found where a greater harmony reigned between principal and worker."

Mr. David Smith.—We have to announce with much regret the death, on the 10th inst., at the age of 50, of Mr. David Smith, managing director of the United River Plate Telephone Co., Ltd., and also a director of the Constantinople Telephone Co., Ltd. Coming to London from Scotland some 20 years ago, Mr. Smith entered the service of the Electric Construction Co., and later the Electrical Power Storage Co. The late Sir Irving Courtenay, then chairman, impressed by his business capacity, selected him to fill the vacant secretaryship of the United River Plate Telephone Co. in November, 1914. He was subsequently appointed managing director. For some time past his health had caused some anxiety to his friends, though, until quite recently perhaps, none was prepared for a fatal termination. Highly esteemed by his colleagues, he was much respected by all who were brought into business relations with him, and those who were privileged to enjoy his friendship will mourn the loss of a helpful and cheerful companion, whose actions were invariably governed by high principles. Much sympathy will be felt for the widow and two young children.

NEW COMPANIES REGISTERED.

Elbron Metallising Co. (1915), Ltd. (139,823).—This company was registered on March 30th, with a capital of £100 in £1 [illegible], to take over the business carried on by L. G. [illegible] 42, Berners [illegible], as the "Elbron Metallising Co.," and to carry on the business effecting the electrolytic deposit of metals on non-metallic substances, engineers, machinists, coppersmiths, metallurgists, etc. The subscribers (with one share each) are: A C. Crowl, 15, Harringay Gardens, Green Lanes, N., clerk; S. F. Hewett, 33, Stavordale Road, Highbury, N., clerk. Private company. The number of directors is not to be less than two or more than five; the first are L. G. Lewis (permanent director and chairman) and M. Dodds. Registered office: 42, Berners Street, Oxford Street, W.

Radio Electric Lamp Co., Ltd., (139,784).—This company was registered on March 26th, with a capital of £200 in £1 shares, to carry on the business of manufacturers of [illegible] kinds of devices for lighting or heating by electricity, electricians, electrical contractors and engineers, etc. The subscribers (with one share each) are: C. M. Holmquist, 69, Leighton Road, West Ealing, W., electrical engineer; P. Adair, 163, Denmark Hill, S.E., electrical engineer. Private company. The directors are to number not less than two or more than five. C. M. Holmquist signs documents as director. Registered office: 27, Kingly Street, Regent Street, W.

Newcastle West and District Electric Light and Power Co., Ltd. (4,227).—This company was registered in Dublin on March 30th, with a capital of £3,000 in £1 shares (2,000 pref.), to carry on the business of electricians, mechanical engineers, manufacturers and contractors, etc. The subscribers are:—W. Phelan, Newcastle West, [illegible], 25 shares; W. A. Phelan, Galbally, Co. Limerick, merchant and farmer, 25 shares; M. Phelan, Walshestown, Co. Limerick, farmer, 1 share; J. Phelan, Newcastle West, Co. Limerick, manager, 1 share; Mrs. B. Phelan, Newcastle West, Co. Limerick, 25 shares; Mrs. M. Phelan, Newcastle West, Co. Limerick, 25 shares; J. Phelan, Newcastle West, Co. Limerick, shop keeper, 1 share. The first directors are W. Phelan, W. A. Phelan and Mrs. B. Phelan. Qualification, one share. Registered office: South Quay, Newcastle West, Co. Limerick.

Fallolite, Ltd. (139,852).—This company was registered on April 1st, with a capital of £5,000 in 4,850 pref. shares of £1 each and 3,000 ordinary shares of 1s. each, to carry on business as a lighting and heating company, to manufacture and deal in lamps [illegible]ing or heating apparatus and plant, etc. The subscribers (with one share each) are: L. E. Tucker, 5, Noel Road, North Acton, W., clerk; L. P. Potter, Broad Street House, E.C., solicitor. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Solicitor: C. R. Enever, Broad Street House, E.C.

Salsbury Co., Ltd. (139,910).—This company was registered on April 9th, with a capital of £100 in 1s. shares, to take over the business carried on at 11, Long Acre, W.C., as Salsbury Lamps, Ltd., and to carry on the business of manufacturers of and dealers in lamps, electricity, gas, oil and other illuminants, cycle and motors cars, aeroplanes, and hydroplanes, engineers, founders, etc. The subscribers (with one share each) are: W D. Berry, Maxwell House, Arundel Street, Strand, W.C., clerk; Amy A. Dalton, Maxwell House, Arundel Street, Strand, W.C., clerk. Private company. The first directors (to number not less than two or more than seven) are to be appointed [illegible]. Registered office: 11, Long Acre, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Sevenoaks and District Electricity Co., Ltd.—Particulars of £15,000 [illegible] November 2[illegible] 1914 [illegible] 93 (3) of the Companies [illegible] Act, 1908 [illegible] issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

G. H. Turner and Co., Ltd.—Particulars of £500 2nd debentures, [illegible] 1914 [illegible] Companies (Consolidation) Act, 1908, the amount of the present issue being £200. [illegible] and future [illegible]

Derby Lamp Works, Ltd.—Debenture [illegible] March [illegible], 1915, to secure £[illegible] present and future, including uncalled and unpaid capital. Holders: F. W. Greaves, Derby, and J. Rae, 4, Bartholomew Lane, E.C.

Flather and Co., Ltd. [illegible]

Coast Development Corporation, Ltd.—Eight mortgages, dated [illegible] 1915 [illegible] 24th, 1903, securing an amount not exceeding £[illegible] now outstanding), charged on various properties in Felixstowe and Southwold. Holders: F. P. Matthews, Hearn Street, Curtain Road, E.C., and E. J. Bellord, 8, Waterloo Place, Pall Mall, S.W.

Montreal Tramways and Power Co., Ltd.—Particulars of [illegible] 5 per cent. £[illegible] gold notes created March 10th, and secured by [illegible] 1915 filed pursuant to Section 93 (8) of the Companies Consolidation Act 1908, the amount of the present issue being £[illegible] 3s. 3d. ($7,000,000). Property charged: $6,000,000 5 per cent. mortgage debenture stock of Montreal Tramways and Power Co., Ltd., 16,000 shares of common stock of $100 each in Montreal Tramways Co., 59,000 shares of common stock of $100 each and $1,800,000 principal amount of the first mortgage 5 per cent. bonds of the Canadian Light and Power Co., and 1,250 shares capital stock of $100 each in the Montreal Public Service Corporation. Trustees: Bankers' Trust Co. (New York).

London Electric Supply Corporation, Ltd. (24,957).—Capital, £1,300,060 in 200,000 ord. shares of £3 each, 90,000 pref. shares of £5 each, and £250,000 unclassified shares. Return dated March 11th, 1915. 111,000 ord. and 89,840 pref. shares taken up; £3 per share called up on the ord. and £5 per share on the pref. shares, £782,360 paid, including £160 paid on 160 shares forfeited. Mortgages and charges, £487,355.

Pernambuco Tramways and Power Co., Ltd.—Issue on March 9th, 1915, of £25,000 debentures, part of a series of which particulars have already been filed.

Carville Site and Power Co., Ltd.—Issue on March 29th, 1915, of £10,000 debentures, part of a series of which particulars have already been filed.

Telegraph Construction and Maintenance Co., Ltd. (1,147).—Capital, £448,200 in £12 shares. Return dated March 18th, 1915. All shares taken up, £448,200 paid. Mortgages and charges: Nil.

Lamp Manufacturing Co., Ltd. (76,151).—Capital £10,000 in £1 shares. Return dated February 4th, 1915. 5,400 shares taken up; £5,400 paid. Mortgages and charges: £2,500 debentures.

H. F. Foster and Co., Ltd.—Issue on March 31st, 1915, of £550 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Swiss Electrical Companies.

The Société Franco-Suisse pour l'Industrie Electrique, of Geneva, which is closely connected with the group of the Banque de Paris, recently announced that although the electrical undertakings in which the company is interested are developing satisfactorily, some of them had not paid any interest on the loans for 1914. This statement is confirmed by the directors' report for 1914, which records gross receipts from interest, dividends, etc., amounting only to £46,000 as contrasted with £110,000 in 1913. After providing for depreciation and interest on loans of £916,000, the net profits are returned at £4,600, which sum has been carried forward, as compared with £63,000 in 1913, when a distribution at the rate of 5½ per cent. on the ordinary capital was made.

The Swiss. Gesellschaft fur Elektrische Industrie, of Basle, which is a Swiss investment company whose sphere of activity extends to several countries, and which is associated with the group of the Siemens & Halske Co., of Berlin, reports that the company participated in 1914 in the increases in capital made by the Italian Moncenisio Hydraulic Power Co., the Petrograd Electric Lighting Co., and the Siemens Elektrische Betriebe. In addition, an augmentation took place in underwriting holdings by subscribing to new shares in various Italian and Russian companies, whilst a reduction was effected in the case of the Baku Power Co. The gross profits amounted to £193,000, as compared with £180,000 in 1913, and the net profits were £69,300, as against £69,600. A dividend of 7 per cent. has been declared on the share capital of £800,000 as in the preceding year, the total loan capital reaching £2,400,000.

German Electrical Companies.

The Ges. fur Elektrische Hoch und Untergrundbahnen, of Berlin, proposes to pay a dividend of 4½ per cent. for 1914 on the ordinary fully-paid shares of £2,500,000, as against 6 per cent. in the preceding year, and the same rate on shares of £500,000 upon which 25 per cent. has been paid.

The accounts of the *Norddeutsche Seekabelwerke, of Nordenham*, after setting aside £9,100 for depreciation in 1914, as compared with £24,000 in the previous year, are reported to show a loss of £11,000, as contrasted with profits of £37,000 in 1913, on a share capital of £300,000. A year ago the dividend paid was at the rate of 5 per cent.

The Elektrotechnische Fabrik Max Schorch & Co., whose dividend of 12 per cent. for 1914, as against 8 per cent. in 1913, has already been announced, reports that working was fully maintained on the outbreak of the war in so far as workmen were not called up. The company had provided itself with an abundance of raw materials, and was therefore still able to carry out orders at comparatively favourable prices at the end of the year. The net profits amounted to £15,000, as contrasted with £11,000 in 1913. The methods of manufacturing had been accommodated to the prevailing conditions, and at the present time a larger number of workmen is employed than at any other period.

The report of the *Deutsche Kabelwerke A.G., of Berlin-Lichtenberg*, states that the undertaking was well employed during 1914 and earned larger profits than in the preceding year, these amounting to £98,000, as compared with £89,000. After deducting general expenses, taxes and interest charges and placing £14,000 to depreciation, as contrasted with £12,000, there remain net profits of £41,000, as against £34,000 in 1913. It is proposed to set aside for additional depreciation the sum of £11,000 for the machinery account, which will represent the final writing-down to one shilling of all the capital expenditure, except for sites and buildings. The sum of £4,000 has been allocated to the special reserve fund and £3,700 to a war risks' reserve fund, and the balance permits of the payment of a dividend of 6 per cent., as compared with 8 per cent. for 1913.

The directors of the *Sachsenwerk, Licht und Kraft A.G., of Dresden*, state that production and turnover of the workshops, which at the beginning of the war materially exceeded those which prevailed in the corresponding period in 1913, were not very considerably less at the close of 1914 than in the previous twelve months. As gross profits the accounts show the sum of £66,000, as against £55,000 in 1913, and of the former the amount of £19,000 has been applied to depreciation, as compared with £12,500, and £15,000 been placed to the reserve fund, as compared with £18,000. The balance allows of the distribution of a dividend of 8 per cent. as against 7 per cent. in 1913. It is added that the prospects for the current year do not appear unfavourable, as orders for electrical machinery and apparatus are arriving very satisfactorily, whilst the large Army orders render it possible to maintain working in the shops without any restrictions.

Indian Electric Supply and Traction Co., Ltd.—The directors' report for 1914 shows that the surplus on the year's working in Cawnpore, including £187 for interest accrued, was £12,724 (against £10,145 in 1913), and including further interest in England and transfer fees, the credit side of net revenue account shows a total of £12,758; London expenditure was £1,537 (against £1,335 in 1913), and after providing £3,856 for debenture interest a net profit of £7,365 is shown. The amount brought in from last year being £940, there remains £8,305, of which the directors have placed £3,000 to reserve and £687 against the expenses of the debenture issue. They recommend the payment of a dividend of 5 per cent. for the year, which will absorb £3,901, and that the balance of £717 be carried forward. In February, 1914, a further amount of £5,000 of the 6 per cent. debentures was issued, making the total outstanding £65,000, and leaving £10,000 available for future requirements. The increase in London expenditure arises from payment of the directors' commission on the 1913 dividend, and from the low rates of exchange which have ruled during the war. The increase in debenture interest is due to the fresh issue previously referred to. Mr. D. Cruickshank, who has been a director since the formation of the company, has retired owing to ill-health, and the board have appointed in his stead Sir George Henry Sutherland.

Annual meeting: April 22nd.

Guildford Electricity Supply Co., Ltd.—Mr. H. P. Smallpeice presided at the annual meeting held recently. He said that the gross receipts showed an increase of £571. The exceptional circumstances of the latter part of 1914 had, to some extent, modified the profits which they had hoped to make. After referring to the increases which had occurred in oil, waste, water and engine-room stores (£537, as against £279), wages at generating station (£885, as against £680), rates and taxes (£575, as against £405), salaries of engineer, secretary and clerks (£781, as against £519), he said that the result of their appeal against the increased assessment was eminently satisfactory, a considerable reduction having been made. Considering all the circumstances they must congratulate themselves upon being able to write off £1,000 in respect of depreciation, put £250 to reserve, and pay 5 per cent. ordinary dividend, a rate which they had been able to pay for the last five years. In reply to questions, the chairman said that it was unlikely that they would require any additional machinery for the next two or three years. Reference was made to the devotion to their work of the engineer (Mr. H. L. Alderton) and the secretary (Mr. R. H. Piper). Mr. Alderton, in responding, said that the past three months had been exceptionally difficult owing to the shortage of coal, but they had managed to get through.

Winnipeg Electric Railway Co.—The report for 1914 states that the gross earnings amounted to $4,101,302, in comparison with $4,078,694 for the previous year. The expenses of operation, including maintenance, repairs and renewals, amounted to $2,416,209, against $2,252,607. The net earnings from operation therefore amounted to $1,685,093. Of this amount the fixed charges, including 5 per cent. on gross earnings payable to the city of Winnipeg, interest on the funded debt, and other fixed charges, absorbed $690,482, leaving a surplus for the year of $994,611 to be added to the balance brought forward from the previous year of $901,698, making together $1,896,309. The usual quarterly dividends, at the rate of 12 per cent. per annum, were paid, amounting to $1,080,000, leaving a balance at the credit of profit and loss account of $816,309.—*Times.*

Great Northern Telegraph Co., Ltd., of Denmark.—At the general meeting, which will be held at Copenhagen on May 8th, the board will propose to pay a total dividend and bonus of 22 per cent. for the year 1914, including the 5 per cent. already paid, and to transfer to the reserve and pension funds the following amounts, namely, £111,111 and £11,111 respectively.

Sao Paulo Tramway, Light and Power Co., Ltd.—The directors have declared a dividend of 2½ per cent. on the capital stock.

Minehead Electric Supply Co., Ltd. — Mr. H. D. Leather presided at the recent annual meeting. He said that the year was, on the whole, satisfactory. Receipts had increased, but the average price per unit was a little down, owing to increased sales for heating and cooking, &c. The works costs showed a saving, and their cost per unit was decidedly less than that of any other works of similar size. They had added £1,000 to depreciation and reserve, and he hoped that as years went by they would be able to build up a strong reserve fund. He would not prophesy as to the future, but the first quarter of the year showed an improvement on last year. The thanks of the meeting were given to Mr. Swarbrick (the secretary) and the staff.

Provincial Cinematograph Theatres, Ltd.—For the year ended January 31st, 1915, the net trading profit was £67,587, or £6,637 better than last year. The total distribution on the ordinary shares is 15 per cent., as against 20 per cent. for the previous year, and £9,416 is carried forward as compared with £1,131 brought in. Although the profits are larger and the theatres continue to do excellent business, a smaller dividend is declared, as a conservative policy during the continuation of the war is desirable. Two of the directors and 120 employés have joined H.M. Forces. All appointments are being kept open, and allowances made to dependents.

Canadian General Electric, Ltd.—The report for the past year states, says the *Financier*, that the profit amounted to $914,527 (against $2,029,899 in 1913), and, after deducting interest on borrowed capital, $190,957, the net profit before providing for depreciation amounted to $723,571. Dividends paid absorbed $696,741, leaving a surplus for the year of $26 830, to which is added $913,932 undivided profits at December 31st, 1913, and reserve $2 700,000, making the surplus in the balance-sheet $3,640,762. Dividends for the year on the Common stock amounted to 7 per cent., against 7 per cent. and a bonus of 1 per cent. in 1913.

Paignton Electric Light Co., Ltd.—At the annual meeting on Monday it was reported that the net profit on the year was £720. The directors had written off £491, the remaining balance on net revenue account, and were carrying forward £229. Forty-two new consumers had been connected during the year, and the whole of the machinery and plant was reported as working very satisfactorily. The Chairman (Mr. W. J. Ham) said there was every prospect of a dividend next year.

Official Notices re Companies.—The following companies will be struck off the register at the expiration of three months, unless cause is shown to the contrary :—

Automatic Telephone Co.
Globe Code Co.
Illuminated Signs.
New Imperial Electric Lamp Co.
*Sudd Fuel (Suddite) (registered September 4th, 1911).
*West India and Panama Telegraph Co. (registered July 30th, 1869).

*Other companies with these names still exist.

Indo-European Telegraph Co., Ltd.—The directors recommend a dividend for the six months ended December 31st, 1914, of 17s. 6d. per share (making, with the interim dividend already paid, 6 per cent. for the year) and a bonus of 20s. per share, both free of income-tax ; also a special distribution of 15s. per share, free of income-tax, out of interest accrued during the year upon certain investments and advance accounts.

Western Union Telegraph.—The report for 1914 shows gross revenue and income $47,287,388, from which must be deducted operating expenses, including rent for leased plant, taxes, &c., $40,578,750, leaving a net income of $6,708,638. Interest on bonds has absorbed $1,337,243, leaving a balance of $5,371,395.—*Financial Times.*

New Issue.—*The London Electric Supply Corporation, Ltd.*, is inviting its shareholders to subscribe for £100,000 4 per cent. first mortgage debenture stock at 85 per cent., to meet overdrafts in connection with the L.B. and S.C. Railway power contracts and the general advance in demand for industrial supply.

Vickers, Ltd.—The directors have decided to place £250,000 to general reserve and to recommend a final dividend of 1s. 6d. per share (free of income-tax) on the ordinary shares, making 2s. 6d. per share, or 12½ per cent. for the year. £228,876 is carried forward.

Direct United States Cable Co., Ltd.—Final dividend of 2s., less income-tax at 2s. 1d. in the £, payable 30th inst., making, with the three interim dividends already paid, a total distribution of 4 per cent. for the year ended March, 1915.

Monte-Video Telephone Co., Ltd.—Interim dividend for the half-year ended January 31st last at the rate of 6 per cent. per annum on the ordinary shares.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors have declared a dividend on the preference shares at the rate of 4 per cent. per annum for the six months ended March 31st, 1914.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. on the issued ordinary capital stock.

STOCKS AND SHARES.

TUESDAY EVENING.

While a little erratic, the course of the Stock Exchange markets during the past few business days has been upward on the whole. In certain sections, more especially that for rubber shares, business is active and prices are buoyant. In American Rails, too, has occurred such a boomlet as the Stock Exchange has not seen for a year or two. As regards these last, most of the shares now changing hands are being bought by the neutrals on the other side of the Atlantic; and the quaint position will arise of no American shares being good delivery on this side before very long, except such as have been held in physical possession within the United Kingdom for six months past.

Various new issues are being made by companies able to show good cause for raising money at the present time. In the electric lighting market, for instance, a debenture issue has been sanctioned by the Treasury in favour of the London Electric Supply Co. The money is needed in order to cope with the demand from the Brighton Railway for power on the electrified portion of its system, and at 85, this 4 per cent. debenture stock is attractive largely because it is redeemable definitely at par, in 1931, instead of being redeemable at the option of the company, as in so many other cases.

There is a continuance of the demand for first-class telegraph stocks and shares, and the amount of high-grade debenture stocks, for example, which is available to purchasers is almost absurdly small. One indirect result of the Treasury's refusal to sanction new issues *ad lib.* is to force up the quotations of existing securities, because the investor is of such a nature as a rule that he insists upon having a certain stock and no other, and will pay several points more for his particular fancy than for some other stock, equally sound, about which he has less knowledge. The which is natural enough, though it leads occasionally to such anomalies in quotations as the newspapers love to discover and proclaim.

The Home Railway market is still one of the most stagnant in the House. Labour demands remain the chief bugbear of investors who might otherwise be disposed to look with a favourable eye upon the low prices to which most of the erstwhile popular stocks have descended. So far as the electrical issues are concerned, there is next to nothing going on; but within the past few days something like a free market has sprung up in London Electric ordinary shares, which are changing hands pretty freely on the basis of 31s. middle. There are inquiries, too, for the Company's debenture and preference stocks; but the other members of the electric railway group are neglected.

Brazilian Tractions have benefitted substantially from the declaration of another quarterly dividend at the usual rate of 1½ per cent. on the common shares. The price rose 5¼ to 59 last Saturday, came back a dollar or two in consequence of the persistent shrinkage in the Rio exchange, and again recovered. Even at the present price, the yield on the shares works out to about 10¼ per cent. on the money; and it is not a little curious that the sharp rise which has occurred within the past few weeks should have had the result of tempting so few sales of the profit-taking order.

Brazilian Tractions have benefited substantially from the land. Sales on behalf of Dutch proprietors are prohibited, under the Treasury regulations; while with respect to the unhappy Belgians, only such realisations are permitted as are certified to be for account of refugees requiring comparatively small sums of money with which to maintain the absolute necessities of life. With these sources of supply of shares thus cut off, and with the market now in strong hands, it may be easily seen how a little demand from fresh buyers has the effect of advancing the price rapidly.

Mexico Tramways Fives are 5 points better, and in spite of apparently discouraging news from the country, most Mexican securities have advanced this week, several of the railway stocks securing big rises.

In view of the more settled conditions of Stock Exchange markets, it has been decided to resume in a limited degree the particulars which used to be given here, before war broke out, in regard to the yields obtainable from securities quoted in our lists. The argument against such a course is that many quotations are still somewhat nominal, and that yields worked out upon nominal prices might here and there be deemed misleading. In a way, of course, this argument applied even before the war, for in those days not all the stocks were to be sold, while certain others could not be bought, and this condition of affairs varied from week to week. Weighing pros and cons, however, the present seems to be opportune for re-establishment of tables of yields, and we accordingly add these figures to our lists of prices. For correction of what error may have crept into the figures we shall be grateful—which invitation, by the way, is not so much a confession of carelessness in compilation as an acknowledgment that the most painstaking efforts are not infallible in their results.

With which apologia in advance, we set out the usual list of representative securities, from these are eliminated the mid-July prices, which seem to have less practical interest than the yields obtainable at current levels. At the same time, it may be added that, should any reader wish to know the pre-war price of any electrical issue, a post-card inquiry will be answered with pleasure :—

Home Electricity Companies.

	Dividend, 1914.	April 13, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	8¼	—	£6 1 8
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4½	—	5 11 1
do. do. do. 4½ Pref. ..	4½	4⅛	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	14½	—	6 4 2
do. do. 6 per cent. Pref. ..	6	12½ xd	—	4 16 0
do. do. 5 Deb.	5	112	—	4 9 3
do. do. 4½ Deb.	4½	98	—	4 11 10
County of London	7	11⅜ xd	—	6 3 1
do. do. 6 per cent. Pref. ..	6	11⅜	+ ⅛	5 5 6
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	97	—	4 12 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1¾	—	6 18 0
do. do. 6 per cent. Pref. ..	6	5	—	6 0 0
do. do. 4 Deb.	[illegible]	87	—	4 12 0
Metropolitan	3½	[illegible]	—	5 16 8
do. 4½ per cent. Pref. ..	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—2	4 15 9
do. 3½ Deb.	3½	80	—	4 7 6
St. James' and Pall Mall	10	[illegible]	— ½	6 5 0
do. do. do. 7 per cent. Pref.	7	6⅜	—	5 9 10
do. do. do. 3½ Deb.	3½	80	—	[illegible] 7 6
South London	5	8	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7½	—	6 0 0
do. 4½ Pref.	4½	4⅞	—	4 12 4

Telegraphs and Telephones.

	Dividend, 1914.	April 13, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	104¼	+ ½	5 15 0
do. Def.	1½	22	+ ¼	6 16 4
Chile Telephone	8	6⅝	—	6 0 9
Cuba Sub. Ord.	5½	8¾	—	6 5 9
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	13	—	5 7 8
do. 4 Deb.	4	92	—	4 7 0
Eastern Tel. Ord...	7	134	+2	5 4 6
do. 3½ Pref.	3½	73½	—	4 15 3
do. 4 Deb.	4	93	—	4 7 0
Globe Tel. and T. Ord.	6	11½	+ ¼	5 4 4
do. Pref.	6	12	—	5 0 0
Gt. Northern Tel.	20	29	—	6 18 0
Indo-European	65/-	51	—	6 7 6
Marconi	20	1⅞	—	10 13 4
New York Tel. 4½..	4½	99½	—	4 10 8
Oriental Telephone Ord.	10	[illegible]	—	6 0 0
do. Pref.	6	1 3/16	—	5 1 1
Tel. Egypt Deb.	4½	88½	—	5 1 8
United R. Plate Tel.	8	6¼	+ ¼	6 8 0
do. Pref.	5	5	—	5 0 0
West India and Pan.	1¼	1¼	+ 5/32	5 0 0
Western Telegraph	7	13⅜	—	5 4 8
do. 4 Deb.	4	93	—	4 6 0

Home Rails.

	Dividend, 1914.	April 13, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented ..	4	77	—	5 4 0
Metropolitan	1¼	29⅛	+ ½	4 4 9
do. District	Nil	17¼	+ ¼	Nil
Underground Electric Ordinary ..	Nil	1 3/16	—	Nil
do. do. "A"	Nil	5/6	—	Nil
do. do. Income ..	6	81½	—	7 7 3

Foreign Trams, &c.

	Dividend, 1914.	April 13, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref. ..	5½	4¼	—	6 9 5
do. 2nd Pref.	5½	3⅞	—	7 2 0
do. 4 Deb.	4	84	—	4 15 3
do. 4½ Deb.	4½	90	—	5 0 0
do. 5 Deb.	5	89	+1	5 12 4
Brazil Tractions	6	59	+ 5½	10 3 4
Bombay Electric Pref.	6	10⅜	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	80	—	Nil
do. 5 per cent. Bonds ..	Nil	50	+5	Nil
do. 6 per cent. Bonds ..	Nil	80	—	Nil
Adelaide Sup. 6 per cent. Pref. ..	6	5¼	—	5 14 3
do. 5 Deb.	5	108	—	4 17 1

Manufacturing Companies.

	Dividend, 1914.	April 13, 1915.	Rise or fall this week.	Yield p.c.
British Westinghouse Pref.	7½	2	—	7 10 0
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	99 xd	—	6 1 3
Callenders	15	12	—	8 6 8
do. 5 Pref...	5	4⅞	—	5 2 7
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	3 3/16	—	4 14 1
Edison & Swan, £3 pd.	Nil	14/6	—	Nil
do. do. fully paid	Nil	2⅛	—	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	5	13/6	—2d.	7 5 6
do. do. Pref.	7	1	—	7 0 6
Gen. Elec. Pref.	6	10	—	6 0 0
Henleys	20	14½	—	6 18 0
do. 4½ Pref.	4½	4⅛	—	4 14 4
do. 4½ Deb.	4½	97	—	4 14 9
India-Rubber	5	9⅛	— ⅛	5 9 7
Telegraph Con.	20	[illegible]	—	5 8 6

This week's dividend declarations in the Telegraph market have had no effect upon prices, but it is satisfactory to find the Direct United States Company paying the usual 4 per cent. on its ordinary shares, while the Indo-European declares the regular 6 per cent. dividend, 20s. bonus, and 17s. 6d. special distribution, bringing the whole amount up to the usual payment. Prices are firm, and there are improvements in half-a-dozen of the leading shares. Marconis went back to 1 13/16, recovering, however, to 1⅞ buyers. American Marconis have sympathised with the strength of the American railroad market, and are up to half-a-guinea, though Canadians lag behind at just half this price.

The Manufacturing group is steady, with a good deal of business doing without alteration of prices. The Potteries Electric Traction Co. has declared a dividend of 2½ per cent. on its ordinary shares. The rubber market is still very active, although the rush of last week has subsided to a slight extent. Stock Exchange men engaged in this market find their hands full of work—much of it unremunerative, in consequence of the low prices of shares and the trifling brokerage chargeable, though the amount of work involved is actually more than would be the case in higher-priced stocks. Prices on the whole are keeping extremely firm; and with America a more ready buyer of rubber, there is nothing unreasonable in the assumption that the produce may further improve in price. The Armament group has been favourably affected by the declaration of a dividend on Vickers, making 12½ per cent. for the year, the same as that in the previous twelvemonth. At the present price, Vickers pay 7¼ per cent. on the money.

The Stock Exchange has issued its own report within the past few days, showing a decrease in receipts of £25,000, an increase of expenses amounting to £9,800, with a cut in the final dividend from £6 to £3 per share. Electric power, working expenses and maintenance are charged in the accounts at £1,656, a decrease of £330 as compared with the previous year. It has been mentioned here before that the Stock Exchange has an electric light plant of its own, so it may be well imagined that the recent coal crisis gave the managers some anxious moments.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, April 14th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a „ Nitric	„	19/-	..
a „ Oxalic	per lb.	..	..
a „ Sulphuric	per cwt.	..	..
a Ammoniac Sal	„	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	„	£9	..
a Bisulphide of Carbon	„	£21	..
a Borax	„	£22	..
a Copper Sulphate	„	£29	..
a Lead, Nitrate	„	£35	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	6d.	..
a Potash, Caustic (88/90 %) ..	per ton	..	..
a „ Chlorate	per lb.	1/6	..
a „ Perchlorate	„	1/6	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers ..	„	£11 10	..
a „ Recovered	„	£8	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %) ..	„	£10 2 6	..
a „ Chlorate	per lb.	10¼d.	..
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks ..	per lb.	8½d.	..
METALS, &c.			
Aluminium Ingots, in ton lots ..	per ton	£90	..
„ Wire, in ton lots (1 to 14 S.W.G.)	„	£120	..
b „ Sheet, in ton lots ..	„	£120	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	10d.	½d. inc.
c „ Tube (brazed)	„	1/-	1d. inc.
c „ „ (solid drawn) ..	„	10¾d.	¼d. inc.
c „ Wire, basis	„	10¾d.	¾d. inc.
Copper Tubes (brazed)	„	1/0½	½d. inc.
c „ „ (solid drawn) ..	„	1/0½	½d. inc.
g „ Bars (best selected) ..	per ton	£94	£4 inc.
g „ Sheet	„	£94	£4 inc.
g „ Rod	„	£94	£4 inc.
d „ (Electrolytic) Bars ..	„	£80	£3 inc.
d „ „ Sheets ..	„	£98	£3 inc.
d „ „ Rods ..	„	£86	£3 inc.
d „ „ H.C. Wire	per lb.	10¼d.	⅜d. inc.
f Ebonite Rod	„	3/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1/8	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/7	1½d. inc.
l Iron Pig (Cleveland warrants) ..	per ton	67/-	3/5 inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£18	..
g Lead, English Pig	„	£21 15	£2 5 dec.
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£12 to £12 5	..
e Mica (in original cases) small ..	per lb.	4d. to 2/6	..
e „ „ „ medium	„	3/- to 5/-	..
e „ „ „ large ..	„	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/2 to 1/3½	..
p „ „ rolled strip & sheet	„	1/3½ to 1/6½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£70	..
g Tin, Block (English)	„	£172	£3 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/8	2d. inc.
p White Anti-friction Metals ..	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

THE FRENCH ELECTRICAL ENGINEERING INDUSTRY AND ITS FUTURE.

At a recent meeting of the Société d'Encouragement de l'Industrie Nationale, held in Paris, an instructive address was given by M. Hillairet, on the capability of France to meet the demand for electrical machinery and material. The paper was accompanied by a number of statistical tables, some of which are reproduced herewith.

Dealing first with that relating to the importation of electrical material into France, it may be noted that, although less than in 1912, France still makes relatively large purchases of carbons; these have hitherto mainly come from Germany and Austria, and are chiefly intended for arc lamps; the decline that has taken place in the importation is principally due to the increasing popularity of metal-filament lamps. Great Britain and even America have, it was pointed out, also hitherto procured part of their requirements in arc-lamp carbons from Germany, largely owing to the fact that they have been obtainable at lower figures than those demanded for the home-produced goods. M. Hillairet considers that, as regards arc lamp carbons, the four or five French works producing them could not only meet the German competition but even overcome it, were they to organise their establishments on a truly industrial and economic basis.

French Imports of Electrical Material.

	1913.	1912.	1911.
Carbons for electrical purposes...	£42 640	£46,080	£26,360
Incandescent lamps—carbon filaments...	2,000	5,000	16,960
,, Metal-filaments	87,440	135,760	130,920
,, Unmounted filaments ...	14,280	240	240
Dynamos	382,330	353,320	370,720
Electrical and electro-technical machinery and apparatus ...	700,200	677,600	573,380
Dynamo parts	440	2,360	5,720
Insulated wires and cables ...	65,200	24,010	23,120
Armatures and detached parts of same	184,480	150,080	122,240
Arc lamps and parts of same ...	3,200	5,000	7,320
Magnets	13,120	8,160	6,680
Accumulators and parts of same	7,160	10,600	9,440
Dry batteries	5,689	32,160	1,120

As will be seen, there was a falling-off in the importation of incandescent lamps in 1913. This was due to the fact that several works had been established in France capable of turning out 100,000 tungsten lamps per day, which gave rise, in M. Hillairet's mind, to the hope that by concentrated effort French manufacturers would soon succeed not only in meeting the requirements of the home market but also in building up a foreign trade.

The increase in the importation of armatures and magnets in 1913 is explained by the development of the French automobile industry which is a large user of such parts in connection with the ignition mechanism on petrol cars. As for dry batteries, Germany has inundated the shops, both large and small, throughout France with these in conjunction with small pocket electric lamps.

Passing to the exports of electrical material from France, these for the years 1913, 1912 and 1911 are shown below:—

French Exports of Electrical Material.

	1913.	1912.	1911.
Carbons for electrical and industrial uses	£428 200	£311,140	£210,646
Incandescent lamps	71,520	64,760	68 400
Dynamos and transformers ...	164,600	119 520	186,720
Electrical apparatus	583,480	122,960	369,280
Dynamo parts	40	120	280
Armatures and component parts	98,400	131,360	110,880
Insulated wires and cables ...	136 640	118,200	142,200
Arc lamps	11,920	43,480	123,040
Magnets	160	40	40
Accumulators and parts of same	20,920	23 560	16,760

Resulting, no doubt, from the growing demand for electrodes for electrotechnical purposes, the exports of carbons from France have shown a steadily expanding tendency. In the case of the insulated wire and cable industry, the trade showed an improvement over 1912, although the export total recorded in 1911 was not reached. The decrease in arc lamp shipments finds its explanation in the increasing favour that is being shown towards high-intensity low-consumption metal-filament lamps. It is unnecessary to consider the tables further, as, after all, figures relating to imports and exports have only a relative value. M. Hillairet endeavoured to supplement them by an estimate, or rather an under-estimate, as he termed it, of the annual production of the French electrical industry, his figures being as follows:—

Dynamos, transformers, &c.	£2,664,000
Electric lamps and fittings	2,680,000
Electric wires, cables and materials for mains	1,600,000
Telegraph, telephone and electrical measuring instruments	1,040,000
Accumulators, primary batteries, insulators and miscellaneous material	856,000
	£8,840,000

In M. Hillairet's opinion these figures show that, with a full determination, combined with suitable action, some form of common objective between manufacturers, a wide view of commercial opportunities, a desire to meet the wishes and requirements of consumers, and with suitable endeavours to educate and instruct the latter in modern applications of electricity, French electrical material would not only be more widely used at home, but would find its way into foreign markets, both those near at hand and distant. In the lecturer's opinion France is already in possession of all the elements necessary for such an industrial development. Thirty years ago, at the outset of important applications of electricity, the position was vastly different—skilled labour was not available; raw material was not readily forthcoming; dynamo castings and armatures were made of cast-iron; the correct conditions of their use were not known: and the available steels varied greatly in their carbon content. To-day, thanks, to a large extent, to the Robert process, the progress in steel manufacture at the Creusot and Chatillon-Commentry and other works has been such that it is possible to obtain steel plates and sheets of a definite and exactly regular thickness, and precise composition and quality. The losses due to Foucault currents and hysteresis can be accurately determined and verified by actual tests. Wire mills and cable works are able to turn out material that will meet the most stringent specifications. In a word, electrical engineers now work in a well-explored field that leaves little or no scope for unexpected happenings.

France, indeed, the author claimed, now possesses everything necessary to permit of the extension and development of the electrical engineering industry in the country. He even anticipated the statement which is usually advanced, that the cost of skilled labour in France is higher than in other countries, by pointing out that this was not so serious as it was usually represented, it being only, comparing one of the largest works in France with the labour cost in Germany, the difference between the pfennig and the centime.

To make this clear, it may be stated that 1 pfennig is equal to, approximately, 1·2 centime, and that our shilling is equal to about 104 pfennigs or 125 centimes.

According to M. Hillairet, this difference can be disregarded, as, in his opinion, the cost of labour is the least important of the elements that constitute cost of production, his estimate of this being:—Labour, 20 per cent., raw material, from 50 to 60 per cent., and general expenses, from 20 to 30 per cent.

What the lecturer considered a much more important matter was the impetus that the improvement in technical methods was giving to practical applications of electricity. Originally, electrical engineering work was carried on very much in an empirical rule-of-thumb fashion, which has been largely overcome, and M. Hillairet looks forward, in the not far distant future, to seeing technical education included in the curriculum of French Universities.

The first electro-technical institute on French lines was that which, thanks to the liberality of M. Montefiore Levy, was established in Liège (Belgium), and at the head of which is M. Eric Gerard, whose teaching has had very valuable and far-reaching results, his students coming from all countries. The Liège Institute has, as a matter of fact, served as the model for those that have since been started in France:—The Ecole Centrale, the electrotechnical schools at Grenoble, Lille and Nancy, the Laboratory and the Ecole Supérieure d'Electricité, of Paris, and the Ecole de Physique et de Chimie. It is from these schools that the French electrical engineering industry is receiving a constant stream of professional recruits.

Capital, raw material, skilled workmen and managers, and commercial leaders—France is now well supplied in all these sections of the problem. The concentration of each of these elements in a common effort should, he considers, give the French electrical engineering industry a prominent position in the world's markets.

Commenting on M. Hillairet's address, M. Dieudonné, in *La Lumière Electrique*, draws attention to some points in connection with which France is not on a level with Germany, which country has hitherto proved the principal competitor in this industry. The support given to new undertakings by the banks in Germany is superior to that in France; the German patent laws, too, are better, while, from the point of view of commercialism and salesmanship, the Germans have shown that they have nothing to learn from other countries, but in this department set an example which could be advantageously followed in France. The success of German electrical engineering concerns, in M. Dieudonné's opinion, is due more to active commercial enterprise than to superior technical knowledge and skill. Indeed, he does not consider that the latter is up to the French level; it may be more sectionised and specialised in Germany, but while he is not an advocate of too wide a course of training, he holds the view that too much specialising in one branch will eventually lead to a drying-up of the springs of reasoning and observation, and so hinder technical progress.

Turning to another aspect of the subject, M. Dieudonné points out that on the termination of the war, French electrical engineers will have an excellent opportunity of demonstrating that they are in a position to cope with the demands that are sure to be made upon them to replace the central stations and other electrical installations that have been damaged or destroyed during the hostilities with model plants, constructed in accordance with carefully-prepared designs and plans, and equipped with the most up-to-date machinery.

REVIEWS.

The Electron Theory of Matter. By Prof. O. W. Richardson. Cambridge: University Press. Price 18s. net.

There are two kinds of physicists, practical and theoretical, but there is, or should be, only one kind of engineer, the practical. That is to say, the practical and theoretical are not distinct, as they may be in physics. So that the engineer is always on the look-out when he reads a book such as this one, which deals chiefly with the theory of its subject, carefully to pick out and lay to one side what he considers the more or less hypothetical portions, and to take a firm grip of those parts which promise help or advantages in actual application. What the future may bring forth to the practical man out of the mysteries of atomic astronomy is problematical, but this much can be said with certainty, that there are vast reservoirs of latent energy locked up in atomic structures, and these structures also hold secrets concerning the origin of electricity, gravitation and matter. And it seems impossible, in view of such certainties, that the engineer of to-day can afford to pass by, without trying to sieve all that is worth having from the labours of those engaged in this department of knowledge and other allied branches of pure science.

Therefore this important work by Prof. Richardson, while it contains too much of the hypothetical and theoretical for most practical men, yet also contains much that is of interest to him.

It is based upon a course of lectures delivered to graduate students at Princeton University. It is, therefore, not an elementary book, and is thus of little use to those whose knowledge of the facts of radioactivity is of a more or less rudimentary nature. Nor is it experimental in character, for it endeavours to deal with known quantities and to amplify and extend them by the tools of mathematics. The writer in general tries to indicate the extent to which the fundamental facts of physical science may be co-ordinated by means of the conception of the electron and the laws of electrodynamics; and with this purpose in view, in consideration of the immense field covered by the subject, he has chosen for the topics to be discussed those which seem of most importance and interest at the present time. References to scientific papers and other works are given wherever necessary.

A considerable portion of the book is occupied by a treatment of the more elementary matters, this treatment, however, being mathematical throughout. It opens with a chapter on the origin of the electron theory, and then goes on to consider electric intensity and potential, dielectric media, magnetism, electromagnetism, electromagnetic waves, dispersion, absorption and selective reflection.

In Chapter IX the fundamental equations of the electron theory are taken in hand. Then there is an important chapter on the æther, in which the question whether the æther is at rest in the neighbourhood of moving bodies is discussed, the Michelson and Morley experiment being described with its negative result and the speculative hypotheses to explain this result. The author mentions that there is no experimental evidence of any optical effects arising from the motion of matter relative to æther or to space, and he is therefore tempted to inquire whether it is really necessary to postulate an æther for the propagation of electrical and optical effects. He discusses at length the principle of relativity, and reviews the bearing of the principle on the question of the existence of a luminiferous æther. He arrives at the conclusion that it furnishes no evidence for or against the existence of an æther, and it denies the possibility of determining the motion of such a fluid, supposing it to exist.

The chapter on "Radiation and Temperature" is very complete, and goes well into the mathematics of the subject, including dissertations on Stefan's Law, Wien's Law, the formula of Rayleigh and Jeans, Planck's Law, and so on.

Perhaps one of the most important parts of the book deals with the equilibrium theory of electronic conductors. This subject is brimful of interest and latent possibilities. Much experimental work has been done upon it, but a vast amount more remains to be done. The author takes the few laws which experiment shows to be true, and, assuming that the emission of electrons from elementary and compound substances is a purely thermal effect, sets out to discover what laws such a phenomenon should be expected to obey.

Chapter XXI on the structure of the atom reviews most of what is known about the matter up to date, and it specially deals with the stability of electronic systems under various hypotheses regarding the unknown positive element.

A chapter on "Gravitation," that most elusive of the mysteries of matter, closes the book. The author truly says that, paradoxical though it may seem, it is quite likely that one of the chief difficulties in the way of a physical theory of gravitation lies in the extreme simplicity of known laws of gravitational action, and that any addition to our knowledge of it by experiment is scarcely to be hoped for on account of the smallness of the forces concerned; these are large enough when we deal with the enormous aggregations of matter familiar to astronomy, but they are exceedingly small with masses which can be controlled in the laboratory.—W. J. C.

The Underwar. By A. Gowans Whyte and T. C. Elder. London: The Electrical Press, Ltd. Price 1s. net.

This is "a reasoned statement of the true strategy involved in the 'War upon Germany's Trade,'" and is intended to show, without political or party motive, what measures are necessary in order to organise victory in the commercial campaign as, we hope and believe, it is being organised in the military struggle. That success can never be attained by merely proclaiming, and again proclaiming, commercial warfare is a fact to which we have repeatedly called attention in these pages, and the authors drive it home with forceful argument and literary skill. The keynote of the book is unity of purpose—we had almost said co-operation—but it is something more than is conveyed by that expression; energetic action on the part of the Government in support of the manufacturing industries, with a view to providing security for capital invested in new industries and extensions of existing undertakings, statutory provision to ensure that all public money raised in Great Britain shall be spent in Great Britain, improved methods of salesmanship, and the practical support of the workers and their representatives, are the principal features of the authors' plan of campaign. While their proposals are not new in principle, having been advocated in our own columns, for example, for years, their book provides an admirable review of the present situation and of the requirements of the future, bringing together in a handy form the powerful arguments which have hitherto fallen on deaf ears, and concentrating their collective weight upon the mind of the reader. The question of a protective tariff inevitably crops up in the course of the work, but is dismissed as being at present hopelessly entangled with party politics; there are not wanting signs, however, that even strong upholders of Free Trade are willing, in view of the unprecedented circumstances, to modify their views, and to accept the principle of a special tariff designed to prevent the flooding of our market with German goods at knock-out prices when peace is restored. The fact that the Board of Trade at an early stage vigorously (if inexpertly) embarked upon the commercial war is welcomed as an indication that the policy of *laissez faire* with regard to British manufactures has been abandoned, and we may add that the decision of the Government to provide capital for the establishment of dye manufactories in this country marks a new era in this respect. We hope the book will be widely read, and will stimulate its readers to be up and doing—not merely "killing Kruger" with their mouths.

Electrical Practice in Collieries. By Daniel Burns, M.Inst.M.E. London: Chas. Griffin & Co., Ltd. Price 7s. 6d. net.

That there is a demand for a practical treatise dealing with the very important question of electrical engineering in mines is evidenced by the fact that this book, first published in 1903, is now in its fourth edition, and we quite agree with the author that "the application of electricity to mining operations extends with such rapidity that it is no easy task to keep a text-book in line with growing practice." The work is divided into ten chapters, dealing respectively with units of measurement, &c.; theory of the dynamo; the dynamo; motors; lighting; pumping; haulage; coal cutting; underground conveyors; and miscellaneous matters.

In our review of the last edition we suggested that the electrical portion of the work might with advantage be improved, and we are sorry to note that the suggestion has not been acted upon; in the present edition there are several illustrations of machines of a bygone age which we should like to see replaced by more up-to-date illustrations of representative machines. We think also, in view of the very great importance of the subject, that the question of "earthing" might be more thoroughly dealt with. We can quite imagine a colliery manager or colliery engineer searching for illumination on this point, and not being much wiser after a search in the present work, and we are convinced that few colliery managers or engineers thoroughly understand "earthing." The author himself admits that the "whole question of earthing is . . . a most important one, and must be so regarded by the responsible person, and 'an efficient earth is not so easily obtained in a colliery as many persons imagine'"; with this we thoroughly agree, and, therefore, we question very much whether the author goes far enough when he says "short of a connection to a line of water pipes or a copper plate of considerable area submerged in water, it is difficult to obtain an absolutely reliable and satisfactory set of conditions." We know that both water pipes and submerged copper plates have been used as "earth" in mines, and in either case with disastrous results. The whole subject of earthing should be thoroughly ventilated, especially in a book of this nature. Again, we should hesitate to recommend any colliery manager to install the "lightning arrester" shown in fig. 6, on any overhead system of wiring. The greater part of Chapter III is devoted to the D.C. dynamo, and the three-phase machine is dismissed in about two pages. The illustration on page 56 described as a "consequent" pole type might be better named, and we would point out that "Parson's turbine" should be spelt Parsons; in connection with steam turbines the test "by Prof. Ewing, of Cambridge (which) gave a steam consumption of 21·2 lb. per electrical horse-power-hour" is rather ancient history, and we question whether even a colliery manager would be satisfied with this consumption. The chapter on motors is also weak, very little attention being given to three-phase machines or switchgear. Generally speaking, the work is weak and more or less out of date from an electrical point of view, and deals more with the mechanical application of electricity: on the whole, here it is good, especially in the parts dealing with pumping, haulage, coal-cutting and underground conveyors. But is this what the colliery manager or engineer wants? We venture to think he is in search of a little more insight into constructive details, and the elucidation of the mysteries of three-phase machines, seeing that these are now in fashion at modern collieries. To the student it undoubtedly forms a valuable text-book, and the several worked-out numerical examples and the questions at the end of each chapter lend an added interest. There is room for the work—it is, in fact, badly wanted—the plan of the book is good and very much that is contained in it is good, but we do think that the electrical portion might with advantage be thoroughly revised and rewritten before a further edition is issued.

TELEPHONE TROUBLES IN THE TROPICS.

The following discussion took place at the Institution of Electrical Engineers on Mr. Llewellyn Preece's paper on the above subject, an abstract of which appeared in our issue of April 9th, page 508.

Sir John Gavey said he had had some experience of trouble in 30° or 40° South latitude, where there were heavy storms, which fortunately only had ½-mile front and swept away everything in front of them. Then there was trouble with a bird which built its nest between the cross-arms, and the nest being soaked with moisture caused short-circuits. To overcome this trouble an arrangement of vertical wires was introduced between the arms which obstructed the entrance to the nest. Spiders were also troublesome; there were innumerable small spiders whose webs swept across the wires from pole to pole and caused short-circuits. It had been suggested that they should be swept off, but the mileage ran into thousands. Five species of beetle in the Argentine perforated the lead covering of cables to lay eggs, but did not go into the paper. The author favoured filling joints with compound, which was common in the States, but not in England or South America. it was almost impossible to get an insulating material to expand in unison with the lead, and there was the danger of moisture entering. As regarded staff, the loquacity of the South American, who would exchange compliments with the operators, seriously delayed the services.

Mr. W. Cook said it was difficult to discuss the relative merits of apparatus unless the conditions were specified. He could not understand the author's attitude to the common-battery system—no satisfactory service could be given when the insulation was so low that the common-battery system could not be used; the author was also not quite right in regard to Mahommedan women operators, as these were employed in Constantinople, the only concession to them being a head covering. He was glad to see the remarks in regard to filled joints, as money was often lost by pumping air into the cable, &c.; poles made from discarded steel rails gave satisfactory results, and he had used concrete poles costing half as much as Hamilton poles. The first cost of covered work was often more than compensated for by decreased maintenance. As regarded humidity, some Scarborough records appeared to be almost as bad as those mentioned; at Falmouth 90 per cent. was recorded regularly in the early mornings of July and August.

Mr. W. Slingo, referring to the author's remarks on the magneto system, said the central-battery system had proved its reliability and utility in service, and if difficulties arose steps should be taken to overcome them. The automatic system seemed the most [illegible] priate in a place where there was language difficulty, and it was not more difficult to maintain than the common-battery system. Enamelled coils were being tried by the G.P.O., after being subjected to rigorous tests. An automatic telephone for 700 lines had been installed at Simla, and found more popular and rapid in service than the old system, and this was to be extended.

Mr. J. E. Kingsbury said he had thought that experience with enamelled wire would have enabled some troubles to be got over; as an instance, he cited the case of wool-covering of a multiple switchboard cable, which was attacked by moths. He agreed with the author's remarks on solid joints; air drying-out was something of a luxury. Trouble arose at the joints, and the solid joint appeared to get over the difficulty. The author appeared to be taking the risk of allowing primitive man to put up with primitive appliances.

Mr. Weightman said troubles due to heat and humidity were most felt when such conditions were practically constant throughout the year. Red fibre, leather and uralite used in home practice were quite unsuitable in the tropics, although there were areas in the tropics which were infinitely better from the insulation point of view than the temperate zone.

Mr. Laidlaw remarked that the paper covered two-thirds of the globe. Did the author mean that the type of equipment mentioned would be suitable for all localities? Possibly teak was the best wood for use in the tropics. If wires were run through trees, it was possible that the common-battery would not work at all, but even with poor insulation some sort of service could be obtained with a mageto system; each case must be decided on its merits. The author did not prove that enamelled wire was wrong, and probably in moist places the coils could be sealed up and so protected.

Mr. A. J. Stubbs had always been impressed with the difficulty of getting an accurate idea of the troubles of engineers in the Colonies and tropics. If they would carefully report their difficulties, engineers at home could probably assist them. He believed it was usual in the States to have special magneto extensions for long distances: they did not attempt to use the common-battery system for that purpose.

Mr. McAlpine said lines which followed tropical coasts, subject to monsoons, were encrusted with salt all the time. Iron had to be replaced by teak, and owing to the rapid corrosion of iron wire 400-lb. copper-wire was used. Copper-clad steel wire had been tried, but its life was less than three months. Washing was the best way to get rid of the salt; oiling seemed to increase the trouble. In a hill country other extremes were met; it was very dry, but owing to the contour of the land long spans were necessary, eight poles to the mile, and a wire spacing of 24 in. vertically. Transportation facilities affected the type of pole used; he had used Hamilton steel poles, and found old railway rail poles cheaper locally than any others. One difficulty in the introduction of new things in native country was the local jealousy; if a new instrument was installed for a subscriber all the other instruments developed mysterious faults and would have to be replaced. He had tried many varieties of enamelled wire, and in every case it broke down in a few weeks.

Mr. H. Laws Webb said it was idle to discuss the type of central office equipment if they did not know the number of subscribers and probable growth of the system. Troubles were due to the climate, to neglect of standard practice, and to the subordinate position of the telephone, owing to its being under Government control. Many difficulties would be overcome by using aerial cable, and this was nearly as cheap in the case of several wires as open lines. Steel cased instruments might be used. He asked whether the author had noted rough usage of the apparatus, and suggested that ignorance of the subscribers was due to neglect in not educating them. In Constantinople they were rather surprised to find that Mahommedan girls had offered to be operators. He believed that glass insulators were largely used in the States.

Mr. G. H. Nash thought that every engineer in the tropics formed his own opinion because there was no central point of information. There were hundreds of questions involved in design, to which answers were required by the manufacturers.

Mr. Walker considered that microphones should be damp-proof in all cases, as the diaphragms got damp and dull. Aerial cable was eminently suitable for long-distance work, and almost as cheap as open circuits. Oil in insulators got coated with dust, and oil insulators were no better than double-petticoated insulators in India.

Mr. H. Harrison said they were getting over the difficulty of evenly coating enamelled wire, and such wire, silk-coated and impregnated, was being used in telephone instruments with success.

Mr. Semby said he believed in metal casing for instruments, but care had to be used to avoid rust. Fibre, ebonite and hard rubber insulation gave trouble in the tropics; the receiver should have a metal cap; and all pole pieces should be lacquered to prevent rust from touching the diaphragm.

The author, in replying, said the paper referred to really tropical countries, such as Uganda, the Malay States, &c., which were forest regions. In no case were the switchboards really comparable in size with English boards; the largest would be for 1,500 lines, and the usual size—say, 500 or 600 lines. This made all the difference in the choice of system, and perhaps this condition had not been made clear. Mr. Alexander Siemens said that for the Indo-European telegraph lines iron poles were used, and to protect them from wandering camels a trench was dug round the base of the pole and the excavated material heaped up in conical form round the pole in the centre; this practice was also followed in the Soudan.

CORRECTING ERRORS IN POWER MEASUREMENT BY THE TWO-WATTMETER METHOD.

The extensive and ever-extending use of three-phase current renders its correct measurement by commercial instruments a matter of great importance. Improvements in wattmeter and watt-hour meter construction and testing have been such that errors of instrument-law and calibration are easily kept within narrow limits prescribed by statute and the needs of practice. Where, as is usually the case, a two-element meter is used to measure three-phase power by the two-wattmeter method, incorrect connections are frequently made, and these, if undetected, introduce errors far in excess of those dependent on inherent defects in the instrument itself. The increasing energy demand of industrial consumers and the extending use of high-tension distribution combine to increase the risk of mistaken connections, for both current and pressure transformers are used between high-tension, heavy current networks and three-phase meters, and in a circuit, as shown in fig. 1, there are no fewer than 27 possible permutations of meter connections, only one of which yields accurate readings under all conditions. As shown by the subjoined table and the curves in fig. 3, there are 10 permutations which yield correct meter readings at one particular power factor, and the danger is that a wireman who makes some mistake in connections, evident by the faulty running of the meter, may then commence to interchange leads (instead of tracing all leads back to the mains), and thus hit on a permutation which gives approximately or even absolutely correct readings (within the limits of instrument error) at the particular power factor of the load tested, while leading to very erroneous readings at other power factors. The connections

Permutation.	Pressure phase connected to terminal (fig. 1). a b c	Direction of flow in current coil. Phase. a	 Phase. b	Ratio R (actual/true reading).
I — 1		+	+	1
— 2	a b c	—	+	$-(\tan\phi)/\sqrt{3}$
— 3		+	—	$+(\tan\phi)/\sqrt{3}$
— 4		—		-1
5	— b c	+	+	$\frac{1}{2}-(\tan\phi)/2\sqrt{3}$
6	a — c	+	+	$\frac{1}{2}+(\tan\phi)/2\sqrt{3}$
— 7	a b —	+	+	$\frac{1}{2}$
II — 1		+	+	0
2	b a c	—	+	$-2(\tan\phi)/\sqrt{3}$
— 3		+	—	$+2(\tan\phi)/\sqrt{3}$
— 4		—	—	0
III — 1		+	+	0
— 2	c b a	—	+	$1+(\tan\phi)/\sqrt{3}$
— 3		+	—	$-(1+(\tan\phi)/\sqrt{3})$
— 4		—	—	0
IV — 1		+	+	0
— 2	a c b	—	+	$-(1-(\tan\phi)/\sqrt{3})$
— 3		+	—	$1-(\tan\phi)/\sqrt{3}$
— 4		—	—	0
V — 1		+	+	$-(\frac{1}{2}+(\tan\phi)\sqrt{3}/2)$
— 2	c a b	—	+	$-(\frac{1}{2}-(\tan\phi)/2\sqrt{3})$
— 3		+	—	$\frac{1}{2}-(\tan\phi)/2\sqrt{3}$
— 4		—	—	$\frac{1}{2}+(\tan\phi)\sqrt{3}/2$
VI — 1		+	+	$-(\frac{1}{2}-(\tan\phi)\sqrt{3}/2)$
— 2	b c a	—	+	$\frac{1}{2}+(\tan\phi)/2\sqrt{3}$
— 3		+	—	$-(\frac{1}{2}+(\tan\phi)/2\sqrt{3})$
— 4		—	—	$\frac{1}{2}-(\tan\phi)\sqrt{3}/2$

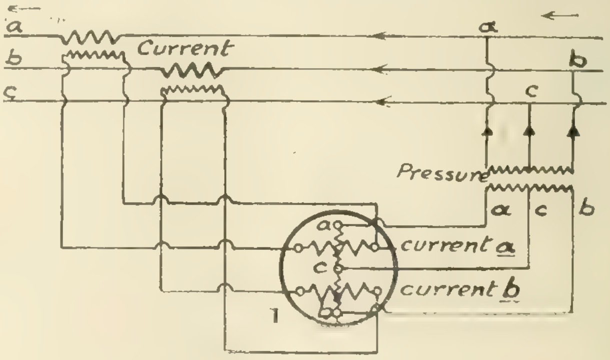


Fig. 1.

shown in fig. 1, and these alone, are correct for a double-element three-phase meter using current and pressure transformers. With correct pressure connections, and with each of the five incorrect permutations of pressure connections shown in fig. 2 (II—VI), there are four possible arrangements of the current connections, viz. : Correct ; phase *a* reversed ; phase *b* reversed ; both *a* and *b* reversed. In the table and fig. 3, those three cases are also taken into consideration in which, the pressure connections being correct, each pressure phase in turn is broken.

With correct meter connections, and assuming (what is sensibly the case in practice) that load and pressure are balanced between phases, the meter reading is proportional to the product $\sqrt{3}\,\text{I}\,\text{E}\cos\phi$ —where I and E = effective current and pressure per phase and $\cos\phi$ = power factor of demand. The ratio R of the actual reading to the true reading in each of the 27 permutations specified above, is shown in the foregoing table.* In columns 2, 3 and 4 are shown which pressure phases are actually connected to the terminals which should carry phases *a*, *b*, *c*.

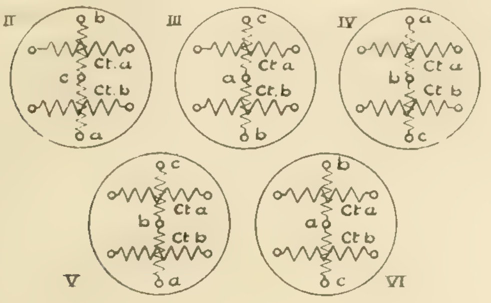


FIG. 2.

Columns 5 and 6 indicate the direction of current flow in current coils, phase *a* and *b*, + denoting correct and — denoting reversed flow.

Values of R for various values of $\cos\phi$ are shown by the curves in fig. 3, the key numerals attached to which correspond to those in the above table. If the meter reading is at all times zero (as in permutation II, III, IV, cases 1 and 4), or if the reading is at all times negative (as in cases I—2, 4 ; II—2 ; III—3 ; V—1 ; and VI—3), the fact that the meter connections are wrong is at once obvious, but there remain 14 permutations under which the meter runs in the correct direction but at incorrect speed. In the four cases I—5, I—7, V—3 and VI—4, the reading is incorrect at all power factors, hence the mistake is at once disclosed by comparing the meter reading with that of a standard instrument. In the 10 remaining cases, however, R = 1 at a certain power factor which is : 0·2 in case V—2 ; 0·28 in case IV—2 ; 0·5 in cases I—3, 6 ; VI—1, 2 ; 0·76 in case II—3 ; 0·87 in case V—4, and 1·0 in cases III—2 and IV—3. At all other power factors the reading differs from that of the standard meter, hence, by testing at say 1·0 and 0·5 power factor, mistaken connections will inevitably be detected.

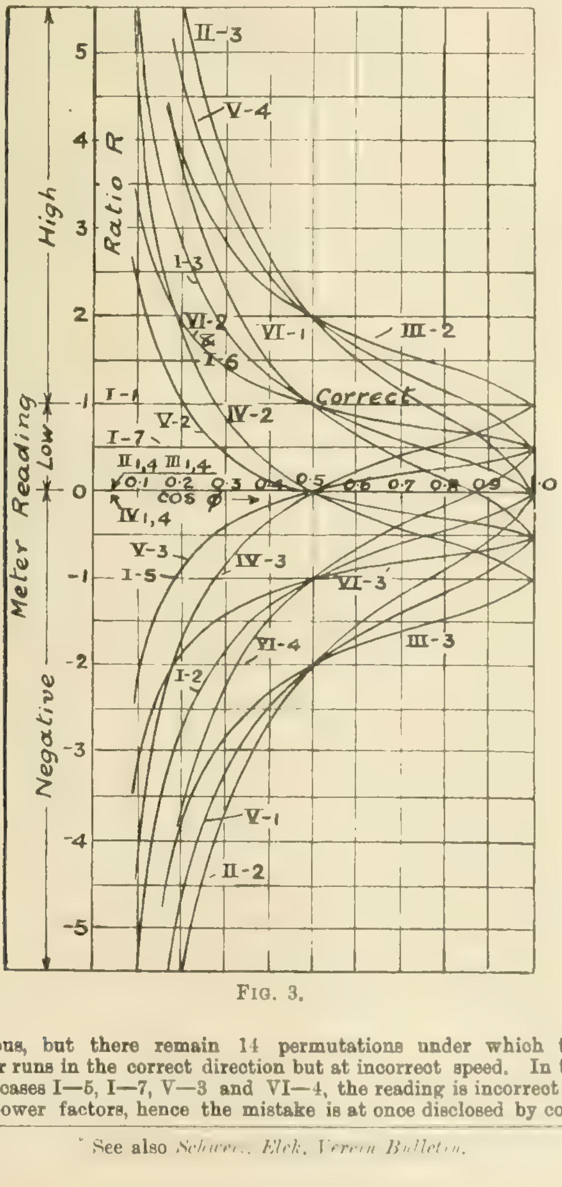


FIG. 3.

When the load power factor is approximately known, the curves in fig. 3 enable at least approximate correction to be made in the actual reading of a meter found to be connected incorrectly after it has been in service for some time. At least the incorrect indication can be made a basis for payment by agreement. In many cases the value of R, during comparison with a standard meter, gives a clue to the mistake made in the connections, but in all cases of doubt the latter must be traced and checked throughout. Mere trials of various interpositions of leads may yield fortuitous and misleading accuracy over a restricted range of power factors.

RUSSIAN CUSTOMS DUTIES ON ELECTROTECHNICAL PRODUCTS AND ON THEIR RAW MATERIALS.

UNTIL now, says an article in the Russian Government Gazette, the Russian electrotechnical industry has mostly used foreign machines, apparatus and materials. Germany has been the principal furnisher of these to Russia owing to her (Germany's) highly developed and intensely specialised industry. For the moment the importation movement from Germany is stopped, and Russia is experiencing a great shortage in many articles to which the country has become accustomed, but the production of which was not effected at all in the country, or was only in the primitive stages. There is a widely spread idea that many of the products of the electrotechnical industry are not produced in Russia because of the existing Customs tariff. Consequently it will be interesting to explain in what degree the action of the existing tariff which was introduced on February 16-29th, 1906, has been effective, whether on the importation of foreign products, chiefly from Germany, or on the corresponding production of such products in Russia.

Taking the electrotechnical industry comprehensively, it must be admitted that some of its branches are firmly established in Russia, and quite satisfactorily supply the demand, whilst others, if established, only partially supply the market, and the balance wanted is made good by a more of less important importation. Of the goods the production of which is firmly established Russian industry, we have—

1. Iron and copper wire, conductors and cables.
2. Electric accumulators.
3. Telephone and telegraph apparatus.
4. Insulating materials, &c.—largely porcelain goods.

Without dwelling on the production of iron wire which is usually employed only for telegraph and telephone lines, and is made exclusively in Russia, it is not without interest to observe the relative extent of the importation and of the inland production of the goods named.

	Imported.		Made in Russia.		Duty. Roubles per pood.	Per cent. of duty to value.
	Poods.	Roubles.	Poods.	Roubles.		
Copper wire ...	19,200	339,000	158,000	1,707,000	7 r. 35 c. 11 r. 85 c.	43
Conductors, various	6,800	318,000	142,000	3,460,000	16 r. 20 c. 17 r. 70 c.	45
Electric cables ...	9,500	101,000	127,000	1,960,000	6 r. 70 c.	50·3
Electric accumulators	1,600	46,000	193,000	1,673,000	9 r.	50·6
Telegraph and telephone apparatus	5,900	178,000	—	4,367,000	9 r.	25·8

The principal materials used in the production of the goods named in the above table are copper, lead, and brass. The duty on copper bars is 5 roubles per pood, and the average price abroad in 1912 was 11 roubles per pood, *i.e.*, 45 per cent. The duty on lead is 70 copecks per pood. The average price of lead abroad was 2 roubles 90 copecks per pood, *i.e.*, the duty equals 25 per cent. of the cost. The duty on brass depends on the composition of its manufacture, and ranges between 5 roubles and 7 roubles 10 copecks per pood ; and it works out at about 45 per cent. of the cost, like the copper duty. The following tables show the duty on the raw material to be about the same as on the finished article per pood :—

	Duty on material.	Per cent. of cost.	Duty on finished product.	Per cent. of cost.
Copper wire...	5 roubles	45	7 r. 35 c.—11 r. 85 c.	43
Conductors, various ...	5 ,,	45	16 r. 20 c.—17 r. 70 c.	45
Electric cables				
Copper ...	5 ,,	45	6 roubles 70 copecks	50·3
Lead ...	70 copecks	25	—	—
Electric accumulators ...	70 ,,	25	9 roubles	50·6
Telegraph and telephone apparatus ...	5 r.—7 r. 10 c.	45	9 roubles	25·8

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* See also *Schweiz. Elek. Verein Bulletin.*

How the furnisher of goods adjust their prices to the cost of corresponding imported goods is shown with regard to copper. The average price of electrolytic copper abroad was 11 roubles per pood. In Russia the price of Russian produced electrolytic copper was 16 roubles per pood; the duty is 5 roubles per pood. Brass again, which is sold only in rods or bars and sheets, is usually dearer than pure copper. Thus, the price of average brass in 1912 was 17 roubles 36 copecks per pood, which, with a duty of 6 roubles per pood, gives us the cost of brass as 11 roubles 36 copecks per pood.

It is obvious that foreign factories have their copper and brass much cheaper than the Russian factories have them, the difference being just the amount of the Customs duty. The conclusion naturally is that we should reduce the duty on the raw material and increase the duty on the finished product in order to encourage home industry.

The foregoing shows the producers of the crude and the finished products to have opposing interests. A high tariff means high prices; but in any case it stimulates the production. Efforts must be directed to establishing a home industry built on raw material of home production. The working of the tariff is shown in connection with copper as follows:—

By the tariff of 1891 copper paid 3 roubles 75 copecks per pood. Whilst the tariff endured—till 1903—the production of copper in Russia increased when the price of copper reached 12 roubles 95 copecks per pood, and decreased as soon as the cost of copper in Russia had to be reduced below this level as a result of reduced prices abroad.

Data on existing Russian copper deposits showed that the production of copper would grow with the price of the metal no lower than that named. The progress of the copper-producing industry in Russia after the introduction of the tariff of 5 roubles per pood in 1906 is seen in the following table:—

Year.	Poods.	Year.	Poods.
1903 ...	764,000	1908	1,033,000
1904 ...	600,000	1909 ...	1,334 000
1905 ...	519,000	1910	1,378,000
1906 ...	571,000	1911 ...	1,564,000
1907 ...	875,000	1912 ...	2,047,000

The quantity of copper imported is much lower than that of the national production; thus in 1911, the copper imported amounted to 447,000 poods, and in 1912 to 429,000 poods.

As to lead, whether for cables or accumulators, it paid 37·5 copecks per pood by the 1891 tariff; but by the 1906 tariff, now in force, it pays 70 copecks per pood. But neither tariff has seriously stimulated the home production of lead. When the tariff was 37·5 copecks per pood the importation of lead rose from 1,880,000 poods in 1900 to 2,899,000 poods in 1903, and fell back to 2,468,000 poods, and rose to 2,879,000 poods, in 1904 and 1905 respectively. Under the 70 copecks per pood duty the importation rose from 1,304,000 pood level, to which it had fallen in 1906, to 3,099,000 poods in 1910, fell to 2,537,000 poods in 1911, rising again to 2,722,000 poods in 1912.

If we remember that in 1912 Russia produced only 82,121 poods of lead, notwithstanding the abundant deposits of lead and silver-lead ore in the country, the ineffectiveness of the duties imposed becomes obvious. It is proposed to raise the import duty to 1 rouble 10 copecks per pood. Further, the Customs duty does not sufficiently protect the finer wires and conductors; so, bearing in mind the prices of raw materials, we arrive at the following Table of duties:—

	Existing duty per pood.	Proposed duty per pood.
Copper-wire from 12 mm. to the smallest gauge	7 r. 35 c.—11 r. 85 c.	8 r.—14 r.
Conductors, various ...	16 r. 20 c.—17 r. 70 c.	16 r. 20 c.—20 r.
Electric cables	6 r. 70 c.	7 r. 10 c.
Electric accumulators ...	9 roubles	14 roubles
Telegraph and telephone apparatus	9 roubles	30 roubles

The consumers' interests in the matter of reduction in price must be found in competition inside the country. The article holds out little hope of lower values for raw materials. But it is different with finished products such as, for example, cables and accumulators. The existing cable works in Russia are syndicated under the name of "Elektroprovod," the leading house being the Russian United Cable Factories, which is the largest cable and conductor-producing concern in Russia. Unfortunately with the lion's share of the business, it cannot be called Russian. It exists on German capital. The production of accumulators is similarly circumstanced. It has been monopolised recently by the Russian Tudor Accumulator Factories—a German concern that dictates the prices of accumulators on the Russian market. Therefore every new accumulator factory is welcomed—such as the Morgulius, of Odessa, and the Recks, of Petrograd. Government orders should be given in preference to Russian—and certainly to non-German—houses.

Another series of electrotechnical goods, the production of which has not been sufficiently established in the country, is listed in the following table. These used to be imported, mostly from Germany, either complete or in parts, to be assembled in Russian factories, founded on German capital.

Respecting dynamo machines, electro-motors and transformers made in Russia, classified particulars have not been received, and in the sum of 12,000,000 roubles are included parts of the respective items and discharge mechanisms. The term "*none*," in the table, means hardly any, if any at all. It has been difficult to estimate an average per cent. of duty for raw materials and finished products. Copper averages 9 per cent. to 16 per cent. in all machines; in transformers it is 20 per cent. to 30 per cent. In view of the numerous other constituents, it becomes almost impossible to estimate the part played by each.

1912.

	Imported. Poods.	Imported. Roubles.	Made in Russia. Poods.	Made in Russia. Roubles.	Duty per pood.	Average per cent. on value.
Dynamo machines and electro-motors of all kinds ..	247,000	5,883,000			8 r. 50 c.	32·9
Electric transformers	25,000	493,000			8 r. 50 c.	38·5
	272,000	6,376,000				
Parts of dynamo machines, electro motors and transformers, armatures, commutators, frames, &c. ..	18,000	360,000	950,000	12,000,00	8 r. 50 c. frames, 12 r. 75 c. armatures and commutators, 17·50 armatures.	36 6
Electric switches, fuses, rheostats, bells, signal fittings, &c. ..	140,000	3,860,000	none	none	9 r.	30 7
Electrical measuring apparatus ..	26,000	1,189,000	none	none	9 r.	27
Electrical incandescent lamps ..	30,000	—	carbon— 2,186 000	335,000	30 r.	30
Units ..	15,500,000	3,860,000	metal— 525,000	192,000	65 r.	

Therefore, the most correct measure of duty is obtained by a comparison of the cost of these goods with that of corresponding foreign, and especially German-made, manufactures. This shows that the existing duty of 8 roubles 50 copecks per pood is sufficient protection for the production of high-power dynamo machines and electromotors, in which cast-iron, iron and steel are largely used, but scarcely protects at all the production of small (20 pood) dynamo machines, electromotors, and transformers; therefore, the duty on these should be increased.

The production of electric switches, keys, fuses, sockets, rheostats, bells, &c., it has proved impossible hitherto to establish in Russia. The duty of 9 roubles per pood is not high enough.

Any production there is of electrical measuring apparatus in Russia is on a very small scale in Petrograd and Warsaw. It is calculated that the cost of production of the simplest types of measuring instruments is about 180 roubles per pood against 150 roubles in Germany; therefore, an import duty of 30 roubles per pood is required on these goods.

There are now two duties on electric incandescent lamps, 30 roubles per pood with carbon filaments, and 65 roubles per pood with metallic filaments. These rates are sufficient, making 6 copecks each on carbon-filament lamps and 13 on metallic.

The writer of the article, Prof. A. Kuznetzoff, here furnishes a table of the before-mentioned goods, showing the importation or protective duty at present levied on them respectively, and the duty that should be levied in order to ensure efficient protection.

	Existing tariff per pood.	Proposed tariff per pood.
Dynamo machines and electric motors—all kinds:—		
Less than 20 poods weight	8 r. 50 c.	12 roubles
Over „ „ „		8 r. 50 c.
Electric transformers		12 roubles
Parts of dynamo machines, electric motors and transformers, armatures ...	17 r. 70 c.	17 r. 70 c.
Armatures and commutators	12 r. 75 c.	12 r. 75 c.
Frames, partly copper:—		
Less than 20 poods weight	8 r. 50 c.	12 roubles
Over „ „ „		8 r. 50 c.
Switches, keys, fuses, lightning conductors, dischargers, sockets, rheostats, insulators, heating apparatus, arc lamps	9 roubles	15 roubles
Electric measuring instruments	9 roubles	30 roubles
Electric incandescent lamps with carbon filaments	30 r. with case 60 r. without case	30 roubles 60 roubles
Electric incandescent lamps with metallic filaments	—	65 r. with case 90 r. without case

The writer concludes his article with the observation that higher duties alone will not necessarily create the desired industries in Russia. If not accompanied by a series of practical measures, which he enumerates, the result, he says, may simply be to make the products dearer in Russia.

Prices Advance.—The Sterling Telephone and Electric Co., Ltd., of 210-212, Tottenham Court Road, London, W., announce an advance of 10 per cent. in most of the prices given in the ninth edition of their catalogue and in current publications.

MAIN-LINE SIGNALLING ON RAILWAYS.

By W. C. ACFIELD.

(*Abstract of paper read before* The Institution of Electrical Engineers *at Birmingham, March* 31*st*, 1915.)

The object of the system of block telegraph signalling is to prevent more than one train being in the section between two block signal-boxes on the same line at the same time, thus providing an adequate interval of space between following trains.

Prior to 1875 the block telegraph system and interlocking of points and signal appliances were worked independently of one another, but a combined lock and block system was introduced which rendered it impossible for a signalman to accept a second train until an electric treadle, operated by the passing of a train over the railway, unlocked the block instrument in the train-on-line position.

There are certain limitations to its adoption, as sufficient elasticity cannot be obtained in cases where passenger, goods, and mineral traffic are concerned. In goods and mineral working it is not necessary to have so large a margin between trains as in passenger-train working.

To enable closer working to be carried out a mechanical arrangement is provided, viz., the cancel key, in the use of which there is unfortunately no check upon the signalman. By injudicious use of this key several serious collisions have occurred. This is the weak spot in a lock and block system.

The treadles in use to-day are of the mercury type, which are far preferable to the old form of rubbing contact. The mercury is contained in a box or chamber, and is set in motion by the deflection of the rail to which the treadle is attached.

The interlocking block is a form of lock and block in use to a large extent on the Midland Railway (which railway it is the author's privilege to serve), and furnishes the necessary elasticity for passenger and goods traffic. The instrument used is known as the rotary block; the handle stands normally vertical in the "blocked position," and to give the "line clear" and "train on line" indications is moved in a clockwise direction. There is a ratchet movement in the instrument to prevent the handle being turned in a reverse direction, and this prevents a signal being given a second time unless the handle has been rotated to both the "line clear" and "train on line" positions.

"Line clear" being given removes the electric lock on the starting signal in the rear section, and "train on line" being given drops the said lock ready to fall into position again when the starting-signal lever in the rear is placed to danger. After "line clear" has been given by the first movement, the handle is then turned to the "train on line" position and becomes locked in that position so that it cannot be moved either forward or backward until a releasing treadle, fixed on the railway inside the home signal, has been operated by the accepted train, after which the handle is free to be turned to its normal and vertical position.

To prevent the possibility of "line clear" being given for a train to approach from the rear section whilst the home signal is at "clear," a lock is provided in the block instrument, and a switch on the home-signal lever, which ensures the home signal being at danger before the handle of the instrument can be turned from the blocked or normal position. With this in combination with rotation mechanical locking on the home and starting, or shunting signals, the signalman is compelled to go through the operations necessary for passing a train through the section, thereby making certain that the starting signal if once lowered must be returned to the danger position before the home signal can be used a second time.

The rotation locking referred to provides that the home signal pulled over and replaced becomes locked until the starting or shunting signals, where the latter exist, have been pulled over and replaced; and upon the completion of this operation the starting signal is once more automatically electrically locked by the advance section, and is only released by "line clear" being given from the advance section as before described.

As it is necessary to provide means whereby the signalman can wipe out one or other of the block indications, press-buttons are provided on the instruments in the advance section and the rear section; and it is only by the co-operation of the two signalmen pressing their respective buttons simultaneously that "line clear" can be cancelled. The action of the two signalmen lifts out the ratchet lock, and enables the handle to be turned in a backward direction to "line blocked." Even this operation cannot be performed unless the starting signal in the rear is at danger, and it thus affords additional safety in working.

The cancelling of "train on line," which may be necessary owing to an on-coming train unexpectedly having to be shunted in the rear section, after permission has been given for it to leave that section, or on account of the treadle having failed to release the block instrument, is quite a different problem. To prevent the cancel being used without a record being made, it is masked by a glass, which has to be broken before the cancel button can be used.

It is the practice now to provide electric repeaters more generally to distant signals, irrespective of the facility with which the latter can be seen, in order to give the signalman an indication of the working of the signal. Home, starting, and other signals are also electrically repeated where they are out of sight of the signalman. These electric repeaters are preferably of the 3-position type, showing "on," "off," and "fault." Where signal lights cannot be seen by the signalman at night-time light indicators, electrically operated on the pyrometer system by the expansion bar placed over the flame of a signal lamp, are also provided in signal-boxes, but are not at the present time generally adopted.

Mr. A. T. Blackall has mentioned a device for interlocking the distant signal with the block telegraph system by making use of the electric repeater circuit; this ensures that the distant signal must have gone to the danger position after the passing of one train and before the acceptance of another.

Train stops for emergency purposes have been suggested by the Board of Trade as a means of arresting trains running past signals at danger. It is comparatively easy to provide them on electrified railways where the speed does not exceed 40 miles per hour, but in the case of steam railways, or even electrified railways where the speed may be anything from 40 to 80 miles per hour, it becomes increasingly difficult to design any appliance of this type that will stand the shock of impact, and at the same time meet with the requirements of express traffic working. No known automatic train-control apparatus of the mechanical type can be considered to be satisfactory.

The author suggests that a cab-signalling device is the solution of the problem; but it is considered undesirable for any indication beyond an audible signal to be given to the driver.

Probably one of the most important appliances introduced into railway signalling in the past few years is the system of track-circuiting the lines of railways, the use of which has enabled innumerable difficulties and problems to be solved, and gives very adequate protection to traffic working generally. It is used not only in automatic and power signalling, but also with very great advantage in manual systems of interlocking, by which it is possible not only to utilise the running lines to perform the indication of the presence of trains and vehicles, but to safeguard such trains by operating electric locking on signals, and also to operate electrically signals in automatic and semi-automatic systems on such sections of railways over which track circuit extends.

The essential feature is a section of track insulated at each end from adjoining sections of the track, each rail in the section being connected together by bond wires for the purpose of making a continuous conductor from one end of the section to the other. At one end of the insulated track section a battery is provided, the positive terminal being connected to one rail and the negative terminal to the other. At the entering end of the section a relay is connected to the rails in a similar manner; thus a path is given from the battery along the rails on one side, through the relay and back through the rails on the opposite side to the battery, and by such connection the relay is continuously energised so long as the track is unoccupied. The presence of a pair of wheels or a train in the section short-circuits the battery, causing the relay armature to drop. A broken rail will open the circuit and de-energise the relay, and the fact that the track circuit operates on the closed-circuit principle renders it very reliable, as any failure is on the side of safety. The relay armature is attracted on the passage of the weak current (necessary only for its operation) of the track circuit, which operates an indicator or electric lock; or controls the motor for working a signal. The armature carries a number of contacts which can be made to close as many different local circuits as desired. The relay, as constructed to-day, consists of very few parts that can get out of order, is easy to maintain, and, although placed in a case at the side of, or between, running lines of railway, is not influenced by the vibration caused by passing trains.

The type of insulated joint used on the Midland Railway is shown in fig. 1. The insulating material on each side of the fish-plates, between the rails, and in the bushes around the bolts, is compressed fibre, and standard-pattern fish-plates and bolts are used, so that it is possible for any platelayer to replace the insulation without any difficulty.

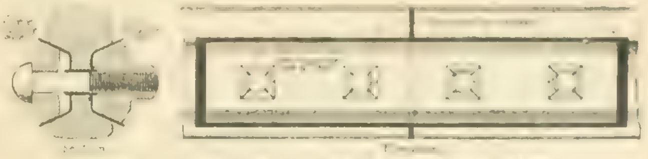


Fig. 1.—Midland Railway Insulated Joint.

Owing to the difficulty of applying continuous-current track-circuiting to meet all requirements, alternating-current track-circuiting has made rapid progress of late years, and now appears likely to supplant the continuous-current system in this country. The A.C. track-circuiting can be rendered absolutely immune from the effects of stray currents, even from an A.C. power supply, and [illegible] to install than continuous-current track-circuiting; moreover, it is said to be easier to maintain, especially on electrified railways.

On electrified railways the track circuits are sanctioned by the Board of Trade to supersede the locking bars on facing points, and the track circuit electrically locks the facing points in whichever position they are set for the trains to pass over, the signal lever governing the route being electrically back-locked until the train has passed the overlap of the section, so that as long as the track circuit is occupied the points cannot be moved until the train has cleared the track.

The adoption of track-circuiting has necessitated greater [illegible] the permanent way and signalling staffs in maintenance work. The action of changing crossing and [illegible] equivalent to the disconnection of signalling arrangements, and the rules for permanent-way operations and disconnection, although practically distinct from one another in the past, now become so closely allied that one depends on the other if safety is to be maintained.

Platelayers' lorries require special attention where a track circuit exists, and before they are placed upon or run over any portion of a line that is track-circuited the permission of the signalman to whose signal-box the track circuit is connected must be obtained, owing to the fact that lorries cannot be relied upon, particularly if unloaded, to short-circuit the track [illegible] at "danger," or to operate the electric locking on the signals.

The problems before all railway companies to-day for the prevention of accidents may be put down under the following [illegible] headings:

(a) Protection of trains detained at home or starting signals.
(b) Prevention of drivers running past signals at danger.

The author suggests that they can be met by appliances such as are now being installed on the Midland Railway.

Protection of trains detained at home signals.—A rotary interlocking block is provided between the home signal of one section and the starting signal in the rear, the latter signal being electrically released by the pegging of "line clear." After "train on line" has been pegged, the block instrument remains locked in the train-on-line position until the train accepted has passed the home signal and has operated an electric treadle ahead of such signal, the operation of which by the train frees the block instrument, as described earlier in this paper in lock and block systems. This appliance is used on the most important lines; but in cases of less important lines a "train waiting" arrangement is used, as described later.

Another arrangement is used where trains are detained at home signals out of sight of the signalman. In this case a short length of track circuit is provided, outside the home signal, which indicates the presence of a train and holds the block indicator (for the section thus occupied) in a train-on-line position until the train has passed off the track-circuited [illegible]

Protection of trains detained at starting signals.—The whole length of the line between the home and starting signals is track-circuited, and when occupied not only gives a visual indication of the condition of the line to the signalman, but also electrically locks the home signal or signals leading on to that line, thus preventing the signal being used again until the track is clear. The problem of track circuits for this function becomes more complex where junctions occur. For every junction or additional junction between home and starting signals, the running lines must be subdivided into separate track circuits in order to give the necessary freedom in traffic working without overlocking the signals for parallel routes. According to the subdivisions of the tracks the various signals are locked by one or more track circuits; in some cases a signal being locked by as many as three and four tracks.

Cases of less important lines are met by providing a treadle ahead of the starting signal and an electric lock on the home signal, so that after the home signal has been lowered and replaced to danger it becomes locked in its normal position until the treadle ahead of the starting signal has been operated. Special mechanical locking is provided on the levers working these signals so that it is necessary for the home signal to be restored to danger before the starting signal is replaced; and similarly the starting signal has to be replaced to danger before the home signal can be used again. This arrangement, in conjunction with the interlocking rotary block, ensures the signals being at danger before another train can be accepted on the block instrument.

Train-waiting arrangement.—This is an audible and visual system, and enables a fireman to inform the signalman that his train is waiting at a signal. A plunger and an electric horn are fixed on a cast-iron column near the signal, and, on the arrival of a train at the signal, the fireman alights, presses the plunger, and in so doing operates an audible buzzer in the signal-box and causes an indicator to show "train waiting." In addition, the block instruments are locked, and the needle turned to the train-on-line position, no matter what indication was there before. The electric horn at the signal denotes to the fireman that these operations have been carried out. The signalman cannot remove the train-on-line indication from his or the rear-box block instrument until he has pegged his instrument to "train on line" and then pulled over and replaced the home signal to danger. Some companies provide illuminated lamps where such apparatus is installed, but from experience these have not been found necessary.

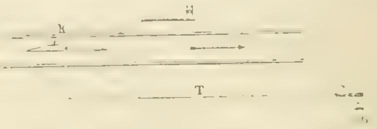
With the introduction of appliances for the protection of trains detained at signals, it has been found necessary to provide some distinctive indication on home and starting signals at which the carrying out of Rule 55 is dispensed with. A diamond-shaped sign indicates that the train standing at the signal is protected by interlocking rotary block, track-circuit, or treadle arrangement. A D-shaped sign indicates that means are provided for trainmen to protect the train by pressing the plunger of the train-waiting appliance fixed on the ground at the signal at which the train is detained.

About 1,200 signals on the Midland Railway are provided with these signs. Other companies are adopting them, and it is hoped that the practice will become universal.

Prevention of drivers running past signals at danger.—Some of the most serious accidents in recent years have been brought about by drivers disregarding signals, even in perfectly clear weather.

Detonator-placing machines are now used to a very considerable extent to enable the signalman to place detonators on the line to which the signals apply. About 600 of these appliances are in use on the Midland Railway and have been the means of effectively arresting runaway trains. The times, however, call for a more effective and permanent appliance that will be in operation at all times and for all trains.

There are serious obstacles to be overcome, the first of these being the general adoption by all railways of a uniform means of warning drivers that they are approaching the danger zone. From practical experience it has been found impossible to obtain satisfactory results from any apparatus that relies on the operation of its parts by impact. It is not considered desirable to give any visual indication to drivers. The author suggests that of all appliances yet introduced, automatic train control and an audible signal go nearest to meeting the before-mentioned requirements.

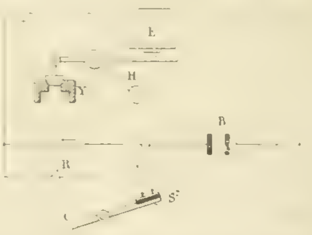


R, Ramp; T, Telegraph wire; S, Switch operated by lever working signal; B, Battery.
NOTE.—Battery connected to ramp only when signal is "off."

FIG. 2.—LINE CIRCUIT.

Automatic train control and audible signal.—The primary object of this system (figs. 2 and 3) is to give an audible warning on the engine when the train is approaching a distant signal which is at danger, and, in the event of this warning being disregarded by the driver, automatically to apply the brakes so as to ensure the train being pulled up before it reaches the home signal. Another distinctive audible signal is also given on the engine when the distant signal is in the clear position. The value of the latter audible signal is that it facilitates the running of trains when the semaphore signals cannot be seen during fogs or snowstorms. The audible signals given are the sounding of a siren indicating stop, and the ringing of a bell indicating proceed. The point at which the audible signals are given is usually about 400 yards before the distant signal is reached.

This apparatus involves a metal ramp, about 60 ft. in length, fixed in the centre of the 4-ft. way of the railway, and a contact shoe on the engine, which engages with the ramp to operate the audible signals. The ramp is slightly staggered in order to reduce wear-and-tear on the shoe, and is at the highest point 4 in. about rail-level. The contact shoe is fixed in the centre line of the engine and hangs down to within 2½ in. above rail-level. It is capable of being raised vertically to the extent of 1½ inches whenever a ramp is passed over, which opens a switch attached to the contact shoe. The ramp is connected electrically with the signal-box by means of a switch on the lever operating the distant signal, and the signalman can, when the signal is "off," connect it with a battery, so that the ramp is electrically alive; otherwise it is dead with the signal at danger. The switch on the shoe is connected with the electrically-controlled brake valve and the siren in such a way that whenever it is opened air is admitted through the siren and brake valve to the train pipe, thereby sounding the siren and applying the brakes on the train if the ramp is not electrified. Should the ramp be electrified by the signal being "off," when the train passes over it the brake valve is not released, but a bell on the engine rings instead, owing to a current picked up from the electrified ramp, the effect of which is to cut out or render inoperative the switch attached to the shoe, so that although the switch is opened it does not



R, Bell; E, Electromagnet controlling brake valve and whistle; Y, Brake valve and whistle; C, Contact Shoe; S², Switch attached to contact Shoe; B², Battery (engine); H, Restoring handle.
NOTE.—Local circuit closed. Electromagnet energised, brake valve and whistle closed.

FIG. 3.—LOCAL ENGINE CIRCUIT.

release the valve admitting air through the siren to the train pipe. If there is any failure to pick up the current when the ramp is passed over, the effect on the engine is the same as though the ramp was not electrified, the brakes being applied.

This apparatus distinguishes distant signals both by day and night, gives distant signals to engine-drivers in the cabs of engines, and dispenses with fog-men at such signals.

Another advantage of this system is that ramps may be placed in any position regardless of distance at curves, bridges, tunnels, etc., and can be used on single lines in connection with electric train staff and tablet systems by certain modifications.

The problem of cab-signalling on electrified railways requires much consideration, owing to the fact that the negative rail is placed in the centre of the 4-ft. way, and consequently the ramps would have to be fixed between the negative rail and one of the running rails. There is every reason to suppose that the shoes would have to be duplicated so as to suit the reverse running of trains, both on single and double lines. The possibility of such an apparatus being affected by extraneous currents is another point that would call for special consideration.

Railophone.—This system, an invention of Mr. H. von Kramer, as applied for giving an automatic warning in the engine cab of the vicinity and indication of a signal, is undoubtedly designed on right lines, and may be said to mark the latest phase of electrical operation. It is primarily intended for use in connection with distant signals, with the object of giving the desired warning of the position of the signal arm and causing the train brakes to be applied automatically when occasion requires should a train overrun a signal.

Unlike the automatic train control previously mentioned, this system has no physical connection or contact with either the rolling stock or the permanent way, but is operated entirely on the wireless inductive principle, the transmission of electrical energy being between a fixed circuit on the ground and a circuit placed on the moving train.[*]

An experimental installation has been tested on the Midland Railway, but so far it has not been considered desirable to publish any results. It may, however, be interesting to note that a driver on approaching a distant signal receives three short warnings in quick succession by means of a compressed-air whistle fitted in the engine cab, quite irrespective of whether the signal is at danger or clear. Should the signal indicate danger, the three warning signals are followed by a fourth prolonged signal, and the brakes are automatically applied, but it is so arranged that the fourth signal and the application of the brakes take place only if a driver fails to apply the brakes in the ordinary way after the three warning signals have been received. Should the signal be in the clear position the train is allowed to proceed without interruption, but the driver is aware that he is passing a signal by the three warning signals given on the whistle.

(*To be continued.*)

ELECTRIC COOKING.

During the discussion upon Mr. W. R. Cooper's paper on "Electric Cooking, mainly from the Consumer's Point of View," which was abstracted in our issue of March 19th, at the last meeting of the Yorkshire Local Section of the Institution of Electrical Engineers, Mr. Campion said that in regard to heating water at one farthing per unit, on the assumption that the cooking load was supplied at a halfpenny per unit there was a good case for it. He was, however, of the opinion that the central station engineers had taken a very liberal and broad view in cutting down these rates and had done their part; it was now time that the people who were making the apparatus came forward and helped. In Dewsbury the people who had cooking apparatus used about 250 units per month. They had the assessment principle in vogue, and the local authorities stipulated that when a consumer accepted this tariff he must, according to his rateable value, install a certain amount of heating or cooking apparatus; in eleven cases out of twelve the consumer installed heating apparatus. The question of outlay was a very big one indeed. In Dewsbury there were some fairly wealthy men, but they would not install apparatus at half the price suggested by Mr. Cooper in his paper. They would not mind hiring it, but they were averse to risking £12 10s. 0d. He endorsed the author's remarks about the earthing of his apparatus. With reference to the flexibles, he believed they had all found—and most of the cable manufacturers were coming to it now—that a steel wire inserted in the flexible gave a good deal more mechanical strength, and he was surprised that it did not come out better on the test. In industrial towns he believed it was being found that the big loads occurred between 10 and 11 in the morning, and they would certainly get a big cooking load when they got a good number of houses upon the mains where mid-day meals were the rule. He knew of a case where a consumer obtained the following contract with the makers in regard to the maintenance of a cooker which he had purchased :—First year's maintenance free; second year, 8s. 6d. per quarter; third, fourth and fifth years, 17s. 6d. This arrangement was satisfactory to the consumer, because he knew about what the maintenance was going to be.

Mr. Wright said he believed that although lighting and power connections were rising at a satisfactory rate, heating and cooking connections were rising at a more accelerated rate. The question of electric lighting might be taken as settled for all new houses within reach of tenants of a rental value of, say, 7s. or 8s. per week; the houses were now wired as a matter of course, because the owners realised that a house wired for electric light had a better chance of letting. It was different, however, with electric cooking, and it rested with the station engineers and electrical manufacturers of cooking plant to supply electric cooking on the same plane as electric lighting. They must not suppose that because electric cooking was progressing the gas cooking was necessarily stationary. Between 1908 and 1912 the number of gas cookers added to the mains of seventeen selected towns in England rose from 811,000 to over 1,000,000, and he had no doubt that since then the total number had risen considerably. The initial cost of electric cooking apparatus very much handicapped the more extensive adoption of that apparatus, and the novelty of electric cookers was reckoned as an experiment. From the station engineer's point of view the cooking load was well worth cultivating, as it would give him a better annual load factor and improve his diversity factor at the same time, though it would not, he thought, increase his peak load. The advantages of cleanliness, regulation of temperature, reduction of waste, etc., in electric cookers were bound to appeal strongly in their favour, but the present difficulty was the great difference in first cost of the apparatus as compared with gas or coal cooking. As soon as these became comparable he thought electric cooking would come much more extensively into domestic use and a reduction of the cost of current and maintenance would automatically follow.

Mr. Wallis said he felt that electric cooking was one of the coming things, but great difficulties of manufacture had to be overcome. It was by attention to little details that perfection would be attained.

Mr. Innes said he believed the ideal place for electric cooking was in flats. He did not think they could get many people to go in for heating water even at one farthing per unit. In his own experience the boiling of water—even tea water and for similar requirements—consumed a great deal of the total energy consumed in the house. The actual cooking was only a small proportion of the total load. Keeping food warm took a good deal of current; and if there was an Ideal boiler installed which served as a hot plate, as mentioned by the author, it did away with a good deal of the cost of current. He totally disagreed with the author's suggestion that the makers or corporations—if they were hiring-out apparatus—might go so far as to repair the apparatus free of cost, because contractors naturally looked to the maintenance to bring some return to them for their expenditure on apparatus. He doubted whether they could get the ordinary cook to keep her eye on the thermometer. He suggested the addition of an indicating lamp on every element and not simply on the main switch, because that was rather misleading. In regard to flexibles, he did not think they got nearly the trouble now that they used to get.

Mr. Lang said that apparently the author had not differentiated between wires insulated with double pure rubber and those insulated with pure rubber and vulcanised rubber. Pure rubber insulation was absolutely of no use at all in damp places or in positions where heat was likely to affect the rubbers.

Mr. Collinson said that as a contractor his difficulty was in selling the apparatus. The cost of an electric cooker was at least three times the cost of a gas cooker, and to hire-out apparatus for a house rented at from £20 to £25 he would have to make a charge of £3 per annum, whereas the Bradford Corporation would hire-out the same cooker at 10s. per annum. The whole trouble seemed to be the high initial cost. Electric cookers were not worth the money the electrical manufacturers were charging for them, but they must agree that the manufacturers had not yet been in a position to manufacture them at competitive prices.

Mr. Burnand said there was no doubt that in a good many cases earthing was deficient, and insulation was preferable to earthing in a kitchen if it could be arranged.

Mr. Moss said that if earthing the portable apparatus was carried out to its uttermost limit, instead of cheapening the cost of the apparatus it would cripple the sales. As a contractor, he maintained that so long as people sent repairs the contractors should have a fair margin of profit on the cost.

The Chairman (Mr. T. [illegible]) said that the [illegible] of domestic water could be done successfully by using a large amount of electricity for heating the water as it flowed from the tap. That might be looked upon by central-station engineers as a rather drastic proposal, but he did not think it would affect the pressure on the electric supply mains as much as was generally anticipated, provided fairly large mains were laid. His experience was that screwed steel tubing, if properly earthed, formed a very good earth. There was little doubt that there was a [illegible] by the use of electricity as compared with either coal or gas ovens.

The Author briefly replied to the points raised in the discussion.

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[*] A full description appeared in the Electrical Review of July 5th and October 11th, 1912.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PANAMA.—H.M. Minister at Panama has recently drawn attention to the publication in the *Gaceta Oficial* of a law regulating, amongst other things, ship's manifests, invoices, and fees chargeable by Consular officers. This Act provides that all persons wishing to ship merchandise to a port in Panama open to commerce must present to the Consul of Panama at the port of shipment six copies of an invoice giving the following particulars, viz.: The name of the shipper; the place of origin; the name of the consignee; the name of the ship and port of destination; the mark, numbering class and weight of each package; together with exact details of the goods and their original prices. The charge for certification of the six copies of the invoice is 0.9 per cent. of the total net value of the invoice payable in the currency in which the invoice is made out with a minimum charge of one gold dollar. In addition to Consular fees for certifying invoices, three dollars is charged for certifying each set of bills of lading dealing with invoices of a greater value than 100 dollars, and six dollars for certifying four copies of ship's manifests for every 100 packages, and 1.20 dollars for every additional 100 or fraction thereof. The fee for a ship's manifest covering articles of iron, steel, copper, zinc, wood, tiles and similar goods, is six dollars, however large the amount of shipment. Consular officers can only certify to invoices when they refer to packages with one mark, from one shipper, consigned to one individual or company, and for one place. If invoices are not accurate or do not comply with the requirements, 5 per cent. of the value of the invoice is collected in addition to the duties; when the inaccuracies or omissions, however, are not of a general character, but refer to one or more items, only the fine is imposed on the value of the articles which have not been properly declared. The full text of the law and a translation may be seen at the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, London, E.C.

NEW ZEALAND.—The New Zealand Customs Authorities have decided that Kelvin composite balances defined as electric testing apparatus may be imported free of duty.

RUSSIA.—With reference to a notice regarding a proposed revision of the Russian tariff which appeared in a recent issue of the Electrical Review, the Board of Trade have now received telegraphic information from H.M. Ambassador at Petrograd to the effect that an Imperial Decree which was promulgated on March 25th and came into force on the same day repeals the Decree of the 16th August, 1914, by which the Russian "conventional" rates of duty (*i.e.*, lower rates the result of Treaties) provided for in the Commercial Treaties between Russia on the one hand and Germany and Austria on the other, were temporarily maintained in force in so far as they were applicable to goods imported from Allied and neutral States. In addition, certain goods are subject to special augmented rates, and the General Tariff rates of duty in certain other goods are increased by 10 per cent. The General Tariff rates for machinery of all kinds falling under Section 167 of the Tariff are not modified. With this exception the effect of the new legislation would appear to be as set out in our previous notice. H.M. Ambassador is forwarding a translation of the Decree, and as soon as possible after its receipt the Board of Trade propose to issue a Parliamentary Return showing in detail the effect of the amendments now introduced in the Tariff.

SWEDEN.—The Swedish Government have recently prohibited the exportation of the following amongst other goods: Electro-magnetic igniting apparatus for the ignition of motors; lead ore; scrap of pig-iron and malleable iron; unmanufactured tin, also scrap tin; manufactured tin—pipes and parts of pipes, sheets and wire, also rods.

NEW PATENTS APPLIED FOR, 1915

(NOT YET PUBLISHED)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

4,808. "Sparking plugs and manufacture of the same." T. Crosbee & Sons, Ltd., and W. J. Spicer. March 29th.

4,812. "Electrically-heated kettles and analogous vessels." W. W. Soutter. March 29th.

4,820. "Dielectric filling, insulating, or grouting composition." R. C. Sharp. March 29th. (Complete.)

4,835. "Magneto-generator-operated telephone bell signals." S. P. Wood. March 29th.

4,849. "Apparatus for electrically detecting vibrations." F. Gottschalk. March 29th. (Complete.)

4,885. "Means for connecting electrical conduits to their fittings." F. L. Broughton. March 30th.

4,895. "Combined electric lighting and starting apparatus for motor vehicles." L. Duca, E. Naldini, C. Massavelli, & L. Bellone. March 30th. (Complete.)

4,896. "Electric switches as applied to stop-motions on textile machinery." F. Sharp. March 30th.

4,911. "Electro-magnetic switches." British Thomson-Houston Co., Ltd. March 30th. (General Electric Co., United States.)

4,912. "Transmission of sound waves." E. M. C. Tigerstedt. March 30th. (Convention date, March 30th, 1914, Germany.) (Complete.)

4,953. "Sound-magnifying appliances for telephonic and telegraphonic purposes." H. Smith. March 31st. (Convention date, April 18th, 1914, United States.) (Complete.)

4,955. "Apparatus for obtaining unidirectional electric currents from sources of alternating electric currents." E. F. Clark. March 31st.

4,967. "Emergency electric lighting system." W. Dobie. March 31st.

4,978. "Pipes and electrical conduit fittings." H. F. Joel, Sen. March 31st.

4,987. "Hot-wire alternating-current limiters." P. Wessel. March 31st. (Complete.)

4,999. "Electrical welding." W. M. Mordey. March 31st.

5,001. "Electric motor controllers." Igranic Electric Co., Ltd. March 31st. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

5,002. "Means for regulating electrical circuits." Igranic Electric Co., Ltd. March 31st. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

5,007. "Spring arrangement, especially for use in electric contact devices." Landis & Gyr Akt. Ges. March 31st. (Convention date, April 2nd, 1914, Germany.) (Complete.)

5,055. "Electric resistances." W. F. Jones. April 1st.

5,061. "Electrical circuit fittings." J. I. Hall. April 1st.

5,076. "Electric signalling systems for use on railways." J. Boot & W. E. Scourfield. April 1st.

5,079. "Dynamo-electric machines." R. Boin. April 1st. (Complete.)

5,088. "Metering in telephone systems." E. Shibko. April 1st.

5,089. "Telegraph key." Sterling Telephone & Electric Co., Ltd., and T. D. Ward-Miller. April 1st. (Complete.)

5,104. "Electric motor controllers." Igranic Electric Co., Ltd. April 1st. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

5,106. "Electric heaters." A. Mond. April 1st. (Soc. Anon. Electrocalor, Switzerland.)

5,120. "Blowing devices." Midland Electric Rotary Blowing Co., Ltd., and J. Page. April 3rd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1914.

6,179. Railway Signalling System. M. H. Collins. March 11th.

6,421. Means or Apparatus for Indicating when the Flow of Current in an Electric Circuit is Interrupted or Varied. A. F. Berry. March 13th.

6,428. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). March 13th.

6,659. Telephone Systems. T. G. Martin. (March 17th, 1913). March 16th.

6,918. Electrical Generating and Control Systems. H. J. Read. March 18th.

6,970. Silent and Balanced Electro-magnetic Step-by-step Driving or Synchronising Mechanism, particularly applicable to the Control of a System of Time-indicating Units. E. E. Craig. March 19th.

7,023. Carriers for Lamp Shades. A. R. Craddock & W. Scott. (August 12th, 1913.) March 19th.

7,513. Telephone Switches. T. Green. (Cognate applications, 10,904/14 and 13,281/14.) March 25th.

8,010. Electric Switches. G. Chebrou & A. Lemp. March 30th.

8,413. Signalling in the Shafts of Mines, Tunnels and the like. J. W. Land. April 3rd.

11,229. Construction of Telephone Index or Directory Holder. H. R. Hazard. May 6th.

12,804. Electrical Egg Testers. F. du Bois. March 25th.

12,976. Electrical Switches. H. W. Cox. May 27th.

13,348. Electrically-heated Vulcanising Apparatus. W. T. Henley's Telegraph Works Co. & H. Savage. May 30th.

13,523. Telephone Exchange Systems. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.) June 3rd.

13,960. Electric Wire Connection. M. E. Holdaway & B. J. Anderson. June 9th.

14,192. Process and Electric Furnace permitting the Extraction in a state of Purity of Zinc from its Ores. E. F. Coté & P. R. Pierron. June 12th. (November 19th, 1913.)

16,318. Electric Circuit Interruptors. J. N. Mahoney. July 8th. (August 11th, 1913.)

18,747. Automatic Current Cut-off for Electrical Appliances. C. S. Smith. August 17th.

18,809. Pocket Electric Flash Lights. W. J. Mellersh-Jackson (Posen). August 18th.

19,878. Material for the Insulation of Electrical Conductors. W. Teggin, and London Electric Wire Co. & Smith's, Ltd. September 17th.

20,239. Electric Regulating Rheostats. L. Boothman. September 26th.

20,494. Means for Communicating on Trains. J. Rafferty. October 3rd.

22,133. Self-induction Coils for use in Duplex or Multiplex Telephone Systems. A. H. Olsson & H. B. M. Planck. November 6th. (November 7th, 1913.)

22,732. Means for Regulating the Speed of Electric Motors. Allmänna Svenska Elektriska Aktiebolaget. November 18th. (January 5th, 1914.)

1915.

2,060. Means for and Methods of Changing the Frequency of Alternating Electric Currents. A. M. Taylor. February 9th. (Divided application on 15,729/13, February 9th, 1914.)

Electric Baggage Trucks.—With reference to our description of the Elwell-Parker battery trucks supplied to the North-Western Railway Co., appearing on page 530 in our last issue, we are informed that the turning radius of these trucks is only 6 ft. 6 in.; they measure 7 ft. by 3 ft. 10 in., and weigh 1,900 lb. empty, being of a smaller type than those for which similar data (supplied by the agents) was given in our article. We also gather that these particular trucks are fitted with a worm drive on the back axles.

THE
ELECTRICAL REVIEW.

VOL. LXXVI. APRIL 23, 1915. No. 1,952.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: April 23, 1915. [No. 1,952.

Page

Electric Power on the Rand 569
The Russian Government and German Interests in Supply Works 570
Rubber 570
Those who Fall by the Way 571
The Beck Searchlight Projector (*illus.*)... 571
Swansea Electricity Extensions (*illus.*)... 573
Correspondence—
The Capturing of German Trade 573
Electric Road Rollers 574
Legal... 574
New Electrical Devices, Fittings and Plant (*illus.*) 576
Electrical Trades Benevolent Institution 577
War Items 578
The Case for the Electrification of Engineering Works, by E. P. Hollis 579
Business Notes 580
The Power Supply of the Central Mining-Rand Mines Group (*illus.*) 585
Notes 589
City Notes 593
Stocks and Shares 595
Share List of Electrical Companies 596
Exports and Imports of Electrical Goods during March, 1915 597
Reviews 598
Main-Line Signalling on Railways, by W. C. Acfield (*illus.*) (*concluded*) 599
Trade Statistics of Siam 601
Train Dispatching by Wireless 602
European Markets for Electrical Supplies 603
Indian Notes 604
New Patents Applied for, 1915 604
Abstracts of Published Specifications 604
Contractors' Column ... ... Advertisement page xxii

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The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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ELECTRIC POWER ON THE RAND.

IT will be generally admitted that the paper which Mr. J. H. Rider presented to the Institution of Electrical Engineers last week was one of the most interesting and informative essays that have been delivered in recent years. The subject was one of exceptional scope and variety, as may be inferred from the fact that the electric motors in operation have an aggregate of 142,300 H.P.—a colossal system—and the demand for compressed air, which is mainly used for working rock-drills, amounts to no less than 37,900 KW. Plant installed on so large a scale, and so constantly in operation that the load factor of the electrical system is 75 per cent., entails a heavy load of responsibility on the engineer, and affords unique opportunities for the acquisition of experience of the most varied character.

Electrical engineers may therefore be grateful to the author for drawing so freely upon his knowledge as he has done in this paper. While there are many points which invite comment, we wish to direct our readers' attention especially to the subject of main winding gear, which is of constantly increasing importance in connection with British colliery installations. It is not long since engineers in this country were discussing at great length, and with many detailed calculations, the question whether electrical winding could possibly compete with steam winding; that stage, through which so many of the applications of electricity have had to pass—for the British electrical engineer is slow to grasp the possibilities of new openings for his talents—has been safely traversed, and now the question is whether three-phase or direct-current motors offer the greater advantages for the purpose.

As in the case of so many other problems, the solution of this one depends upon circumstances, and it is impossible to arrive at a decision applicable to all cases. Where power is derived from the mains of a large power company, the conditions are in favour of the three-phase motor; where a private station of moderate dimensions supplies the power, the use of the Ward-Leonard system of control with a fly-wheel motor-generator set may be obligatory. Again, the size of the winder exerts an important influence on the decision; for a small winder the objections to the three-phase motor lose much of their force, and the advantages of the Ward-Leonard system are diminished. It will be remembered that Mr. C. P. Sparks in his recent paper showed that he employed both types of motor, and the same thing is found on the Rand.

Mr. Rider states that of 69 electric winders, only 9 are of the Ward-Leonard type. Most of the three-phase motors, however, were applied to winders converted from steam drive—47 in number—leaving only 14 wholly new three-phase winders, as compared with eight new D.C. winders. Mr. Rider also quotes Mr. Heather as stating that the saving in capital outlay due to using induction motors was probably £50,000. But the working cost must also be taken into consideration, and the author expresses no decided opinion on this point. Moreover, the addition of an eddy-current brake to the three-phase winder, with the accompanying motor-generator, &c., brings up the capital cost practically to that of the Ward-Leonard system, which is certainly far more handy to control, and probably possesses a much higher degree of safety in operation than the A.C. system. With the eddy-current brake retardation is effected with 45 KW. applied to the magnet system, whereas braking by reverse current on the winding motor requires an input of 1,600 KW., so that the advantage of using the brake is obvious. On the other hand, while several eddy-current brakes have been installed, it is quite clear that the majority of the three-phase winders used by the group of mines are working satisfactorily without their aid. There is also a significant paragraph in which the author points out that three-phase motors running at comparatively high speeds and driving through gearing can be advantageously employed, whereas with the Ward-Leonard system the motor is preferably direct-coupled.

So impartially does Mr. Rider weigh the pros and cons, that it is difficult to detect in his paper any decided leaning towards either system; but, on the whole, while he says that each case must be considered on its merits, we think that where the arguments on either side appeared to be of equal weight, he would prefer to install the Ward-Leonard control.

Not the least interesting and valuable feature of the paper is the section dealing with the "troubles" that the author has met with, due mainly to faults in design and manufacture. These call for the earnest attention of our manufacturing firms, with a view to their avoidance in the future. Some of the examples cited of bad workmanship and material were absolutely disgraceful, and there is little consolation to be derived from Mr. Rider's statement, in his reply to the discussion, that they were fairly equally divided between British, American and German products. For faults in design, the author finds some excuse in the limited experience of the designer with regard to the work a machine may have to do; but this is really an explanation rather than an excuse. We fear that, only too often, designs for new types of machines are entrusted to men who have seen little or nothing of the processes for which the machines are required, and who cannot make good their deficiencies by a hurried search through the text-books available; though it may be flattering to the D.O. to be credited with the ability to design any mortal thing that may be called for, from its inner consciousness, sooner or later disaster is bound to come. It would be well worth while to dispatch a capable designer to the Rand, as well as to other important industrial centres, to find out exactly what is required and what unsuspected conditions exist that must be provided against.

Such papers as that of Mr. Rider afford immense assistance to those who have to supply the plant, and we trust that British manufacturers will profit by the information now at their disposal, so that full advantage may be taken of the opportunities that will be open to them after the war. An abstract of the paper will appear in our later issues.

The Russian Government and German Interests in Supply Works.

The more we read concerning the Russian Electric Lighting Co. of 1886, of Petrograd, the expropriation of which is proposed by the Russian Government, the more does it appear that the latter are in possession of better information than is revealed by the German and German-Swiss newspapers of the actual situation of affairs, or the liquidation of the company would not be contemplated even at the present time. The company was formed in 1886 as a Russian company on the basis of statutes which were sanctioned by the Russian Government. Lighting concessions were obtained from the City Councils of Petrograd and Moscow under definite agreements which provide, among other matters, that the former city possesses the right of acquiring the local undertaking for the first time in 1918, according to definite terms specified in the concession, whilst Moscow is similarly situated in regard to the purchase of the city undertaking in 1920. An extension of the company's scope was subsequently made to Lodz and other Russian towns, but the chief business was concentrated in the capital and in Moscow. Unfavourable early years, the loss of capital, the reorganisation undertaken in the nineties of the past century with the assistance of German and Swiss capital, the impossibility, as is said, of procuring further Russian capital, and the aid, sought for and obtained, of further German and Swiss capital—all these causes contributed towards the disposal of the greatest portion of the shares in Germany and Switzerland, a small portion only being in Russian and French possession. Indeed, it is stated that it was impossible to awaken interest in the shares to a greater extent in Petrograd, notwithstanding the efforts put forth in this direction. Gradually, however, the shares are declared to have been increasingly transferred to Switzerland; ordinary shares for 41,000,000 roubles and preference shares for 9,000,000 roubles were recently in Swiss ownership.

Now the Government must be in the position to know exactly from the company's records when those transfers took place, and to what persons or banks or other institutions in Switzerland the shares were diverted, and the question or origin of partly German banks or other partly German financial institutions in Switzerland, and their relations with German banks or other financial institutions or electrical firms in Germany, should probably also be known. If the Russian Government, however, are not in possession of details which prove that the company is merely a German undertaking under a Russian title, it is difficult to understand the drastic Bill which the Swiss *Neue Zurcher Zeitung* states, as a result of inquiries, the Government has prepared for the liquidation of the company. The Bill provides that the Government will appoint a commission to ascertain the value of the undertaking in full operation, and to consult the cities and third persons. After the price has been determined by the five representatives of the Government and the two cities, the cities of Petrograd and Moscow may acquire the undertakings in question during one month, at the fixed price. If the cities refuse, the right will pass to the Government, and if the State also declines to exercise the right, a public auction is to take place. During the period of the liquidation the management will be entrusted to a second commission of seven members, of whom three will be appointed by the Government, two by the two cities, and two from the existing board of directors.

The Russian Government would scarcely proceed with a Bill of this nature unless certain that the undertaking was almost entirely German. Russia has been so greatly indebted to foreign capital, and will be so to a still greater extent after the war, for the development of her enormous resources, that it is unlikely that steps likely to shake the confidence of foreign investors would be taken without excellent reason. If Swiss ownership has really preponderated in the company for several years past, the holders are assured of the support of the Federal Government in protecting their financial interests.

Rubber.

The rubber market has had a pretty firm appearance lately, and there have been times when the trade demand showed signs of developing upon a fairly satisfactory scale, while prices showed some improvement. The moderate quantities actually available were recently absorbed more freely than had been the case for some little time, and there seemed to be a little apprehension among consumers lest the filling of the extra requirements usually met with at this, the most active period of the year, in the manufacturing trades, should, combined with belated landings, lead to a temporary scarcity. There is a possibility, too, of shipments from the East being delayed owing to freight difficulties. Prospects as to consumption in Europe and America are quite encouraging, because war requirements are licking up such enormous quantities of material that the closing of the German market is hardly felt. Shipments to America should continue on a pretty good scale over the spring, provided matters proceed normally as regard shipments. The deliveries of plantation grades have been better than for some weeks past. The total outgoings in London during last month were 6,363 tons, or nearly 400 tons in excess of the arrivals. A very large portion has been absorbed by clearances for America. When allowance is made, however, for the increased stock of Para grades in Liverpool there seems little alteration in the total stocks here, which amounted on April 1st, to 8,980 tons against 6,609 tons last year, and 5,967 tons in 1913. It is generally acknowledged, however, that the London stocks as indicated above are misleading, because they include considerable quantities which have been actually sold, but have not been delivered, owing to transport and other difficulties. The enormously large contracts now in course of execution by manufacturers point to the continuance of an active consumption, and holders appear to be quite hopeful as to the course of the market during the next few months. The Brazilian export trade returns have been officially returned for 1914 as 32,526 tons against 35,304 tons in 1913.

According to a telegram from the Government to the Malay States Information Agency, the reports of rubber from the Federated States for the month of March amounted to 3,418 tons, compared with 3,411 tons last month, and 2,418 tons in the corresponding month last year. Appended are the comparative statistics :—

	1913.	1914.	1915.
January ...	2 131	2,542	3,473 tons.
February ...	1,757	2,364	3,411 „
March ...	1 737	2,418	3,418 „
Total ...	5,625	7,324	10,302 „

Those who Fall by the Way.

The Electrical Trades Benevolent Institution has been in existence eight years, and its accumulated funds amount to less than £8,000—a total still unworthy of the electrical industry and utterly inadequate to meet its needs. "He that has no charity deserves no mercy," and charity certainly cannot be expected to come to us from outside if we of the electrical industry have not a faculty for it within. Further, it cannot be expected that employers and shareholders should make systematic contribution to electrical benevolence unless those who one day may wish to claim that benevolence, support it when they are on the upper spokes of Fortune's wheel. It is true that the income of the Benevolent Institution was nearly three times as great last year as in 1913, but very special causes contributed to that end, and, with war in progress, and every probability of increased demands for assistance in the near future, wholesale additions must be made to the sources of revenue. On the basis of the past two or three years' figures, it would be 60 years before one could enjoy the prospect of being accommodated in the Institution's almshouses, and at least two generations before the child of any worker in the electrical industry could be offered the shelter of an orphanage. Such a state of affairs is neither creditable to the electrical industry nor fair to the Benevolent Institution. The funds collected are administered faithfully and well, but they are totally inadequate. Expenses cannot be reduced, for they are already low for the range and amount of work done. It is income which must be increased, and as capital may not be spent, funds must be raised to provide sufficient dividends and interest to alleviate every genuine case of distress in that large and ever-increasing middle-class stratum of the electrical industry which has *no other organised benevolence to rest upon.* The primary object of the Institution is to render financial and other assistance such as will lead to permanent benefit, and in the past about 75 per cent. of the recipients of grants have been assisted to permanent employment. Later, as available funds increase, the activities of the Institution can be extended, but the first essential is to provide an ample and *secured* income.

If each of the five or six thousand electrical firms in the country subscribed five guineas, or even one guinea, per annum, and if each of the tens of thousands of employés who stand to benefit by the aims of the Institution contributed 10s. or even 5s. per annum, there would rapidly accumulate funds permitting relief to be given to everyone in distress in the electrical industry. A collection after every electrical staff dinner or public banquet would amount to a respectable total in the course of a year. There are many other pressing claims, but the electrical industry can and ought to establish a really adequate benevolent fund. As Mr. Garcke said on Monday in presenting the annual report of the Institution, the problem is not what is the right thing for each one of us to do, but what steps can be taken to awaken us to our duty and persuade us to perform it. "All mankind's concern is charity," and we issue a sincere and urgent appeal to the large number of persons engaged in the electrical industry who have not yet identified themselves with the excellent work and ambitions of the Electrical Trades Benevolent Institution.

THE BECK SEARCHLIGHT PROJECTOR.

In the course of a discussion before the Society of Illuminating Engineers recently, some particulars were given of a new searchlight arc invented by Mr. Heinrich Beck, and were published in our report of the meeting. Further information on this subject was given in a paper read before the American Institute of Electrical Engineers in February last, by Mr. C. S. McDowell, the gist of which is given below.

The author states that the lamp mechanism of a searchlight should keep the crater of the positive carbon at the focus of the mirror, should keep the arc length that which is desired, should carry the current of the carbons, should contain mechanism for rotating at least the positive carbon, should be sufficiently rigid to keep the carbons in proper alignment, and should require little care and adjustment.

An illustration of the Beck lamp mechanism is shown in fig. 1. Both carbons are rotated for the purpose of keeping their surfaces bathed in the inert gas and to keep the arc central, and thus promote evenness of burning. The positive holder is fixed, the carbon being fed through it at such a rate that the crater is always maintained at the focus of the mirror ; the rate of feed is controlled automatically, a small mirror being placed in the drum, which, when the carbon feeds too slowly, reflects a small beam on a thermocouple, and closes a relay circuit, which, by means of a solenoid, quickens the feed. When the carbon is back in focus, the small beam of light is off the thermocouple and the feed is slowed down. In addition, the feed may be controlled by hand. The negative carbon is fed through the negative holder in a similar manner, except that the control is by hand. The negative holder is also fixed, except when striking the arc, when it is moved up by a striking motor.

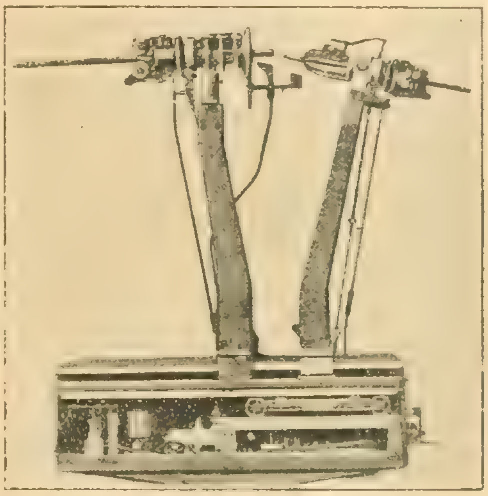


Fig. 1.—Beck Searchlight Lamp.

During tests recently conducted on searchlights, the Beck lamp mechanism functioned very satisfactorily ; variation of the crater of the positive carbon from the focus was about 1 mm. (hardly noticeable), and the arc length was kept practically constant. No trouble in maintaining the arc was experienced while rotating both carbons, the crater of the positive carbon remained even, and there was no noticeable hissing or jumping of the arc.

The desired searchlight arc should excel in the following particulars :—

1. Small positive carbons with high current densities and thus high crater temperature throughout the crater area, which gives high intrinsic brilliancy.

2. Small negative carbons.

3. Long arc length, that is, distance between positive crater and negative point.

4. Uniform mixture of carbon so as to help the evenness of burning.

The Beck searchlight may be considered as being especially designed to meet the above requirements, and therein lies its marked superiority over the searchlights now in use.

In a searchlight the angle of dispersion is directly dependent on the diameter of the source of illumination, provided the focal length is constant, and if the diameter of the source can be decreased one-half while the candle-power remains constant, the intensity of light on the target will be quadrupled. Actually in the Beck searchlight, the positive carbon is reduced one half, and at the same time the candle-power is increased, so that greater efficiencies are obtained.

To decrease the angle of shadow it is necessary to increase the arc length or decrease the diameter of the negative carbon. The arc length is restricted to the stability point of burning. Whilst complying with this requirement, the arc length of the Beck lamp is maintained constant at about ½ in. as compared with about ⅝ in. obtained at 60 volts in the standard 36-in. lamp.

Carbon is the most refractory of all known materials, boiling at about 4,000° C., but it unfortunately commences to evaporate at a much lower temperature (about 1,800° C.), so that in an ordinary arc very little of the total area of the end of the positive carbon is at the melting temperature, a small wandering spot being the real efficient part of the carbon, and the rest of the end of the carbon is consumed at a much lower temperature, giving off less intense rays and a longer wave length. This may be readily seen in a comparison of the Beck and ordinary arcs by the colour of the arc.

In the Beck arc the ends of the positive and negative carbons are enveloped in hydrocarbon vapour, which prevents the consumption of the carbons at a lower temperature, by keeping oxygen from them; in addition it cools the outer shell of the carbons, the gas being at a temperature of about 1,000° C., and thus concentrates the current in the centre of the carbons. Thus a current density greater than 0·75 ampere per sq. mm. is obtained, and the whole crater of the positive carbon reaches a very high temperature. The current is brought to both carbons near the ends by roller contacts, so that the only part having this high current density is the part protected by the indifferent gas. The positive carbon is cored with a rare earth having a melting point of about 3,500° C. The positive develops a deep crater, about 12 mm. deep, filled with incandescent gas. The sides of this crater reflect the light radiation to the focus of the crater, and, in addition, the light from the negative is reflected, so it is believed that nearly true black-body radiation is obtained; and by adjusting the focus of the crater to the focal point of the mirror the high peak in the luminosity curve of the beam is thus produced.

Figs. 2 and 3.—Beck Searchlight Arcs.

The area of the Beck positive carbon is 201 sq. mm.; the area of the ordinary 36-in. searchlight positive carbon is 805 sq. mm. In the Beck light the maximum intrinsic brilliancy is greater than 438 c.p. per sq. mm. The intrinsic brilliancy of an ordinary carbon arc varies from 120 c.p. per sq. mm. to 160 c.p. per sq. mm.

In addition to the black body radiation obtained from the crater, there is evidently a large amount of light radiated from the incandescent gas in the crater, of a selective nature. It would probably at first be thought that this gas would follow Kirchhoff's laws and absorb the lines which it naturally radiated, giving the Fraunhofer lines seen in the sun's spectrum; but in this case the incandescent gas is at a higher temperature than the crater, and the spectrum shows positive lines apparently superimposed on the regular temperature radiation.

The temperature of the incandescent gas within the positive crater is estimated to be between 5,000° and 5,500° C. Two views of the Beck carbons burning with normal current densities are shown in the illustrations, figs. 2 and 3.

It is very hard to compare two searchlights by the eye, but during a test both searchlights were lighted (the Beck and the U.S. Navy 36-in.), and first one and then the other was turned on the same object, with the result that objects not distinguishable, except in a hazy way, with the Navy 36-in. were plainly outlined by the Beck light. It is apparent to the eye that the Beck light is more of a bluish-white light than the standard; the ordinary searchlight beam looks yellow in comparison. The aggregate quantity of blue and violet rays in the Beck beam is about 23 per cent. At low intensities of illumination the maximum sensation to the eye for the same strengths of illumination shifts towards the blue end of the spectrum, while at higher intensities of illumination the maximum sensation for the same strengths is towards the yellow part of the spectrum. This shifting of the relative sensations for different intensities of illumination is the well-known phenomenon called the Purkinje effect. It is thus seen that the Beck light is particularly good for picking up distant objects where the illuminative intensity would be small.

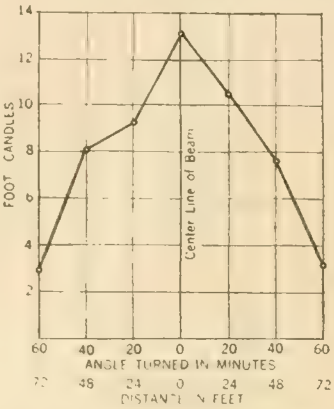


Fig. 4.—Foot Candle-Power-Distance Curve of the Beck 44-in. Searchlight taken at a Distance of 2.850 ft. Lamp Burning Normally.

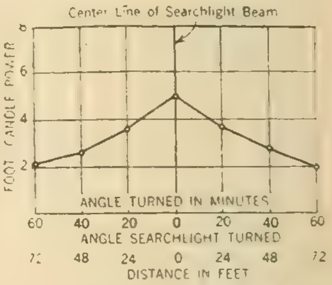


Fig. 5.—Foot-Candle-Power-Distance Curve of the Navy Standard 60 in. Searchlight taken at a Distance of 2,850 ft.—Lamp Burning under Normal Conditions.

It is also a well-known fact that a coloured body reflects the colours from the rays falling on it which the body itself contains, and absorbs the rays which it does not contain; the Beck light being strong in the short waves of light would thus be particularly effective in picking up objects of a bluish colour, such as the various classes of ships painted bluish grey.

Comparative night illumination tests were conducted between standard 36-in. and 60-in. searchlights and the 44-in. Beck searchlight. The beam given by the latter was a more concentrated beam than that obtained from either of the standard lamps, and the colour of the Beck beam was whiter.

With the carbons burning in a normal condition and placed in the proper focal centres of their respective mirrors, foot-candle-power readings at intervals of 24 ft. were taken across the beam at a distance of 2,850 ft. from the searchlights. Figs. 4 and 5 show the illumination across the beam of the Beck searchlight compared with that of the 60-in. standard searchlight. From these curves it can be seen that the maximum illumination obtained from the Beck light is approximately two and a-half times as great as that obtained from the standard 60-in. projector. In the Beck searchlight beam the illumination is very high at the centre and falls off very rapidly at the edge of the beam.

The maximum candle-power obtained with the present U.S. Navy standard carbons is 45,000 c.p., as against 88,000 c.p. obtained with the Beck lamp.

From the *Electrical World* we reproduce fig. 6, showing the complete projector, with the spirit tank mounted on the side of the barrel. The vapour is generated from methylated spirit in a cylindrical chamber filled with wire gauze, and heated by a small electric resistance heater, the spirit being admitted at a uniform rate into the vaporiser, where it is volatilised on the hot metal parts, escaping in the form of gas through nozzles under the electrodes. The spirit is fed automatically, when the arc is struck, by an electromagnetically-controlled valve.

The diameter of the negative electrode for 150 amperes is only 11 mm., and, owing to the protective effect of the vapour, the rate of consumption is only 50 to 60 mm. per hour; for the positive electrode a rate of 200-250 mm. per hour is allowed. The positive electrode can be renewed in a hot projector in a few seconds, and whereas the ordinary projector arc burns unsteadily until the carbons have settled down to shape, the Beck arc is ready for work within a few seconds.

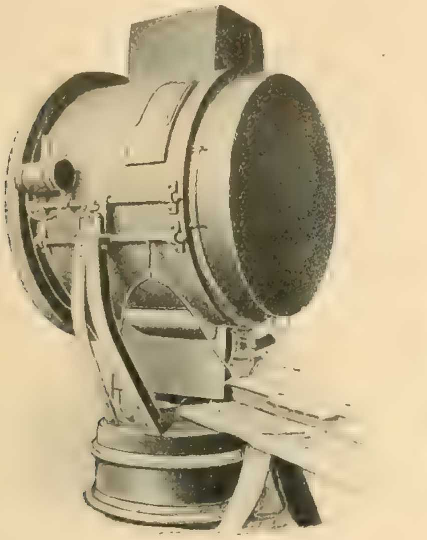


Fig. 6.—Exterior of Projector.

The positive electrode is 16 mm. in diameter, as compared with the ordinary carbons, 38 mm. in diameter, for the same current (150 amperes). The positive is not reduced to a point, but maintains its full diameter up to the crater.

SWANSEA ELECTRICITY EXTENSIONS.

We referred in a recent issue to the three-phase plant which has been brought into use by the Swansea Corporation electricity department.

This consists of two 1,875-K.V.A. turbo-alternators, with rotary converters and the necessary H.T. switchgear at the power station, where also new boiler plant has been installed; H.T. trunk feeders, and sub-stations, only one of which, at Uplands, is ready for running at the moment.

The turbine plant is of the horizontal Curtis type supplied by the British Thomson-Houston Co., giving its rated output at 3,000 R.P.M. and supplying energy at 6,600 volts and 50 periods. Overloads of 25 per cent. for two hours and 50 per cent. for 10 minutes are provided for, with normal steam pressure (150 lb.) and 85 per cent. vacuum. Centrifugal and emergency governors are fitted and the governing can be electrically adjusted from the switch gallery. The air for ventilating the turbo-alternators is supplied through ducts from dry air filters fixed outside the building.

The turbines exhaust into Cole, Marchant & Morley condensers, in connection with which are Edwards air pumps and circulating pumps, the pumps for each condenser being driven by a single motor.

Each condenser is designed to maintain a 28-in. vacuum when dealing with 27,000 lb. of steam per hour, with cooling water at 65° F. and a 30-in. barometer.

The three-phase H.T. switchgear was supplied by the British Westinghouse Co., and is of the remote controlled type; the L.T. control switches and instruments are mounted on a bench board, provided with red and green lamp indicators.

The bus-bars oil switches, &c., are enclosed in moulded stone cubicles. This switchgear controls the two turbo-alternators, also two rotary converters and four three-core ·1 sq. in. outgoing feeders. Two direct-current panels have also been supplied for the rotaries, arranged for either lighting or traction supply. The two rotary converters are of 500 KW. capacity each, of the six-phase type running at 750 R.P.M., and were also supplied by the British Westinghouse Co.

They are 8-pole horizontally divided machines, each with an alternating-current booster and squirrel-cage starting motor mounted on the same shaft, and supply either lighting or traction voltages; the main transformers are each of 550 K.V.A. capacity, of the oil-insulated self-cooling type.

The boosters allow of complete and independent control of the power factor on the A.C. side and of the D.C. voltage

The new plant in the boiler house consists of two Stirling water-tube boilers fitted with superheaters and underfeed mechanical stokers.

One boiler has a heating surface of 5,157 sq. ft. and a grate area of 91 sq. ft., and will evaporate 26,000 lb. of water per hour; in the case of the other boiler with 5,719 sq. ft. heating surface, and 93 sq. ft. grate area the evaporation is 29,000 lb.

The superheaters, made by Superheater Units, Ltd., consists of four distinct units of 88 tubes giving a total heating surface of 580 sq. ft.

The stokers were supplied by the Underfeed Stoker Co., Ltd., and are of the push-plate type.

B.T.H.-Curtis Turbo-Generator, as Installed at Swansea.

The Uplands sub-station plant consists of two 500-KW. rotary converters, together with the necessary transformers and switchgear.

The cost of this extension, for the particulars of which we are indebted to Mr. J. W. Burr, the borough electrical engineer, has been some £40,000.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Capturing of German Trade.

Now that the time for the electrical industry is here, in all seriousness—and has been for some time past, as a matter of fact—to arouse itself and concentrate on the prime factors which will enable it to capture and hold that large volume of trade which has been hitherto secured by our present enemies, the Germans, not only in these islands, but in all parts of our Empire, and also in the markets of our Allies, does it not behove the industry at once to set about what is one of the most essential primary movements to ensure this end?

It seems to me that the industry *en bloc* should immediately take those steps which will not only ensure the inception, but also the continuity, of the propaganda campaign, viz., by the preparation and publication of catalogues in, say, French, Russian, Spanish, and even in Japanese and Chinese, and, in fact, in the languages of all those countries with which we have every hope our mutual interests will be linked up and advanced in the future. We might leave the German language alone altogether, as, in any case, for some considerable time after peace is declared, it is highly improbable that we shall do much business with the Germans, at any rate, as sellers; as their customers we have had enough of them in the past, and should do all in our power not to give them the benefit of good British gold any more than we can possibly help, until such time as they can give us some evidence that they can to some degree be trusted. Therefore, for the time, blot their language out of our trade literature. The languages mentioned at the commencement of this letter will suffice for all international trading.

Perhaps one or two of the bigger and more important firms may be able to afford their own publicity and translation staffs, and will individually take up the running on the above lines, but there must be a large number of firms with not overflowing financial resources who would find it difficult, if not actually impossible, to employ their own translators capable of efficiently producing well-finished technical catalogues and propaganda.

Might I suggest that the present moment appears to be a particularly opportune one to institute a central organisation on behalf of the electrical industry (this might be undertaken under the auspices of the I.E.E. or the B.E.A.M.A.), where catalogue and propaganda matter might be efficiently dealt with by a competent body of linguists who have engineering training and capabilities. At this time, when there must be resident in this country a goodly number of electrical and mechanical engineers of French, Russian, and Belgian nationality, too old to join the fighting forces, or perhaps already incapacitated from further fighting, who would be only too glad to avail themselves of an opportunity to do something not only remunerative but also patriotic on behalf of their own particular country's future interests, such a central organisation could be established almost at once, I feel sure, given the necessary initiatory spirit.

There would be nothing to prevent the electrical firms from sending their copy to this institution, and paying for translations at a scheduled rate to be decided upon by the promoters and executive of the organisation. The particular style of cataloguing and printing could still be dealt with as at present by the firm's own printer or publisher. The writer has spoken to several representatives of publishing houses, and feels sure that there would be no hesitation in these firms quickly adapting themselves to the demand by the provision of the necessary type of printing—for instance, Russian type is somewhat outside the ordinary, likewise Japanese and Chinese—as, once having started, the trade for them in this direction would undoubtedly be a remunerative one.

Again, surely we have now had enough of the suspicion of each other among our home manufacturers. No doubt the German element in our midst was greatly responsible for this, but with that element eliminated, and the experiences which the war has taught us, undoubtedly there will be a return to the good old British axiom, so prevalent in the days of our trading forefathers, of "Let us trust each other."

Each firm's specialities are nowadays so defined, and it is—and always has been—such an easy thing for any firm to get hold of its rival's catalogue, that there should no longer be any distrust or hesitation in deciding upon some course which will work out, not only effectively but comparatively economically, in the common cause of the industry.

The writer hopes that the idea put forward may receive the serious consideration of the electrical trade, but the principal point is—not to adopt the *laissez faire* policy, but that of "Do it now!"

The principle might be extended to the establishment of a central school of languages for the teaching and training linguistically of commercial and engineering travellers, who will eventually be required to follow up the propaganda in foreign countries—*i.e.*, if we have learned anything or are likely to learn anything as the outcome of this terrible world upheaval, and we are to ensure that never again will Britain be caught napping.

The average monolinguistic Englishman has for many years been almost the laughing-stock of his German rival, because he could not speak several languages, but the writer fancies this will be another instance where "those laugh best who laugh last," and, as in the matter of fighting, the Englishman will prove himself also not wanting in the matter of linguistic achievements, when he recognises the necessity of grappling with the issue.

Suggestive.

London, *April 19th*, 1915.

Electric Road Rollers.

The letter *re* "Electric Road Rollers" from your correspondent, Mr. Topliss, is particularly interesting, as the next issue of the *Electric Vehicle* will deal largely with electric battery traction for municipal purposes, and the question of electric road rollers will be dealt with in an Editorial.

I have sent the draft to a well-known maker in order that any possible "bloomers" may be eliminated, as I am not an expert in this type of machine, but, from a common-sense point of view, it does seem to me that electricity applied to road rollers ought to change for the better the whole aspect of this branch of municipal work. The present steam roller is an unmitigated nuisance on account of its noise, smoke and dirt.

The necessary weight can easily be obtained in the form of the battery, and there is no question whatever that the cost of upkeep (repairs, maintenance and power), must be considerably less than with the steam or petrol-driven machine. I believe if one or two enterprising makers took the matter up—it would result in advantage to them, and to the central-station engineer, who would tap a big source of revenue.

The journal does not go to press until the end of May, and in the meantime any information on the subject that your readers can send me will be very welcome and help along the movement.

A. Hugh Seabrook,
Hon. Editor, The Electric Vehicle.

London, W., *April 17th*, 1915.

Ball-Bearing Extensions.—The Hoffmann Manufacturing Co., Ltd., of Chelmsford, are still further considerably extending their already large works. Their ball-bearing hanger for line shafting has been in great demand during the past year, the total supplied being sufficient to carry 42,000 ft. of line shafting at normal pitch.

LEGAL.

Taunton *v.* Harkness Bros.

The Electric Appliances Co. were on April 15th defendants in an action heard in the King's Bench Division, before Mr. Justice Low and a common jury, in which Mr. Thorn Lionel Taunton, a traveller in electrical fittings, &c., residing at Ealing, claimed commission and compensation for wrongful dismissal.

According to the opening statement of Mr. Mayer, K.C., who appeared for the plaintiff, an agreement was entered into verbally between plaintiff and Messrs. Harkness Bros. for him to travel in vacuum cleaners on commission and £1 a week for travelling expenses. The engagement dated from May, 1911, and the plaintiff's operations were confined to London. Subsequently Messrs. Harkness's business was turned into a company, and plaintiff continued his duties under the original agreement. In 1913 he was asked to give demonstrations with the vacuum cleaner upon the understanding that his commission should continue while he was so engaged, and that his interests, which would be looked after by others meanwhile, would not be affected. The defendants then asked him to part with half of his commission to those who looked after his business, but this he declined to do. Subsequently differences arose over the plaintiff's letters from customers being opened at the office and acted upon by other travellers, and plaintiff wrote stating that letters from his clients addressed to him personally "must" remain unopened and left for him to deal with personally. To this communication the defendants took exception, characterising it as impertinent, and demanding a written apology within 24 hours, failing which he would be given a week's notice. The plaintiff told the defendants' directors that he was sorry they should have regarded the word "must" as offensive, and assured them that it was not so intended. They, nevertheless, gave him the week's notice, and he had to leave.

The Plaintiff was called, and in the course of his cross-examination his Lordship said there was no justification for saying that he (plaintiff) had been guilty of misconduct, as was alleged as the reason for his dismissal at a week's notice instead of six months, claimed to be the custom where travellers were paid by commission only. It was absurd to say that the word "must," as used by the plaintiff, was offensive, and his neglect to send a written apology could not be construed into a refusal to obey reasonable orders. It was clear that there had been no misconduct, and it was a serious matter to make such a charge against a man where there was no foundation for it. He suggested that the parties, under the circumstances, might come to some arrangement.

After consultation between counsel, it was agreed that judgment should be entered for the plaintiff for an agreed amount, with costs, and that the £26 3s. 7d. paid into Court by the defendants should be paid out to the plaintiff's solicitors.

Judgment was accordingly entered for plaintiff for an agreed amount, endorsed on counsel's briefs, with costs.

Prize Court.—Seizure of Electric Fans.

Sir Samuel Evans, presiding over the Prize Court, again had before him a few days ago the case in which the Crown asked for condemnation of five cases of electric fans seized on board the P. & O. steamship *Poona* in London on October 17th. The goods were claimed by Isaria, Ltd., of 208, Tower Bridge Road, a company duly incorporated in England on May 30th, 1912. The matter was adjourned from last term for further evidence to be produced by the claimants.

Mr. A. W. Elkin, on their behalf, said he now produced certain documents which were asked for on the last occasion. The first was a duplicate of the agreement made between claimants and Messrs. Lascelles, Parrington & Brasche, of Melbourne, appointing the latter their agents in Australia. The original was in Melbourne. That proved beyond doubt, he submitted, that Messrs. Lascelles, Parrington & Brasche were claimants' agents. The next documents consisted of a bundle of reports from Mr. Charles Brandt, claimants' traveller in Australia, and a number of commission notes between claimants and their agents.

The President said it rather looked from these documents as if the goods belonged to the claimant company, and that Messrs. Lascelles, Parrington & Brasche were only the agents for sale, and Mr. Brandt was the traveller. He would like to see the share register of the company.

Mr. J. B. Aspinall (for the Crown) said he had a list of the shareholders, dated July 18th, 1914. There seemed to be seven shareholders, all German. He gathered that his Lordship was satisfied that these goods were the property of the Isaria Co.

The President said he would like to have some further evidence from Mr. Moreton, the manager of the company.

Mr. Frank Moreton, recalled, stated that the document appointing him manager was signed by Mr. Ludwig Schoenmann, the engineer and secretary, and by Mr. Carl Seifer, the commercial manager, on August 3rd.

The President: What became of them after they appointed you?

Witness: They left the country on the night of August 3rd, to the best of my knowledge. I think they went to Germany *viâ* Copenhagen.

Have you had any communication with any of the directors since you were appointed?—No; I account to no one but the Board of Trade Supervisor.

Replying to Mr. Elkin, Witness said that the Board of Trade were quite satisfied with his mode of carrying on the business, and they countersigned all the cheques drawn by him on the company's account.

Cross-examined by Mr. Aspinall, Witness said he did not know what authority the two gentlemen who appointed him manager had so to do. He assumed they had authority from the directors.

Mr. Elkin submitted that Mr. Morton was properly appointed, and that having regard to the fact that the claimants were a duly incorporated company in this country they were entitled to the release of these goods, on the authority of the decision of the Court of Appeal, in the case of the Continental Tyre and Rubber Co. *v.* Tilling.

The President: Supposing this company constituted as it is wanted to buy ships, could it own them?

Mr. Elkin said that had not been decided.

The President remarked that it would be very odd if the company was the owner of the ship and also the cargo, and was entitled to the cargo and not to the ship.

Mr. Elkin said he relied very strongly on the decision of the Court of Appeal.

The President said he was willing to pay all deference to that decision, but it did not bind him in that Court. He might after careful consideration come to the conclusion that he might be able to agree with Lord Justice Buckley's dissenting judgment.

Ultimately, his Lordship reserved judgment.

Trading with the Enemy.

In the City of London Court, on April 19th, a considered judgment was delivered by Judge Atherley-Jones, K.C., in a case of much trade interest and importance, in which Bruno Ullmann, successor to Bechmann & Ullmann, 21, Moor Lane, E.C., sued Mr. S. Nyman, 80, Westbourne Grove, Bayswater, for £11 5s. for trade goods supplied. The defence was that the plaintiff could not recover because of the Trading with the Enemy Act, although the defendant was quite prepared to pay if so ordered. Plaintiff, it seemed, was a German by birth, and was naturalised in 1899. In 1901 he said he went into partnership with Bechmann, a German. Bechmann died and the business passed to Ullmann. The goods sued for were ordered and delivered in March of last year. Plaintiff ranked as a British subject and was entitled to all the assets of the concern including the debt due from the defendant. There could be no question there of trading with the enemy. Plaintiff had communicated with the Board of Trade, the Treasury, and the Controller of Companies, and they had no objection to him recovering. Of course he would not part with the money or send it to Germany. The business here was a London branch. The headquarters were in Erfurth. The business here was a distinct entity. The goods supplied to the defendant were invoiced from London and Germany. Defendant said unfortunately his business was with foreign houses, and during the last two months there had been awful trouble through people paying money. He had already got into trouble with the authorities for paying in another case.

Judge Atherley Jones, K.C., said that as the point raised was a novel one and had never been before any Court, and as it was of great importance to every trader in this country, he had taken time to consider his decision. He had come to the conclusion that plaintiff could not recover as he was satisfied that the business of Ullmann & Bechmann was a German house. As for the correspondence with the Board of Trade, &c., it was immaterial, as Courts of Law did not found their judgments on the opinions of Government officials. Plaintiff's business in London was only an agency. Judgment for the defendant with costs, but he gave leave to the plaintiff to appeal, as he thought it quite likely that the Divisional Court might take another view. It was certainly a very important case.

National Freehold Land and Building Society *v.* Maurice Freeman.

An alleged nuisance by motor-driven machinery gave rise to this action, which came before Mr. Justice Sargant on April 19th, the plaintiff Society and their tenant, Battista Barzalia, claiming an injunction in respect of an alleged breach of agreement, and the defendant, also a tenant of the Society, counterclaiming for damages for alleged breach of warranty.

Mr. Stroud, in opening the case on behalf of the plaintiff, said he claimed an injunction to restrain the defendant from using or permitting to be used on his premises, the first floor of 39 and 40, Mitre Street, Aldgate, any machinery so as to cause a nuisance either to the plaintiffs or the other occupiers of the premises. The plaintiff Society were the landlords, and the plaintiff Barzalia was a tenant of theirs who carried on a restaurant business there. The defendant became the occupier of the first floor of the premises under an agreement dated January 15th last year, and he alleged that before entering into the agreement the Society, through its agents, had warranted the premises to be adapted for motive power. That gave rise to the counterclaim, the defendant contending that in the event of the second plaintiff recovering any damages, or an injunction being granted, he was entitled to claim against the society for breach of warranty. Prior to January 12th the defendant entered into negotiations with Messrs. F. Hilbury & Co., house and estate agents, of 140, Leadenhall Street, for premises suitable for his business of a buttonhole maker. In an interview with Mr. Hilbury the defendant explained that he required the premises for his business of a buttonhole manufacturer, and also mentioned that he would be using machines, but it was not suggested or brought to the knowledge of Mr. Hilbury in any way that there was any intention of introducing electric or other power on the premises. In a letter written before the tenancy agreement was entered into the defendant said he had ascertained that there was no electric light installed on the premises, but no reference whatever was made to electric power. Mr. Johnstone, the secretary of the plaintiff society, and Mr. Hawkins, a rent collector in their employ, had interviews with the defendant prior to the signing of the agreement, and both would tell the Court that though the defendant said that he would put machines on the premises they understood him to mean treadle or hand machines. Nothing whatever was said about power-driven machines. The defendant asked Hawkins whether there was electric light on the premises, and Hawkins by mistake said that there was, but nothing would turn upon that as the defendant afterwards had a letter stating the contrary. When the agreement was completed at Messrs. Hilbury's office, again nothing was said about power-driven machines. The agreement was for a tenancy of the whole of the first floor of 39 and 40, Mitre Street, and the clause upon which the plaintiffs relied was that the tenant covenanted to do nothing that might cause nuisance or annoyance to the occupiers of adjoining property, nor carry on any trade or business except that of a button-hole maker.

Mr. Justice Sargant: That would imply that he was not to use the premises for the business of a button-hole maker so as to be a nuisance, unless the nuisance was absolutely essential to the carrying on of a button-hole maker's business. The defendant would have to show that it was quite impossible to carry on his business without causing a nuisance.

Counsel, continuing, said that the defendant was let into possession, and he proceeded to make arrangements with an electric lighting company to install electric power without consulting the plaintiff society in way.

Mr. Justice Sargant asked whether the installation was for both light and power.

Counsel said he did not know.

His Lordship said he asked because there must have been a separate installation for power, as power was charged for at a different rate.

Counsel said he did not think it mattered, as there was no question that the defendant was working his machines by electric power. Mr. Hawkins visited the premises about some repairs and saw an electrician at work there, but thought it had merely to do with electric lighting. Barzalia wrote to the plaintiff society complaining of the nuisance and loss of custom in consequence, and after some correspondence, in which it was suggested that the nuisance might be obviated by more firmly fixing the machines, the present action was commenced.

Both sides agreed that if the Court should hold that the question was one of damages the amount should be fixed by his Lordship, to save the expense of an inquiry.

It was admitted, added counsel, that the defendant had installed on the premises a 2-H.P. electrically-driven machine.

Evidence was given in support of counsel's opening statement.

Called for the defence, and examined by Mr. Fortune, Maurice Freeman said that he had been in business in Old Street, and had used power-driven machines. It was perfectly understood when he took the premises in question that he would be using machines in his business, and the electrically-driven machines made little or no more noise than would hand or treadle machines. The machines he was now using stood on a bed about 3 ft. high, and were the best machines that could be got for his trade. There was no better method known in the trade of carrying on his business than the one he had adopted. As a buttonhole maker, he did not think his business could be carried on with less noise. All the large firms used these machines. He was now busy on Government work, and worked on a Sunday.

Cross-examined, Witness said that when he asked whether electricity was laid on on the premises, he did not lead Mr. Hilbury to suppose that his inquiry referred only to electric light. He asked whether there were electric wires on the premises, and he did not suppose that anyone could suppose his inquiry was confined to wires for electric lighting.

Re-examined, Witness said that he made it clear to both Mr. Hilbury and Mr. Hawkins that he would be using motor-driven machines.

Other evidence was given for the defence to the effect that there was very heavy machinery in the neighbourhood, the working of which could be heard in the street, and that the defendant's electrically-driven machines would make less noise than treadle machines.

Mr. Fortune, in summing up the defendant's case, admitted that there was undoubtedly some noise caused by these machines, but people could not live in a city without having to endure some noise, and he submitted that the noise in question fell very far short of a common-law nuisance.

His Lordship, in giving judgment, said that there had not been the slightest evidence put before him that the negotiations for the agreement of tenancy proceeded on the footing that the defendant was to be entitled to use power-driven machinery on the premises, and he was satisfied that the plaintiffs' agents never had it brought before them that it was the intention to use such machinery. The onus of showing that his business could not be carried on without causing a nuisance was on the defendant, and he had not only not established that proposition, but had not attempted to do so. He had come to the conclusion that the working of these machines was a nuisance, though he thought it was just on the border line of what was a common-law nuisance, and he accordingly granted an injunction to restrain the defendant from so working his machines as to cause a nuisance, and awarded the plaintiff Barzalia £15 by way of damages

The defendant was ordered to pay the costs of the action, but the injunction was suspended for four weeks to enable the defendant to get out of the premises

The defendant's counterclaim was dismissed, with costs.

Cunningham, Ltd.

The petition of W. T. Henley's Telegraph Works, Ltd., for a compulsory order to wind up Cunningham, Ltd., electricians, again came before Mr. Justice Astbury, in the Companies' Winding-Up Court, on Tuesday. Counsel reminded his Lordship that at the previous hearing he stated that a few creditors had not come into the arrangement that had been proposed. He was now able to state that the whole of the creditors had come in, and the only thing to do now was to dismiss the petition by consent, without costs.

Mr. H. E. Wright said he appeared for a large number of creditors opposing the petition and he assented.

His Lordship dismissed the petition, without costs.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Variable Speed A.C. Commutator Motors.

Messrs. F. Parkinson & Co., of Wells Works, Guiseley, near Leeds, have recently issued a new catalogue and price list of their A.C. commutator motors, an installation of which at the Government Stamp Printing Works, Hayes, Middlesex, was described in the Electrical Review, of November 21st, 1913. The makers claim that these are the only British-made motors in which the following features are obtainable: (*a*) A large speed variation, up to a ratio of three to one, with a shunt speed characteristic throughout the range; (*b*) this is obtained without the use of any resistances; (*c*) efficiency practically constant at any speed, and comparable with that of a D.C. motor of equal size. The motors have fixed brushes and no mechanical governor or short-circuiting device of any description is employed.

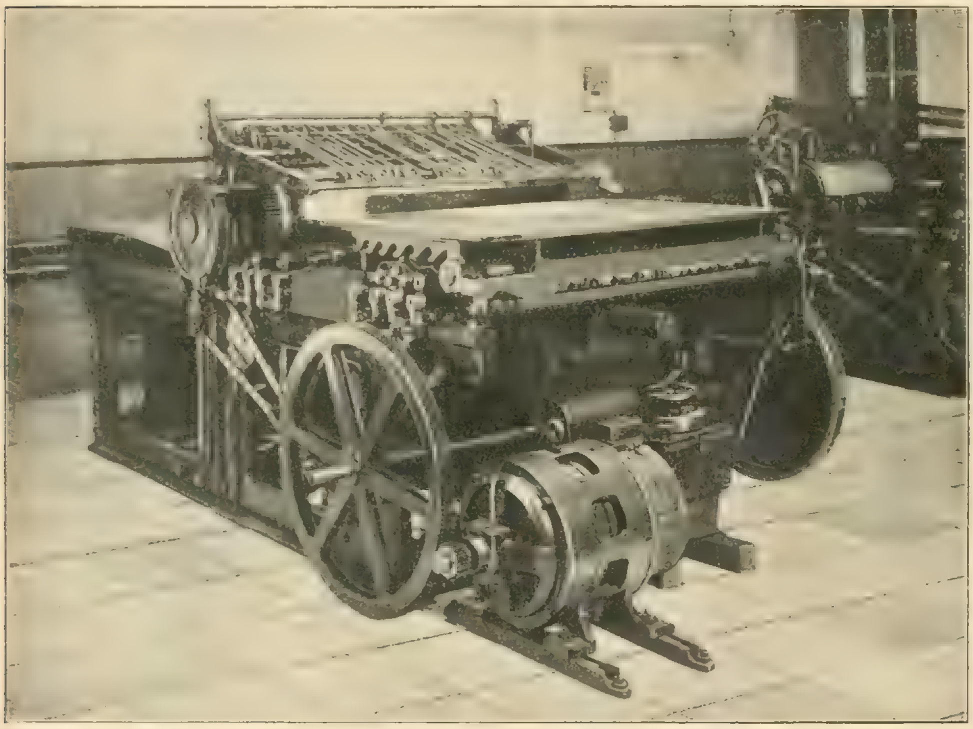


Fig. 1.—Variable-Speed A.C. Commutator Motor Driving Printing Press.

The motors are provided with exceptionally robust shafts, bearings and commutators, which ensure great reliability in service, and have been designed in five types, covering practically the whole field of the application of alternating-current motor driving for industrial purposes. We illustrate in fig. 1 a variable-speed single-phase motor driving a printing press. The speed controller consists of a small oil-immersed transformer which is shown in the illustration. These machines are built under the Punga and Creedy patents.

A serious objection to alternating-current commutator motors in the past has been the difficulty of obtaining satisfactory commutation. This feature has received very careful consideration in the design of the Parkinson motors, and the makers can guarantee the commutation to be equal to that of the best modern direct-current practice. These motors fill a long-felt want in the application of alternating current for industrial purposes.

The firm have recently completed a large extension of their works in order to meet the increasing demands for their manufactures, and the whole of their works is devoted to the manufacture of alternating-current commutator motors.

The Firadanac Mining Switchgear.

Messrs. Berry, Skinner & Co., of 78, Upper Thames Street. London, E.C., have brought to our notice a new type of explosion-proof switchgear, consisting of a very compact form of combined fuse-switch specially constructed for use in those regions of the coal mine where the Home Office Regulations require the apparatus to be explosion-proof, and preferably fool-proof.

It is conceded by experts that an apparatus which has its component parts in one chamber is better and safer than an apparatus which separates its switches and fuses into different compartments connected by small inlets; moreover, a combined apparatus of the fuse-switch type is obviously more compact, and for a given output has a less cubical content for the retention of explosive gases. It is claimed that the present invention contains a number of points, all important, but never hitherto combined in one piece of apparatus.

The following are the features of the Firadanac explosion-proof, interlocked combined fuse switch with air-break, to which attention is directed:—

Great mechanical strength: exceptionally small size for a given output; wide machine-faced surfaces in comparison with the cubical contents of the cabinet: every current-carrying contact is renewable from the front; by an ingenious mechanical device the movable switch contacts can be revolved to present an entirely clean switch contact after damage; every switch is arranged so that the current is broken upon each pole, upon two contacts in series, and with a parallel action. This is better than a knife-switch with one, or even two, contacts where the current is broken at a point; it is impossible to tamper with the contacts by mischief or accident; the switch has positive quick make-and-break action; access to the explosion-proof cabinet is impossible until the moving switch contacts and fuses have been made dead; the design is arranged so that the mains may enter at either the top or bottom of the cabinet, and without having to turn the switch "upside down"; the apparatus is fitted with Berry's patent magnetic blow-out fuses. Without a screw-driver or any other tool, these can be re-fused with ordinary copper wire in a few seconds. There is no possibility of accidental shock during replacement.

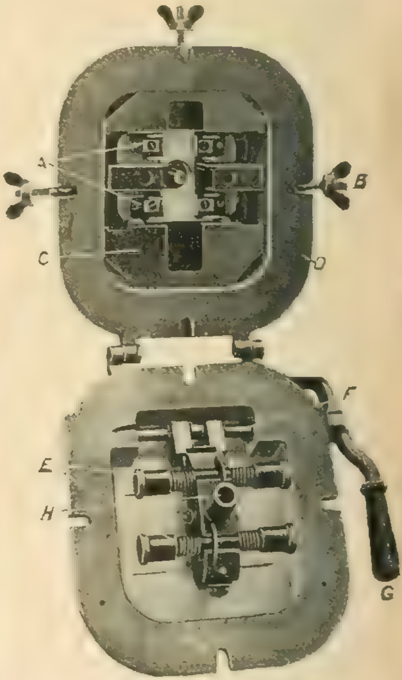


Fig. 2.—Firadanac Switch-fuse, Box Open

The switchgear was examined and tested by the Underwriters' Laboratories, Inc., of Chicago, U.S.A., in December last. A sample 20-ampere 200-volt switch was operated 12 times by hand, closing and opening a circuit in which a continuous current of 30 amperes at a pressure of 315 volts was passing, first with the switch cabinet earthed, and afterwards with the generator alternately earthed on the positive and negative side. Strips of copper were placed in parallel with the fuses to prevent the latter from blowing. The contacts were only slightly burned.

The insulation resistance was measured with a 500-volt Evershed Megger, and the result was:—Positive to negative, 20 megohms; positive to negative to earth, seven megohms. The two poles of the same switch were connected to the terminals of a transformer, and starting at 800 volts the pressure was gradually raised to 2,000 volts and maintained for one minute. The test was repeated with the transformer terminals connected to the switch contacts and metal case respectively. The insulation satisfactorily withstood this test. The illustration (fig. 2) shows an ironclad fuse-switch cabinet with the cover open; this cabinet is provided with a 1½-in. machined flange D, with similar provision on the hinged cover. When the cover is closed and the metal surfaces are together, they are clamped by four equally-spaced wing nuts as at B.

The cover having been closed, the lever G can now be operated by means of the spindle and rock shaft F to throw the rapid-acting toggle joint carrying the magnetic blow-out fuse carriers E into their respective base contacts at A. This operation of closing the switch automatically locks the cabinet by means of the engagement of a male bolt in the centre of the base with the female projecting tube H. It is impossible to open the cover until the bolt is withdrawn by moving the switch to its "off position."

Shrouding of the cable connections in the base to meet the Home Office requirements is provided by the insulating screens as at C. To rewire a blown fuse, the magnetic blow-out fuse carriers E can be out-sprung in one second, re-fused and in-sprung into position in under 30 seconds for the complete operation. The apparatus is low in price and simple in construction. Every part is interchangeable; it is "made like a gun."

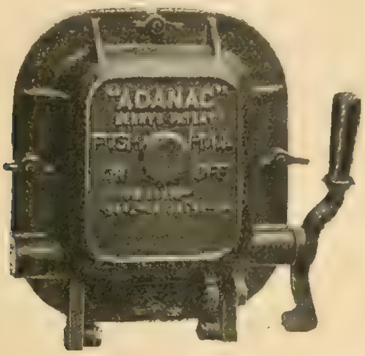


Fig. 3.—Firadanac Switch-fuse, Closed.

Electrically Heated Grip for Steering Wheel.

Electrically heated leather-covered grips for use on steering wheels of automobiles, have been developed by the **Interstate Electric Co.**, New Orleans, La. The grips are attached to the wheel, as shown in the accompanying illustration, and are provided with laces for making them tight. Energy may be obtained from the storage battery of the car, or, if the magneto's rating is high enough, from the magneto.

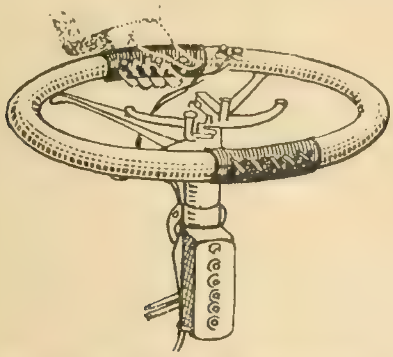
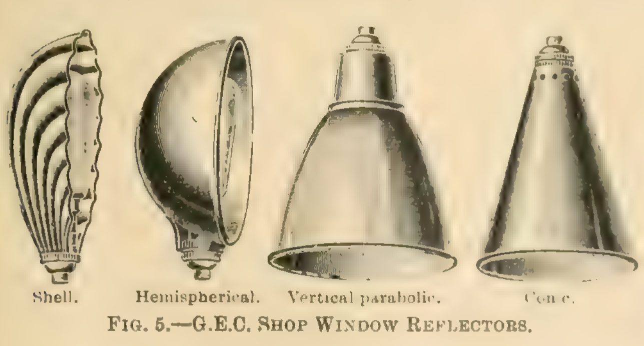


Fig. 4.—Electrically Heated Grips.

Shop Window Reflectors.

A complete series of seven shop window reflectors has been brought out by the **General Electric Co., Ltd.**, of Queen Victoria Street, E.C., which includes the following types: Shell, fluted scoop, plain scoop, hemispherical, horizontal parabolic, vertical parabolic, conic, all of which (except the hemispherical) are made in two sizes, the smaller designed for up to the 30-watt Osram lamp size, and the larger for lamps up to the 60-watt size, thus ensuring any pear-shaped Osram lamp of the usual sizes having its correct reflector. All these reflectors have scientific contours, and effectively screen the light from the eyes of persons looking in the shop window.



Shell. Hemispherical. Vertical parabolic. Conic.

Fig. 5.—G.E.C. Shop Window Reflectors.

Special care has been taken to see that the shade carrier ring, which holds the reflector in position, is easily accessible, and a special feature in the case of the deep conic and vertical parabolic patterns is the provision for the necessary ventilation. The high-class nickel plating finish assures the maximum amount of reflection being obtained.

A neat folder, No. F. 1,902, gives particulars of these reflectors, some of which are shown in fig. 5, in tabulated form.

ELECTRICAL TRADES BENEVOLENT INSTITUTION.

The report of the Committee of the above Institution for the year ended December 31st, 1914, was adopted at the annual meeting, held at the Institution of Electrical Engineers, on Monday evening. Dealing first with financial matters, the Committee says that for the second year in succession the principle of having the head of a large firm as President of the Annual Festival resulted in a most satisfactory addition to the funds. The total income from contributions for 1914 was £3,139. This, added to the receipts from dividends and other sources, produced a total income of £3,380, as compared with £1,363 in 1913. The subscriptions from members and the number of members have again increased. The result of the year's work has been a net income of £3,127. The following investments have been made out of this sum:—£404 Canada 4 per cent. registered stock, £407 3 per cent. Metropolitan Water Board stock, £925 New Zealand 3½ per cent. inscribed stock, £1,071 Bombay, Baroda and Central Indian Railway capital stock, = £2,807, bringing the total of the invested funds to £7,727.

For the sixth year in succession a donation has been received from the Electrical Engineers' Ball. Mention is made of the financial and other support received from the electrical Press, and this year for the first time from the general Press.

The working expenses have naturally, in view of the large amount collected, been heavier, but it is a matter of satisfaction that the percentage of the expenses to the amount collected is very much less than in previous years.

The total amount paid out for temporary relief during the year was £253, as compared with £154 in the previous year, the number of grants dealt with being 28. Every person who has applied and who was qualified for assistance received the same.

Employment was found for many of the applicants. The committee has always endeavoured to find work if possible for those who apply for assistance, and in this way the amounts expended on temporary relief are much smaller than they otherwise would be, with the result that the invested funds can be increased more rapidly than otherwise would be the case.

The committee feels that it cannot too strongly impress upon all those connected with the electrical industry how desirable it is that the members of the staffs of firms should join the Institution as members, and it therefore again points out in the report the advantages of membership. It is hoped that the heads of electrical businesses will bring this matter before the members of their staff.

Mr. Hugo Hirst was elected President of the Annual Festival, 1914, and owing to his untiring energies preceding the festival he was able to announce at the dinner that a total sum of over £2,700 had been collected. The chairman's list amounted to £2,464.

The Chairman in his appeal at the dinner was ably supported by Sir David Salomons, Mr. Wordingham (Vice-President of the Festival), and Mr. Godfrey Isaacs, and as the result, the total amount collected in connection with the festival, exclusive of the subscriptions of new members who then joined, was £2,741.

The benefit which has resulted to the Institution by the system of collectors' books is demonstrated by the list in the year-book. The committee trusts that those gentlemen whose names appear in the list, and who devoted so much time and energy during the year 1914 to assist the collection of funds of this Institution, will continue their much appreciated efforts in the year 1915.

The Institution of Electrical Engineers is thanked for the use of its premises, and the electrical Press for its assistance in the matter of publicity.

The balance sheet shows that the fund now has £7,727 invested, and £199 at the bank, with £22 standing as sundry debtors, = £7,948. The income of the year from all sources, including dividends on investments (£225), subscriptions, donations, and sale of tickets, etc., for the Annual Festival Dinner, was £3,470. The expenditure was as follows:—Printing, postages, stamps and stationery, £64; secretary's salary and commission and other expenses, £179; 28 grants paid (ranging in value from £1 10s to £20), £252; cost of Annual Festival Dinner, £100, making the balance carried to the balance sheet £2,875.

Among those present at the meeting were Messrs. F. Gooden (in the chair), Justus Eck, F. B. O. Hawes, H. Bevis, F. H. Nalder, H. Oppenheimer, A. A. Campbell Swinton, and L. G. Tate. The total income for the past year amounted to £3,470, compared with £1,362 for 1913, and 28 grants, totalling £252, were made, as against 14 grants totalling £154. The total out-grants were [illegible] ([illegible]), and the surplus carried to the balance sheet [illegible] ([illegible]). The total capital of the Institution on December 31st last was £7,271 against £4,[illegible]. At present there are about 170 members. Messrs. Sugden and Hextall were re-elected hon. solicitors, and Messrs. Price, Waterhouse and Co. hon. auditors. Lord Vaux of Harrowden, Lt.-Col. H. M. Leaf, and Messrs. Guy Burney, H. Beyis, H. H. Berry, F. J. Walker, R. J. Wallis-Jones, and S. D. White were re-elected to the committee of management, and it was resolved that special effort be made to induce Mr. E. J. Clark to withdraw his resignation, owing to the valuable services he had rendered in the past. It is desired to fill vacancies on the committee by representatives of electrical firms.

WAR ITEMS.

Carlisle Supply Men.—The following is a complete list of employés of the Carlisle electricity department now serving with the Colours. these form 35 per cent. of the total. Those still employed are provided with a badge indicating that they are engaged on public service.

Baynham, H. P., station superintendent, Royal Engineers.
Hay, J. H., chief clerk, 4th East Lancs. Howitzer Brigade Cumberland R.F.A.
Fraser, W., storekeeper, 7th Batt. Border Regiment.
Stephens, G., assistant storekeeper, Border Depôt.
Thompson, W. V., consumers' assistant, Army Service Corps.
Ballantyne, H. S., switchboard attendant, 4th Batt. Border Regiment.
Fairclough, F., meter reader, 4th Batt. Border Regiment.
Mannion, J., jointer, 4th East Lancs. Howitzer Brigade Cumberland R.F.A.
Baxter, R., stoker, 2nd Batt. Border Regiment.
Berry, M., coal trimmer, 4th Batt. Border Regiment.
Wright, A., coal trimmer, Royal Engineers.
Clark, W. H., porter, 4th Batt. Border Regiment.
Sanderson, R. H., engine room attendant, 4th East Lancs. Howitzer Brigade Cumberland R.F.A.
Simpson, J., apprentice, 4th East Lancs. Howitzer Brigade Cumberland R.F.A.
Todd, G., apprentice, 4th East Lancs. Howitzer Brigade Cumberland R.F.A.
Gem, R., apprentice, Royal Engineers.

Germans and Russian Cables.—According to the *Novoie Vremya*, the subscription of the house of Bogau & Co., of Moscow, of 300,000 roubles for war charities, has brought the question of the nationality of the house under discussion. It is undoubtedly considered to be German, and two members of the board, M. Ph. and G. M. Mark, only became naturalised Russians after the war began. Further, after the outbreak of the war, a syndicate was formed in Petrograd called the United Cable Factories Co., in which the chief part is played by the house of Bogau, along with the German house—Felten & Guilleaume, of Mannheim. This syndicate, says the journal quoted, now dictates the prices of copper and copper products in Russia, being part owner of the Bieloretzk, Kolchugin and other factories which control practically all the copper goods produced. Controlling also rich copper mines of the Caucasus and the Urals, Bogaus dispose of immense stocks of copper, and if the syndicate has raised the price of copper by about 50 per cent., and of copper goods by 75 per cent., the lion's share of the profit is passing into the pockets of Messrs. Bogau & Co.

A Hungarian Company and the War.—The report for 1914 of the Hungarian Felten & Guilleaume states that after a short period of stagnation the industrial and economic life of the country assumed a regular course with the exception of a few branches. Instead of a dearth of work a scarcity of workers had arisen, and the difficulties resulting therefrom, as well as from the limitation in the production of coal and the increased cost of manufacturing, brought about a diminution in the profits. The gross profits amounted to £37,000, as compared with £41,000, and the net profits were £17,000, as against £28,000 in 1913, the dividend being 10 per cent. as contrasted with a rate of 15 per cent. in the previous year. At present the company is still engaged directly and indirectly on the execution of war orders and would be able to keep the works in full operation were it not for the lack of copper owing to the requisition of this material by the Government.

English Capital in Germany.—The chairman of the Mix and Genest Telephone and Telegraph Co., of Berlin, was asked at the recent general meeting why the company had registered a proposal for the liquidation of the Lampson Co., in which the former is financially concerned. In reply it was mentioned that the telephone company was at present unable to work with an undertaking in which Englishmen were interested, which was now everywhere exciting attack, and was excluded from official orders. After the removal of the English participation it was added that the Lampson Co. would presumably resume business activity, and the hope was expressed that favourable results would then be obtained.

More Electrical Men Wanted.—The 204th Field Company R.E. and 40th Divisional Signal Company R.E. are now being formed and training at Norbury, S.W. Major Minshall, R.E., M.I.E.E., is in command of the 204th Field Company. There are vacancies in both of these companies for electricians, wiremen, telegraphists and mechanics. Applications for particulars or for enlistment should be made to the Norbury Golf Club House, Norbury, S.W.

Board of Trade Assistance.—List No. 16 (week ending April 10th) has been issued giving particulars of inquiries received for sources of goods by the Commercial Intelligence Branch of the Board of Trade.

Municipal Repair Shops.—The Manchester civic authorities are making every effort to assist the Government in increasing the output of war munitions, and on Friday a special sub-Committee of the Corporation Electricity Committee offered the War Office the use of the repair shops at the Stuart Street generating station. This is a large building, containing lathes and other important machinery. The War Office representatives in the city have expressed the opinion that the building is most suitable for the work.

The Liverpool Tramways, Electric Power and Lighting Committee has passed a resolution that the Committee desires to do everything possible to assist the Government in the production of munitions of war, and that the Corporation workshops at Lambeth Road be placed at the disposal of the Government for this or for any other purpose, such as repairs to motor transport vehicles, &c.

Contravening Lighting Orders.—The first prosecution in Leeds for contravention of the Military lighting restriction orders, under the Defence of the Realm Act, occurred last week, when a tradesman was fined £10, with the alternative of eight weeks' imprisonment. When the defendant said he would pay in a week the Stipendiary Magistrate said he must pay that day or go to prison. The defendant had defied the police.

Personal.—Mr. J. H. Thomas, A.M.I.E.E., who has recently returned to England from the Far East has been granted a commission in the Royal Engineers, and is attached to the 204th Field Company now training at Norbury.

Mr. E. A. Shaw, formerly assistant engineer to the Burton-on-Trent and Ashby-de-la-Zouch Light Railway Co., has been gazetted Lieutenant in the Royal Garrison Artillery.

By wireless from Berlin comes the information that the Iron Cross has been conferred upon Prof. Roentgen in acknowledgment of his eminent services to surgery. The professor was decorated on his 70th birthday.

The *London Gazette*, on Tuesday, contained the following announcements:—

TERRITORIAL FORCE.

No. 2 Electric Lights Companies.—Neville L. Phipps (temporary)' Cyril R. Norman (temporary).

No. 3 Electric Lights Companies.—Percy H. Bartlett (temporary), Cuthbert L. Fox (temporary).

No. 4 Electric Lights Company.—George Frederick Bale to be Second Lieutenant. Dated April 21st, 1915.

London Electrical Engineers.—Second Lieutenant Hubert F. G. Roose is seconded. Dated April 10th, 1915.

Roll of Honour.—Information has reached Liverpool that two more tramway men employed by the Corporation have been killed at the front. The roll of honour of the tramway staff is now 17 killed and 40 wounded out of 1,000 men.

Information has reached Eccles of the death of Private E. Ashton, of the 2nd Batallion Lancashire Fusiliers, who was shot though the head by a German sniper. He was a single man, and for 17 years had been employed in the electricity department of the Eccles Corporation.

Sergt. Fred Helm, who was employed in the shipping department of Messrs. Dick, Kerr & Co., Strand Road, Preston, has been killed in action. The deceased, who was 29 years of age, has left a wife and three children. He was recently awarded the D.C.M., and promoted sergeant. He had seen service in India and South Africa.

Corporal A. E. Irving, of Burnley, a local tramway conductor, has been awarded the D.C.M. for his work in the Neuve Chapelle fighting. He is 27 years of age.

Private C. J. Husband, aged 20 years, Pendleton, formerly employed by the British Westinghouse Co., has been invalided home, suffering from the effects of rheumatic fever, which he contracted through exposure in the trenches.

Private Thos. Herbert Hilton, 3rd Border Regiment, of Oldham. has been killed in action. He was 24 years of age, and was formerly employed as a conductor on the Oldham Corporation Tramways. He was killed on April 10th, as his Quartermaster reports—"while doing his duty bravely and nobly." Private Foster Irving, 1st Manchester Regiment, who was also a tramway conductor at Oldham, was shot in the head and killed while going to the trenches on April 7th. He had been through the battle of Neuve Chapelle.

Second-Lieut. Sidney Gudgeon, of the Manchester Regiment, recently reported as having been wounded in France, was for three years a student in the Manchester School of Technology (Faculty of Technology of the University), where, in 1912, he was awarded the Certificate of the University in Electrical Engineering.

"Noise and Vibration caused by Electric Plant."—With reference to the case reported under this heading in our "Legal" section last week (page 545), a correspondent informs us that the nuisance really arose from the noise created by the exhaust from a gas engine driving the electric lighting plant at the picture palace. The writer is anxious that electrical plant should not carry a burden of blame which properly belongs to gas.

THE CASE FOR THE ELECTRIFICATION OF ENGINEERING WORKS.

By ERNEST P. HOLLIS, A.M.I.E.E., A.Amer.I.E.E., M.Assoc.Min.E.E.

For very many years the opponents of the electrification of engineering works have sought to make out their case on the ground of low power costs. It will be within recollection that some years ago almost every railway station in the country was placarded with announcements by firms of gas-engine makers containing the legend "10 B.H.P. for 1d. an hour." Possibly under exceptional circumstances such a claim could be justified; indeed, if it came to be a question of low power costs, the writer could point to a case in which, by the introduction of electrification, a large works is obtaining the whole of its power at a cost of minus £1 a week. For some time electrical engineers found it difficult to make headway against these assertions, and then only by forcing upon the owners of engineering works a realisation of the large losses incurred in line shafting. Before the introduction of the electric motor little care had been bestowed on line shafting, but electrical engineers soon showed that there were exceptional cases in which 60 per cent. of the total power generated by the engine was wasted in the shafting, and 30 per cent. was a common figure. This appreciation of heavy line-shafting losses led to a number of conversions to electric drive.

Later on, when factories grew larger, a further disadvantage of a drive from long lengths of shafting demonstrated itself. The engineer could not say: "I will put my machine here because it is the best place for it," but had to say: "I cannot put my machine here, although I would like to, because it would be too costly to bring up the line shafting; therefore, I must go near to the line shafting."

With increasing competition and the necessity for an intelligent arrangement of the machinery so that work went orderly through the shops and never had to retrace its steps, the engineer began to chafe at the restrictions imposed upon his arrangements by the line shafting, and to look more favourably upon the electric drive, even though its opponents had asserted that it cost slightly more per B.H.P.-hour than other methods of drive. In consequence, he first of all electrified a few outlying machine tools without committing himself to the larger scheme of electrification advocated by electrical engineers, and he experimented with these tools. He found that, contrary to what he had been told, they needed no experts to work them, and that the operations involved in the control of the motor were so simple that they could be safely entrusted to the machine operator. At the same time he succumbed to the temptations of the small electric tools which were pressed upon him, and found, no doubt to his surprise, that an extremely large number of operations which had hitherto involved great labour and inconvenience could be performed by handy little electric drills, grinders and similar machines. He experienced for the first time what a convenience it was in the case of heavy work to be able to take the tool to the work instead of the work to the tool. Probably he was still unconvinced that he had not done all that he could do towards the improvement of the driving of his factory. He was still under the impression that as long as he did not press the extension of the line shafting too far he was not incurring undue losses; at any rate, he was not incurring losses greater than manufacturers of the gas, steam or oil engine told him would be incurred in the transformation of the energy in the steam, gas or oil to electricity and transmitting it and subsequently converting it to mechanical power. But sooner or later he was persuaded by the electrical engineer to test the power taken by the shafting running light and under other conditions, and to compare it with an individual drive. How was he to do it? Obviously, responded the electrical engineer, by installing temporarily an electric motor and measuring the power taken by the motor. The experiment showed that the electrical manufacturers were right. The line shafting often took an excessive amount of power to drive it, even on light load, and there was a great waste of power in keeping the whole of the shafting going when, perhaps, only one machine was required to be run. A few further tests demonstrated that the aggregate power required by individual electric motors was less than had to be applied at the central point for driving through a line of shafting.

But this experiment brought home to him something about the electric drive that he had not appreciated before. For the first time he could conveniently measure the power taken by a machine. For the first time he could say whether that machine was taking more power than the manufacturers had asserted. For the first time he was able to make adjustments in the running of the machine, and able to tell whether those adjustments resulted in an increase or decrease in the amount of power consumed.

With the introduction of the new steels with high cutting speeds, he found that his existing power arrangements were inadequate to run the machines under their new conditions. He experienced difficulties in the cutting of metals of varying degrees of hardness due to the slipping of the belts and the poor speed regulation. It was then not long before the advantages of the electric drive in respect of speed control were brought home to him.

Of course, one of the best canvassers for electrification in engineering works has been the electric crane. Every engineering works of any size employs electric cranes which have often been installed before the conversion of the main drive to electricity.

The foregoing remarks have outlined the different steps involved in the education of the factory owner to the advantages of the electric drive, and up to the present only the main benefits accruing from electrification have been discussed. These are now fairly widely appreciated amongst factory owners, and it is practically only in those few cases where the owner himself is interested in the manufacture of prime-movers suitable for driving from a central point, that the consumers' engineer will find any antagonism to the electric drive. There are, however, numerous points which can be brought home with advantage to assist a consumers' engineer in the securing of new consumers, and an endeavour has been made below to set out briefly telling points which can beneficially be put before potential consumers.

Elimination of Line Shafting Losses.—The elimination of line shafting losses has already been discussed. A consumers' engineer has, of course, to make sure of the extent of line shafting in the works before he can use this argument. In very small works it is sometimes the case that a central drive would not be greatly inconvenient, and in these instances the argument of the elimination of line shafting losses carries no weight.

Tools Worked to their Maximum Output.—The factors which enable an individually-driven tool to be worked to its maximum output are:—

(*a*) The overload capacity of the motor.

(*b*) Better speed regulation, permitting metals of varying degrees of hardness being treated at different cutting speeds.

(*c*) The absence of slipping belts.

(*d*) The ability to make rapid starts, stops and reversals.

(*e*) The ease of control from convenient points.

(*f*) Independence of auxiliary details.

Free Arrangement of Tools.—It is of great importance in a modern engineering shop that there shall be the fullest freedom in the arrangement of the tools, not only to enable the work to be carried through the shops in the best sequence of operation, but to permit the changing of the machine tools for larger or different ones.

Provision of Facilities for Adding New Tools.—It often happens in laying out an engineering shop that it is not possible to foresee the extent or the direction of the developments of the work. A new class of work comes along; a greater demand for a particular class is experienced than had been anticipated; or the demand for certain articles has not realised expectations. In any of these contingencies it may be desirable to introduce new tools or to transport older ones, thrown into desuetude through lack of work, to another part of the shop. When tools are tied to the line shafting, the rearrangement or the introduction of new tools is a matter of difficulty, and the convenience of being able to put down a tool where one likes without any consideration of line shafting is a matter of great moment.

Ability to Measure Power.—One of the greatest advantages introduced by electrification is the great ease with which power can be measured. Not only can the power taken by the machine on full load be ascertained and adjustments made which permit a reduction in the amount of power without any effect upon the quality or quantity of the work, but the light load readings can be taken, which offer a reliable criterion of the mechanical efficiency of the tool, and any deterioration in the gears or other defects can be instantly detected.

Facilities for Overtime and Week-end Work.—In many industries repairs and maintenance work is carried on during the week-end; indeed, in textile mills and in several other works the writer has visited, special engines have been installed to save the main engine being run during the week-end. The disadvantages of having to keep an engine-room and boiler house staff in attendance either during overtime or at the week-end in order that one or two small machines can be run for repair work are so obvious as to make it not worth while to pursue them further.

Elimination of Belts.—Probably in very few engineering works would it be possible or economical entirely to eliminate belts; but by electrification the number can be considerably reduced. Some belts are advantageous in the respect that they form an admirable friction clutch, but they have their many disadvantages, which are well known; while, in addition, there is the cost of maintenance.

In a big engineering works, belt-driven from long lengths of shafting, the handling of work is made considerably more difficult.

No Restrictions upon Head Room.—Electrically-driven cranes are a *sine quâ non* in all engineering works of any magnitude, and anything which interferes with rapid and efficient transport of work about the shops is a decided disadvantage. Line shafting and belts often interfere with the transportation of work.

Increased Safety to Operators.—An individual motor drive affords the fullest protection to the operator; he has only to move a switch. An individually driven machine is in no danger of being started up unexpectedly by the creeping of belts from loose to tight pulleys, the sticking of clutches, and the starting up of line shafting. The tool setter is protected against the inadvertent starting of a machine, and by taking out the motor fuses, assurance can be made that no unauthorised person can start up the machine. Lastly, the operation of belt changing, which has been a source of many accidents, is eliminated.

Non-Obstructed Lighting.—The output of a modern factory is considerably influenced by the lighting conditions. Consciously or unconsciously a workman works much better in a properly-arranged light. That light must not be too strong and not too weak, and the moving shadows which are thrown by belts are a source of great annoyance. As illuminating engineers will know, a works full of belts and shafting offers some trying problems in illumination.

Improvement in Environment.—The elimination of noisy belts and shafting brings about an appreciable improvement in the surroundings. Distracting noises due to belts and shafting are absent, and the workman can concentrate more fully on his work. The incessant din of belts and shafting is not conducive to good workmanship, and with the electric drive the workman does not stand in the midst of a mass of overhead revolving pulleys, moving belts and noisy transmission, permeating the atmosphere with oil spray and dust. Many manual operations, such as belt changing and replacement, are entirely eliminated, and these, in conjunction with other advantages, materially add to the improvement of the lot of the workman.

The foregoing discussion of the merits of the electric drive covers engineering works in general, and there must be in each case special advantages peculiar to the industry itself. As an example of these, the writer was recently visiting a works in which steam haulage had been employed. The steam engine had been replaced by an electric motor. On examining the setting of the relays of the motor, the writer noticed with surprise that although the motor was of 150 H.P., the relays were actually set for 100 H.P. On making inquiries as to the reason for this, he was told that the tubs had to be drawn round a number of difficult curves, and with the steam haulage when the tubs came off, as they frequently did, the track was badly damaged. But with the electric haulage the power they required had not been so great as had been anticipated, and they set the relays to such a low point that the slightest disarrangement in the trucks tripped the relays. In this way the relays which normally are introduced to protect the motor, were utilised to protect the mechanical side of the transportation scheme; and the electrical engineer said that this one advantage alone decided him in favour of electric haulage in all circumstances.

In conclusion, the writer would warn consumers' engineers, if they need any such warning, of the difficulties of dealing with the very small consumer. The man who has a small works driven from a small town gas-engine is very hard to convince. It is of no use attempting to show that for small consumers with power at 1d. per KW.-hour and gas at 1s. per thousand cb. ft., the electricity bill will be smaller than the gas bill. Possibly it will not. Such a consumer counts for nothing the time lost in starting the gas-engine in its recalcitrant moments; he takes no account of the labour involved in its cleaning, or of the time he has to keep it going to run, say, a small lathe after the whole of the other tools in the shop have been shut down, or of the space taken up in his shop by the gas engine plant. It is bad business to convince such a man against his will and then for him to find that electrification is costing him more. Rather is it advisable to deal frankly with him and tell him that under the circumstances electricity cannot compete with the gas; but, nevertheless, there are a number of uses to which electricity could be put in his shop, such as driving portable drills, and so forth. With these he can take advantage at least of some of the benefits accruing from electrification, and when the time comes for an extension of his works his past experience with electricity will incline him towards it, even if he is aware that his electricity bill will be slightly larger than a gas bill.

BUSINESS NOTES.

Osram "Atmos" Lamps. — THE GENERAL ELECTRIC CO., LTD., announce that owing to continued progress in the manufacture of Osram gas-filled lamps, a name has been registered for this class of lamp. In future all Osram half-watt lamps will be marked "Made in England. Osram Atmos type, Patent G.E.C."

Stoker Contracts.—MESSRS. E. BENNIS & CO., LTD., report that the ordinary commercial demand for their machine-stokers, coal elevating and conveying plant has been thoroughly well maintained. A list of contracts recently received covers a very wide range of industries, Corporation electricity stations coming an easy first. We select the following typical examples:—

Nobel's Explosives, Ltd., Powder Factory, South Wales (per Messrs. Yates and Thom).—Thirty-two coking stokers and furnaces for 8-ft. diameter Lancashire boilers.

Manchester Corporation Electricity Department, Bloom Street Station.—Relinking two pairs of chain-grates of another make with the Bennis patent long-life link. (Repeat order.)

Ditto, Stuart Street Station.—Relinking four chain-grates of another make with the Bennis patent long-life links. (Repeat order.)

Huddersfield Corporation Electricity Station.—Four pairs of chain-grate stokers for Stirling boilers.

Burton-on-Trent Corporation Electricity Station.—Two sprinkler stokers self-cleaning compressed-air furnaces. (Repeat order.)

Coventry Corporation Electricity Station.—Eight chain-grate stokers for B. & W. boilers. (Repeat order.)

A railway company's power station.—Two sprinkler stokers and compressed air furnaces (Repeat order.)

Pritchetts & Gold, Dagenham, Romford (per Stirling Boiler Co.).—Two chain-grate stokers for Stirling boilers.

Blackpool Corporation Electricity Station.—Bucket elevator with cast-iron receiving hopper and discharge shoot This plant consists of a bucket elevator to raise 10 tons of coal per hour and deliver it in an overhead bunker with a capacity of 170 tons of coal. As the coal passes from the bunker it will be weighed in an automatic weighing machine and delivered into the mechanical stoker hoppers. The bunker is to be built out of reinforced brickwork and concrete.

The Dowson & Mason Gas Co., Ltd., Alma Works, Levenshulme, Manchester.—Coal and ash-handling plant for India. This plant consists of a Bennis bucket elevator and U-link chain conveyor for receiving the coal from the ground level and delivering it into hoppers for a range of gas producers at the rate of 10 tons per hour. The ashes are withdrawn from underneath the producers, and trimmed by hand into an ash elevator, which raises them into an overhead ash storage bunker, from which they fall by gravity into railway trucks.

The Consolidated Diesel Works. — The *Financial Times* understands officially that a sale has been completed of the Ipswich works of the Consolidated Diesel Engine Manufacturers, Ltd., for the winding up of which an order was made on July 7th last. The purchasers are Messrs. Vickers, the well-known armament and engineering company.

For Sale.—The Manchester Guardians have for disposal one 36-I.H.P. vertical Marshall & Sons' steam engine, driving by belts; one 20-KW., D.C. generator at 205 v.; and one 3-KW. booster at 75 v. Tenders by May 6th. Particulars are given in our advertisement pages to-day.

Book Notices.—*Key to the London Telephone Directory.* Vol. II, No. 1. London: Stone & Colquhoun. Price 2s. net.—Knowing a person's telephone number, but not his name, the difficulty of finding out who he was without ringing him up and putting the question to him was practically insuperable until this useful "Key" was published: for who would essay the stupendous task of hunting through the pages of the Telephone Directory for the number referred to? However, nowadays it is a simple matter. With the aid of this key, one not only finds at once the whole of the numbers at each exchange brought together in consecutive order, but also, in this new edition, besides the page, the column in which each number will be found is indicated. Where more than one use the same telephone number, each has a separate entry. A new edition will be published immediately after each official Telephone Directory. This is emphatically a case of a want well filled. A buyers' guide forms an appendix to the Key.

Submarines, Torpedoes and Mines. By W. E. Dommett. London: Whittaker & Co. Price 1s. net.—This is an excellent little book for the general reader who wants to know something about the construction and operation of the "submarine vessels" referred to in the title. It is not so technical as to present difficulties to the layman, and, on the other hand, it is sufficiently technical to appeal to the engineer. It does not contain much matter relating to the electrical equipment, though this is indispensable to the operation of submarines, which present a notable example of the use of storage batteries for the production of large powers, and are equipped with gyro compasses and other motor-driven appliances, and electric cooking apparatus, as well as wireless telegraph installations in some instances. We can recommend the book as both timely and interesting.

"101 Successful Selling Suggestions" is the title of a little brochure issued free to its 1,233 members by the Society for Electrical Development, of New York; it is claimed to be entirely different from anything ever published before, and to contain ideas which have been selected from 750 that were offered (and paid for at the rate of $1 each). The cost of production has exceeded $1,000. The items cover a wide range of subjects, and in many cases naturally the proposals are not adapted for use in this country; but there is no doubt that many useful hints can be picked up from the booklet, and that where they are not directly applicable to our conditions they contain food for thought, which may lead to profitable results.

Annuaire pour l'An 1915. Paris: Gauthier-Villars & Cie. Price 1 fr. 50 net.—The *Annuaire* of the Bureau des Longitudes for this year contains a mass of tables relating to geography, metrology, astronomy, &c., physical and chemical data being reserved for next year. A special article by M. G. Bigourdan deals with the methods of testing mirrors and lenses exhaustively.

Liquidations—The Chinnery Engineering Co., Ltd. (late the Chinnery Signs (1909), Ltd.).—A meeting will be held on May 18th, at Essex Wharf, Durward Street, Whitechapel, E., to hear an account of the winding up from the liquidator, Mr. H. D. Sheldrake.

Spanish National Submarine Telegraph Co., Ltd.—Particulars of claims must be forwarded by May 31st to the liquidator, Mr. J. Jeffery, at 106, Cannon Street, E.C.

The Consolidated Diesel Engine Manufacturers, Ltd., Aldwych, W.C.—Last day for proofs for dividend, May 4th. Liquidator, Sir W. B. Peat, 11, Ironmonger Lane, E.C.

Catalogues and Lists.—Electrical Alloy Co., Morristown, New Jersey.—Leaflets relating to "Calido" and other resistance materials for electrically-heated devices, instruments, &c.

Messrs. Ferranti, Ltd., Hollinwood.—Binder containing eight new lists describing and giving prices, code-words and weights, for their various types of C.C. ampere-hour meters for house service.

The Electric Suction Cleaner Co., 56, Victoria Street, London, S.W.—Folder giving particulars and prices of the Frant "Premier" electric suction cleaner.

Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—Three catalogues of specialities made by Ing. Luigi Magrini, of Bergame, for low and high tension overhead construction, also switches and circuit-breakers. Mr. Braulik has secured the sole selling rights for these manufactures, and will be pleased to send copies of the catalogues, all of which are fully detailed in the French language and illustrated, to parties interested.

Messrs. Reavell & Co., Ltd., Ranelagh Works, Ipswich.—Leaflets Nos. 69 and 70. The former illustrates and describes a small air compressor, which was originally designed for starting gas and oil engines, and the latter a type of machine for much higher pressures (1,000 to 1,200 lb. per sq. in.), for filling the receivers for starting Diesel engines. We understand that there is a demand for these machines in other fields; for instance, the No. 69 is serving well in public or private garages for pumping up motor-car tires, and is also used for many other purposes where small quantities of air up to pressures of 250 lb. per sq. in. are required. Both of these types of machine are constructed to be independently driven by an electric motor or by a paraffin or petrol engine.

We have just received from the General Electric Co., Ltd., a useful piece of topical advertising literature, which takes the form of a tough paper folder measuring only 5 in. × 3$\frac{1}{16}$ in. when closed, and having the whole of the interior (10 in. × 6$\frac{1}{8}$ in.) devoted to illustrations and descriptions of German and British aircraft. The letterpress is confined to the question of distinguishing different machines. Copies of the folder can be obtained on application to the company's publication department, 67, Queen Victoria Street, E.C. Two of the illustrations show respectively a fleet of aircraft dropping bombs, and the other a "Freezor" electric fan providing a refreshing breeze. The words applying to the latter are "Keep cool in case of a heat wave," and to the former "Keep cool in case of an air raid."

Messrs. Credenda Conduits Co., Ltd., Chester Street, Aston, Birmingham.—Descriptive circular detailing the "Credenda" system of electric heating and ventilating as installed at the premises of the company's London agents, 219, Tottenham Court Road, W.C.

Messrs. Bagshawe & Co., Ltd., Dunstable Works, Dunstable.—Illustrated circular relating to their "B. B." chain, and showing views of the works.

Prices Advance.—The Walsall Electrical Co., Ltd., announce that owing to the increase in cost of production they have withdrawn all outstanding quotations as from April 21st for small meters, and that their prices will be increased by 20 per cent. from that date.

Bankruptcy Proceedings.—W. Walker (D. Smith and Co.), dealer in electric lamps, formerly of 2 and 3, Red Lion Court, Fleet Street, E.C., but whose present business address cannot be ascertained.—Trustee, Mr. E. S. Grey (Official Receiver, Carey Street, W.C.), released March 25th, 1915.

C. Wray, mechanical and electrical engineer, Bradford.—Last day for proofs for dividend May 1st. Trustee, Mr. W. Durrance, Official Receiver, 12. Duke Street, Bradford.

G. J. T. J. Parfitt.—At the Bristol Bankruptcy Court on Friday last, bankrupt, an electrical engineer, examined by the Official Receiver, stated that he had filed an amended statement of affairs, showing gross liabilities, £4,973; deficiency, £2,616; assets, £1. He commenced business in Denmark Street in 1888 with his brother, as Parfitt, Webber & Co. They paid £320 for the business, and subsequently he and his partner put into the business further capital to the amount of about £2,600. In 1912 his partner went to South Africa, and the business was made over to the Colston Electrical Works. In consideration he received £1,650 in £1 ordinary shares. The primary reason for selling the business was to compensate his sister in respect of a guarantee to the bank for £300 which she had been asked to pay off. He entered into a contract to supply electrical fittings, plant, and buildings to the Bristol International Exhibition for the pageant. He made a net loss of £25 in respect of the contract, and he owed £95 for goods in respect of it. He did not supply goods to the Exhibition, but his loss was for work done as consulting engineer. The main cause for his failure was the failure of the exhibition company, of which he was a director without fees or salary. He had charge of the electrical installation, and all exhibitors had to take current from him. He expected to make £1,000 profit. He held £750 first debentures, £710 second debentures, and £271 ordinary shares. A judgment for £551 was obtained against him in respect of guarantees. Since the war began his trade had been cut off, and he estimated that he had lost orders to the amount of £2,500. The examination was adjourned until May 14th.

J. W. and T. W. Tattersall (Tattersall & Tattersall, electrical engineers, Willesden, N.W.).—An application for debtors' discharge will be heard on May 11th at Carey Street, W.C.

Russia.—A large Russian technical agency office in Moscow, which has hitherto dealt exclusively with Germany, desires to represent United Kingdom manufacturers of centrifugal pumps, electric motors, &c. Inquiries should be addressed to the British Consulate-General at Moscow.

Trade Announcements.—Mr. L. H. Parker, formerly with the General Electric Co., of America, and for the last 10 years with the Stone & Webster Engineering Corporation, has been appointed President of the Spray Engineering Co., of Boston, U.S.A., which company has sent us bulletins dealing with its equipment for cooling condensing water and air washers for turbine generators.

Premises at Beehive Corner, Cranbrook Road, Ilford, have been opened by Messrs. Bowes & Co., electricians.

The Argentine Republic.—There was a very heavy decline last year in the importation of electrical goods into the Argentine Republic, the official returns lately to hand showing a total of only £1,405,000, as contrasted with £2,022,000 in 1913.

LIGHTING and POWER NOTES.

Barking.—Price Increase.—The U.D.C. has decided upon a temporary increase of 10 per cent. in the charges for current, except in the case of power users consuming over 8,000 units per month, when the increase is to be at the rate of 5 per cent.

Barnsley.—Proposed Extensions.—The borough electrical engineer has prepared a scheme of proposed extensions at the electricity works.

Bolton.—L.G.B. Inquiry.—An inquiry was to be held this week into an application for sanction to borrow £1[illegible] for the purposes of the electricity undertaking.

Arbroath.—Public Lighting, &c.—The T.C. is to experiment with gas and electricity for street lighting. Recently the Lighting Committee resolved to ask the Gas Works Committee to state at what figure it could supply gas lighting if necessary, and if thought advisable, to take the place of the present electric lighting of the streets, and the Council has decided to test the two systems.

A Sub-Committee is to meet representatives of the Arbroath Electric Light and Power Co. in regard to the assessments on the electric mains; the company holds that the assessment should only be charged on one-fourth of the valuation instead of the full rates being charged, and points out that there is a charge of £43 for water assessment on the mains while the company paid direct for all water consumed by it. If the Council will strike out the assessment of £43, the company is prepared to settle rather than have any further dispute over the matter.

Bedford.—Power Supply.—The T.C. has decided that current for power and lighting combined supplied to manufacturers taking 300,000 units and above per annum, shall be charged 1d. per unit, subject to a scale of discounts for prompt payment of accounts, varying from a deduction of 2 per cent. for a load factor of 12 per cent. or over, to 20 per cent. for a load factor of 20 per cent.

Boston.—E.L. Scheme.—The R.D.C. has consented to the application of Mr. R. A. Smith for a prov. order for electric light at Skirbeck, Fishtoft, Freiston, Skirbeck Quarter, Wyberton, Frampton and Kirton, but the order, by arrangement with the B. of T., is not to take effect until after the war, to prevent capital being locked up in private enterprise.

Carlisle.—Civic Opening of Extensions.—At the ceremonial opening of the electricity works extensions by the Mayor, Mr. F. P. Dixon, which took place recently, the visitors, under the guidance of Mr. Fredk. W. Purse, the city electrical engineer, made a general inspection of the works, visiting the new buildings, where the recently installed plant was set in motion by the Mayor. His Worship also formally unveiled a brass tablet commemorating the occasion. Afterwards the company adjourned to the showroom, where Mr. Gibbings, who presided, said it was interesting to know that the output in units in 1913-14 was 3¾ millions, and this year they hoped to record four millions. As an indication of the greater efficiency of modern plant and machinery, the engineer told them when the extension scheme was fully completed they would have 17 times the original capacity, at only five times the cost; he concluded by proposing a vote of thanks to the Mayor and Mayoress for their attendance, and by presenting the Mayor, on behalf of Messrs. J. Laing & Son, the building contractors, with a handsome silver table lamp.

Mr. J. W. Nicholson, deputy-chairman of the Electricity Committee, seconded the vote of thanks, which was supported by Mr. J. W. Laing, and Mr. P. N. Rand of the British Westinghouse Co.

Sir Benjamin Scott presented Mr. Gibbings with a gold bracelet watch for Mrs. Gibbings on behalf of the British Westinghouse Co. He did not think the public had realised the value of the electricity works, or that by the establishment of this undertaking the Council had appropriated to itself the whole of the motive power of the city.

Mr. J. C. Dove, the first chairman of the original Electric Lighting Committee, seconded the motion, which was supported by Mr. James Morton, one of the leading manufacturers of the city, and Dr. Overton, an ex-chairman of the Electricity Committee.

Castlewellan.—Street Lighting.—The *Belfast News Letter* says a further conference in regard to public electric lighting has been held, when a proposal by Messrs. Curran Bros. to supply and light 30 street lamps at £1 each per annum, provided the local people subscribe £500 in 6 per cent. preference shares was favourably received, and arrangements are to be made to give the necessary security. A generating station is to be erected.

China.—The China papers state, according to *Eastern Engineering*, that the Chefoo Electric Lighting Co. has commenced supplying current to consumers in Chefoo. The plant consists of two complete sets of 100-kw. alternators, consisting of two three-phase, 50-cycle, 3,300-volt alternators; two Belliss compound engines; three Babcock-Wilcox boilers; two Belliss jet condensers and pumps; two boiler-feed pumps, purifier and heater combined, and the necessary switchboard.

Clifden (Co. Galway).—Prov. Order.—The B. of T. has issued a provisional order, to be included in a confirmation Bill, authorising the Council to supply electrical energy in its administrative area.

Continental Note.—Germany.—As was expected, the Berlin City Council has resolved by a large majority to municipalise the works of the Berlin Electricity Works Co. on October 1st of this year, and has sanctioned a loan of £6,500,000 for this purpose. A scheme for the organisation of this department is to be submitted at an early date.

Cuba.—The following persons have been granted permission to install electric power and lighting plant in Cuba:—Senor Francisco Arredondo y Bentancourt, at Jobabo, in the municipal district of Victoria de las Tunas; Senor Dorindo Vazquez, in the town of Florida, province of Camaguey; and also Senor Perfecto Rodriguez in the town of Florida. The *Gacetas*, which contain particulars regarding the installations to be carried out, may be consulted at the Commercial Intelligence Branch of the B. of T.

Dublin.—Committee of Inquiry.—The Corporation has appointed a Special Committee to inquire into, and report upon, the administration of the electricity undertaking, the prices charged for light and power, the number of engineers and workmen employed, salaries and wages question and conditions, procedure in purchasing coal, and charge for interest on and repayment of moneys borrowed.

Dundee.—The electricity department is running the risk of being seriously hampered on account of the large number of enlistments from the staff. Up to date there have been 72 enlistments, and other men are on the point of joining the Army. It was stated that Lochee sub-station has already been shut, and if more men go away further curtailment will be necessary. It is pointed out that the department may be unable to supply the foundries and jute establishments engaged in pressing Government work. The Committee has decided to ask the Government for an exemption for the staff still at work.

Edinburgh.—Coal Contract.—A local paper states that the electricity department's coal contracts for the coming year have been settled, including some 25,500 tons for McDonald Road station, and 15,000 tons for Dewar Place station, bought at prices which represent an increased cost of £10,000 on the previous year.

Featherstone. — The U.D.C. has withdrawn its objections to the Bill of the Yorkshire Electric Power Co., and, in consequence, the district will be retained in the company's schedule.

Glasgow.—Showroom Proposals.—With reference to the proposal to open a permanent showroom for electrical appliances, to be equipped and managed entirely by the Corporation, on the lines mentioned in our issue of March 26th, page 459, agreement has now been reached, and the proposals submitted to the T.C. for approval. The original clauses in the proposal have been slightly modified, and the fourth paragraph now reads:—"That all fittings, accessories, lamps, and apparatus sold from the showroom shall be at the usual trade selling prices, such prices to be the usual current prices of the firms supplying goods to the showroom (originally list prices were mentioned). The fifth paragraph, which stated that, as far as possible, sales initiated in the showroom should be completed through the contractor, &c., has been deleted, and the seventh paragraph now states that the hiring of apparatus shall not be undertaken from the showroom "in the meantime," &c., the latter words having been inserted.

Haworth.—Prov. Order.—A prov. order for E.L. has been granted to the U.D.C.

Heywood. — Plant Extensions. — The T.C. has approved of revised estimates, submitted by the electrical engineer for extensions as follows:—Buildings and plant, &c., £4,135; overhead mains and auxiliary plant, £2,600; total, £6,735.

Irlam.—Prov. Order.—The B. of T. has issued a prov. order authorising the Council to supply electricity for lighting and motive power purposes.

Itchen.—The U.D.C. has passed a resolution consenting to the prov. order for E.L. being applied for by the Southampton T.C. in respect of the parish of Bitterne, for which the laying of mains in a portion of Itchen is necessary, on condition that the mains to be laid will not affect in any way any of the rights of the U.D.C. under the E.L. order of 1913.

Kingstown.—The U.D.C. has appointed Mr. J. P. Tierney, of Dublin, as consulting engineer in connection with the electric lighting scheme for the district, at a fee of 5 per cent.—*Freeman's Journal.*

Llantarnam.—Proposed E.L.—The Highways Committee has had the question of E.L. referred to it, as the result of an offer from the South Wales E.L. and P. Co. to give a bulk supply.

London.—St. Pancras.—Life of Half-Watt Lamps.—The Electricity Committee recommends that the electrical engineer be authorised to carry out the scheme submitted by him for the substitution of half-watt lamps for 172 open-type arc lamps. The Committee reports that an experimental circuit of 14 half-watt lamps has been in operation for the past 10 months in George Street and Gower Street, and has proved successful. These lamps have burned for nearly 3,500 hours without a breakage, although only guaranteed for 800 hours. Taking as an estimate 2,000 hours' burning, the engineer estimates a saving of £132 per annum in maintenance charges; the estimated cost of the proposal is £500.

Loughborough.—The Corporation has, says the *Sanitary Record*, installed at its gas works a De Brouwer electric stoking plant and an electric coke conveying telpher.

Newcastle-under-Lyme.—The T.C. has been informed by the L.G.B. that the loan of £1,250 applied for for mains extensions cannot be granted. The Council had accepted the tender of Messrs. Callender, at £1,240, for the mains, and it was stated at a meeting on April 14th that the firm was prepared to adhere to this price, and to carry out the work when the war was over.

Newport.—A South Wales paper says that the proposal of the E.L. and Tramways Committee to increase the price of energy on account of increasing costs was adopted by the T.C.

Normanton.—Prov. Order.—The B. of T. has granted a prov. order authorising the Council to supply electrical energy for public and private purposes.

Oldham.—Mill Driving.—The Highfield Mill Co., North Moor, has decided to install electricity for driving purposes in substitution for steam driving.

Rochdale.—A Curious Complaint.—Among those who complained to the Rochdale police in respect of the cutting off of the electricity supplies last Saturday was one gentleman who had a curious grievance. At the time the current was cut off, he explained, he had a large number of eggs in an incubator, and the shutting off of the warmth led to the eggs going cold and becoming spoiled.

Rochester.—Refuse Destructor.—The T.C. has decided to inform the Chatham T.C. that it does not see its way to fall in with a suggestion that it should join in a scheme for the provision of a joint refuse destructor for the two boroughs.

Stanley (Yorkshire).—Prov. Order.—The B. of T. has granted a prov. order to the Electrical Distribution of Yorkshire, Ltd., authorising the latter to supply electrical energy for public and private purposes within the urban district.

Stockton Heath.—The P.C. has agreed to the terms of the Warrington Corporation relative to the proposed area of electricity supply, and to support the application provided certain clauses are included in the proposed Order.

Stone.—Gas and Electricity Purchase.—The U.D.C. is, according to the *Journal of Gas Lighting*, considering the purchase of the local gas company's undertaking, which also embraces electricity supply, and has offered £35,000.

Sunderland.—War Bonuses.—At the T.C. on April 15th, several Committees proposed that a bonus be paid, the total involving £9,000 a year. In the case of the Electricity Committee, it was agreed that the bonus should be 3s. with wages up to 50s. a week, and in the case of the tramways 2s. up to 50s.

Swinton and Pendlebury.—Street Lighting, &c.—The U.D.C. has decided that from April 1st the price to be charged for electricity for street lighting be reduced from 1¾d. to 1¼d. per unit.

During the past year the amount of energy generated at the electricity works was 351,116 units, an increase of 93,471 on last year.

Truro.—E.L. Scheme.—The T.C. having asked whether, in view of the refusal of a loan for carrying out the E.L. scheme, it is tied by the stipulation that the compulsory works should be carried out within two years from the issue of the order, which period expires next August, the B. of T. has replied that it has no power to extend the time embodied in the order, which will remain in force notwithstanding any default in respect of compulsory works until it is revoked by it.

Tynemouth.—The Electricity Committee proposes to charge those consumers whose accounts are on a net basis, 5 per cent. extra for current supplied, and to return such additional 5 per cent. as discount, provided the account is paid with the ordinary period allowed for discount.

Waterford.—L.G.B. Inquiry.—The date fixed for the inquiry into the Corporation's application for a loan of £30,000 for its electric lighting project is April 27th.

Wells (Somerset).—E.L. Scheme.—At the monthly meeting of the City Council, a letter was read from the solicitors of the company which proposed to supply electricity to the city, stating that it had been decided, in view of the present national crisis, to withdraw the city of Wells from the proposed order.

West Hartlepool.—Proposed Loan.—Application is to be made for sanction to cover the necessary expenditure for extensions of mains and services for the use of customers, and for the purchase of a water softening apparatus.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—A demand for an increase in wages of 1d. per hour for employés earning 6½d. per hour and under, and of ½d. per hour for those in receipt of 7d. and over, has been made by the Aberdeen tramway men. The T.C. has offered a war bonus of 2s. to all with less than 30s. per week, the wages with bonus not to exceed 30s. per week.

Barnes.—The L.G.B. has notified the Council that, in view of the desire of the Treasury to restrict expenditure, it would not be able to authorise the loan for the purchase of electrically-propelled dust vans at the present time.

Birkenhead.—Rate Relief.—The Tramways Committee has decided to apply the sum of £1,260 to the relief of the rates. In previous years the available surplus has been transferred to the renewals fund, which at the close of the year amounted to £21,955. The Electricity Committee does not anticipate being able to afford any balance to the district rate.

Glasgow.—Female Conductors.—Everything points to an extension of the experiment with women as car conductors, to fill vacancies caused through shortage of male labour on the tramway system. The general manager, after reporting on the earlier observations made in the limited experiment with two women conductors, received sanction to extend the scope of the experiment for further information, and on Tuesday (April 13th) a special tuition-car was run over representative routes of the city and district system. The only passengers carried were eight women aspirants for the posts of conductors and an inspector, who initiated the ladies into the actual work of car conducting, including the selling and punching of tickets. According to the *Telegraph*, the manager has been instructed to engage as many additional women as conductors as may be required; the number is understood to be nearly 400, and a wage of 27s. a week, with uniform, is offered.

On Saturday the services of the eight women conductors enabled the department to run as many extra cars—the women conductors being left with the sole responsibility.

The Tramways Committee has remitted to the general manager for consideration and report, a letter on behalf of the Paisley District Tramways Co., intimating in connection with the renewal of the agreement for the running of the Glasgow Corporation cars from Hawkhead Road to Paisley Cross, that it could not agree to an allowance of 15 per cent. on the present rate per mile to meet working charges, and suggesting 10 per cent. as a sufficient allowance.

Heywood.—Year's Working.—Subject to audit it is reported that the loss on the working of the Corporation tramways for the 12 months will amount to about £1,042, as compared with a profit a year ago of £85. The war is largely responsible for this adverse result.

Hull.—Electric 'Bus.—According to a Yorkshire paper, Ald. Meyer recently stated in the T.C. that an electric 'bus would be put on the Leeman Road for experimental purposes.

The question of the Hull Road tramways is under discussion in view of a letter from the L G B. in regard to prospective expenditure.

The Corporation has had under consideration the situation created by shortage of men on the tramways. The drivers and conductors voluntarily agreed to work overtime to the extent of 12 hours a week if necessary, for the period of the war. They were willing also to work for double pay in lieu of taking their week's holiday.

Ilford.—The U.D.C., at a meeting last week, continued the debate on the motion of Councillor Bailey, that in view of the financial condition of the tramway undertaking, the best available expert advice be called in to assist the Council in formulating a scheme by which the undertaking can be placed upon a sound commercial basis. Replying to various criticisms, Councillor Bailey said that the Council had not accepted the manager's advice, and was apparently taking upon itself the responsibilities of experts. Had not the payment of £2,500 out of the reserve in relief of the rates been made some years ago, the reserve to-day would have been quite £10,000. After discussion an amendment was carried instructing the Tramways Committee to consider the advisability of obtaining expert advice to assist the Council.

Leeds.—Year's Working.—The annual accounts of the tramways department for the year ended March 31st last, showed total receipts £433,939, as against £427,455 in the previous year. After deducting £115,601 for traffic expenses, £40,347 for general expenses, £43,609 for repairs and maintenance and £28,577 for power, the gross surplus to carry forward to net revenue account is £205,805, which compares with £201,073 for the previous year. The net surplus available for the relief of rates is £81,567, as compared with £70,004 last year.

London.—St. Pancras.—The L.C.C. has informed the B.C. that it is not prepared to accept its offer at the present time to supply energy to the Council's tramway department for the ensuing six summer months.

Manchester.—War Bonuses.—At a conference of tramway men on the 14th inst., the decision of the City Council to grant a war bonus of 2s. to all employés earning 30s. a week and under was discussed. It was decided to send a resolution to the Council, regretting that the recommendation of the employing Committee was not given a more favourable consideration. The recommendation of the Committee was that all employés earning up to 40s. should receive the bonus.

Rate Relief.—At a meeting of the Manchester Tramways Committee, on Tuesday, it was agreed to give £100,000 in aid of the relief of the rates for the ensuing year. Prior to this result being announced, some doubt had existed as to whether the department would be able to keep up its contribution at last year's rate of £100,000—a figure to which it is pledged for a further year.

Musselburgh.—The T.C. has decided to insist upon the Musselburgh Electric Tramway Co. putting its track in better order, the burgh surveyor having reported that the track between Leretto and Levenhall was in a serious state of disrepair.

Newcastle.—The B. of T. having called upon the Corporation Tramways Committee to release as many men as possible in order that they may be employed on the manufacture of munitions of war, the situation was considered by the employés at a meeting on Sunday. It was decided to raise no objection, providing that the men who leave and go into the factories shall be guaranteed reinstatement at the end of the war, and that their work in the factories shall count as tramway service. The introduction of women to fill their places was not objected to, provided that the women join the Union and are not underpaid.

At a meeting of the T.C. on April 14th a deputation attended from the tramwaymen and informed the Council that the ballot of the men had resulted in an almost unanimous rejection of the Council's war bonus offered at the last meeting. The Tramway Committee is to report on the matter.

Radcliffe.—During the past year the Radcliffe tramways sustained a loss of £820.

Reading.—War Bonuses.—At the recommendation of the Tramways Committee, the T.C. has agreed that all employés of the tramways department, other than motormen and conductors, shall receive a war bonus of 3s. per week, or such part thereof as shall bring their wages to 34s.; motormen and conductors to receive a bonus of 6d. in addition to their increase of 2s. 6d.

Wigan.—War Bonuses.—As 25 per cent. of the men employed by the Tramways Committee of the Corporation would not benefit by the Council's war bonus scheme, application is being made by the local officials of the Tramway and Vehicle Workers' Association for a reconsideration of the claim of increased wages. Failing this, the men ask for a war bonus of 2s. a week, for all employés over 21 years of age, and 1s. per week for those under the age.

TELEGRAPH and TELEPHONE NOTES.

Canada.—The annual report of the Marconi Wireless Telegraph Co. of Canada states that the company now operates, in all, 40 stations in the Dominion, in Newfoundland, and in Labrador. Ninety-three steamers of Canadian register are equipped with the Marconi system. With the completion of the duplex system the Louisberg trans-Atlantic receiving station has been brought into operation, in addition to the installation of high-speed transmission at Glace Bay.

Telephone Progress.—The *Telegraph and Telephone Journal* for April points out that while in Germany the number of telephone subscribers has greatly decreased, in this country the number increased by nearly 5,000 during the latter half of 1914, in spite of the disconnection of lines rented by alien enemies. In addition some 4,000 military and naval stations were connected, which are not included in the table given below:—

Telephone Canvassing Results for the Six Months ended January 31st, 1915 and 1914.

	New stations.		Cessations.		Net additions.	
	1915.	1914.	1915.	1914.	1915.	1914.
London ...	11,809	15,700	12,305	8,111	496 (dec.)	7,589
Provinces ...	19,830	27,815	14,459	13,242	5,371	14,573
United Kingdom...	31,639	43,515	26,764	21,353	4,875	22,162

United States.—The accumulated traffic at the Tuckerton, N.J., wireless station has been cleared up, and messages for Germany and Austria-Hungary are being accepted, subject to the former restrictions, including liability to considerable delay.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—June 2nd. Electric lighting material for cars (Contract 28,187). Tender box, Railway Offices, Melbourne. Particulars at Contractors' Room, Spencer Street.* Deposit ½ per cent. of amount of tender.

June 1st.—Deputy P.M.G. Eight miles of paper-insulated lead-covered cable. (Schedule No. 1,184.)*

June 2nd. Bogie trucks, wheels and axles for 10 cars of the St. Kilda-Brighton electric street railway (No. 28,621) for the Victorian Railway Commissioners.*

June 15th. City Council. Four mechanically-fired boilers, one turbine-driven boiler-feed pump, two fuel economisers, circulating water pumps. City Electrical Engineer. Specifications from Messrs. McIlwraith, McEacharn & Co., Ltd., London, E.C.

Queensland.—June 1st (instead of March 16th). P.M.G. Switchboard for Warwick. See "Official Notices" March 26th.

Sydney.—May 31st. Three electric battery locomotives for Public Abattoirs, Homebush, for the Department of Public Works. Specifications, &c., 5s., from the Accountant, Public Works Department.

June 15th.—Deputy P.M.G. 400 Morse sounders, American pony pattern. (Schedule No. 449.)*

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Aldershot.—May 4th. Steam and other pipework; water-softening plant. See "Official Notices" March 26th.

Dundee.—April 28th. Corporation. Centrifugal circulating pumps, and 750 ft. of 42-in. and 30-in. cast-iron pipes. See "Official Notices" April 9th.

Hendon.—The Guardians are inviting tenders for an electric lighting installation for the workhouse.

London.—Wandsworth.—April 28th. Three months' supply of electrical fittings, &c., for the B. of G. Forms of tender from Mr. F. J. Curtis, Clerk, Union Offices, St. John's Hill, S.W.

Mountain Ash.—April 26th. U.D.C. Sub-station building, E.H.T. underground cables, L.T. overhead lines and public lighting, E.H.T. switchgear, L.T. switchgear and transformers, for Abercynon. See "Official Notices" April 16th.

New Zealand.—Wellington.—Extension of date to May 21st. Public Works Office. A three-unit exciter set (Section 49) and a 1,500-kw. generator (Section 50), for Lake Coleridge power scheme. Specifications and forms of tender may be consulted at the office of the High Commissioner in London for New Zealand, 13, Victoria Street, S.W., and at the Board of Trade Commercial Intelligence Branch in London.

South Africa.—Johannesburg.—June 1st. Municipal Council. 24 double-pole, automatic, oil-immersed circuit breakers of a continuous carrying capacity of 200 amperes (Contract No. 971). Specifications, &c., from the Controller of Stores, Municipal Offices, Plein Square, Johannesburg. Tenders to Town Clerk.—*Board of Trade Journal.*

Spain.—Tenders have lately been invited by the municipal authorities of Noblejas (Province of Toledo) for the concession for the electric lighting of the town during a period of five years.

The municipal authorities of Zahinos (Province of Badajoz) have lately invited tenders for the concession for the electric lighting of the town during a period of five years.

Tasmania.—Launceston.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II., Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

CLOSED.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

War Office.

Electric fittings.—Foot & Milne; A. V. Gifkins & Co.
Galvanometers.—General Electric Co., Ltd.; W. G. Pye & Co.; Reid Bros. and Co., Ltd.
Telephone board.—Siemens Bros. & Co., Ltd.
Telephones.—Automatic Telephone Manufacturing Co., Ltd.; Gent and Co.; The New Phonopore Telephone Co., Ltd.; Siemens Bros. & Co., Ltd.
Wire, steel.—British Insulated & Helsby Cables, Ltd.; Connolly Bros., Ltd.; London Electric Wire Co. and Smiths, Ltd.; Siemens Bros. & Co., Ltd.
Electric light installation, Northolt.—C. Cooper & Co.
" " " Ripon.—S. Dixon & Sons, Ltd.
Electric lighting huts, Woolwich.—W. G. Tackley & Co., Ltd.
Electric cranes at Deptford.—Stothert & Pitt.
Electric lifts, Whalley.—W. J. Furse & Co.
Generating station, Ripon.—Stott & Alcock.

Crown Agents for the Colonies.

Telegraph poles.—Siemens Bros. & Co.
Copper wire.—Shropshire Iron Co., Ltd.

India Office, Store Department.

Carbons.—General Electric Co.
Cells.—Siemens Bros. & Co.
Insulators.—Bullers, Ltd.
Platinum.—Johnson, Matthey & Co.
Searchlights.—India Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
Wire.—Callender's Cable Co.; Shropshire Iron Co.; T. Bolton & Sons.

Post Office.

Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; British Insulated and Helsby Cables, Ltd.; London Electric Wire Co. and Smiths, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Western Electric Co., Ltd.
Testing apparatus.—General Electric Co., Ltd.
Battery boxes.—Standard Woodwork Manufacturing Co., Ltd.
Electric light cable.—W. T. Henley's Telegraph Works Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telephone cable.—British Insulated & Helsby Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Western Electric Co., Ltd.
Compound (chalk, tar and pitch).—Dussek Bros. & Co.
Jointing sleeves (brass).—C. M. Powell Bros.
Insulator spindles.—Bullers, Ltd.
Bronze wire.—British Insulated & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. and Smiths, Ltd.
Ditto (insulated).—Connolly Bros., Ltd.
Flameproof wire.—C. Macintosh & Co., Ltd.
Ditto (enamelled).—J. C. Fuller & Son, Ltd.
Laying ducts.—Belshill, Motherwell; Siemens Bros. & Co., Ltd.
Laying ducts and pipes.—Jamestown, T. Spence.
Telephone exchange equipment extensions.—Lee Green: Western Electric Co., Ltd. Sydenham; Western Electric Co., Ltd. Willesden; Peel-Conner Telephone Works, Ltd.
Telephone exchange equipment, Wishaw (Glasgow).—Peel-Conner Telephone Works, Ltd.
Provision of a set of accumulators.—Leeds Automatic Telephone Manufacturing Co., Ltd.

H.M. Office of Works.

Renewal of electric cables of Houses of Parliament.—The Western Electric Co., Ltd.
Miscellaneous:—Edinburgh electric bell-hangers' work, Pratt Bros. Electric cable and wire, The Union Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd. Glasgow electric bell-hangers' work, Bennett & Rutherford.

(*Continued on page 589.*)

THE POWER SUPPLY OF THE CENTRAL MINING-RAND MINES GROUP.

After briefly outlining the contents of his paper on the above-named subject at the Institution of Electrical Engineers on Thursday last week, Mr. J. H. Rider, M.I.E.E., described the sequence of operations in the gold mining industry with the aid of a number of lantern slides, most of which, thanks to his courtesy, we are enabled to reproduce herewith. The group of mines with which the author has been associated as consulting electrical and mechanical engineer for the past four years crush about 8½ million tons of ore per annum, and produce about 36 per cent. of the total gold output of the Transvaal, or one-seventh of the total gold output of the world. When it was decided, in 1908, that the whole of the power requirements of these mines should be taken from an outside source, a separate supply company, called the Rand Mines Power Supply Co., Ltd., was formed for that purpose. This power company owns the Rosherville and Vereeniging power stations, and the air-compressing station at Robinson Central Deep (a section of Crown Mines, Ltd.). During recent years electrical power has been adopted for almost all the mechanical operations except rock-drilling, which is done with compressed air mainly supplied from central stations, and, in some cases, the air is compressed by electrically-driven plant; thus the horse-power of the 1,500 motors employed amounts to 142,300 h.p., and the annual consumption of electrical energy to 310 million units, the maximum demand being 47,300 kw. and the load factor 75 per cent. The maximum demand upon the compressed-air system is 37,900 kw., and the load factor 34 per cent.; the consumption is 103 million "air units" per annum, the air unit representing 0·641 of the energy in one electrical unit.

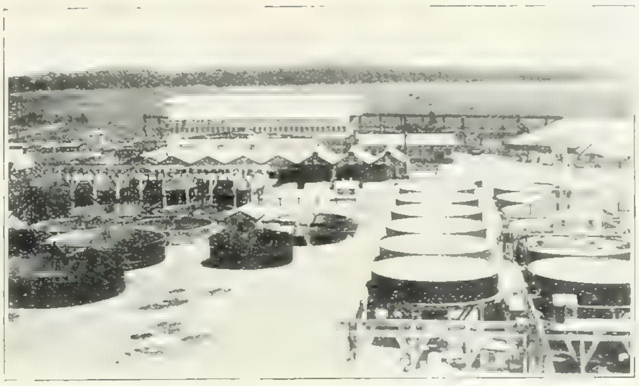


Fig. 1.—City Deep Mines: General View.

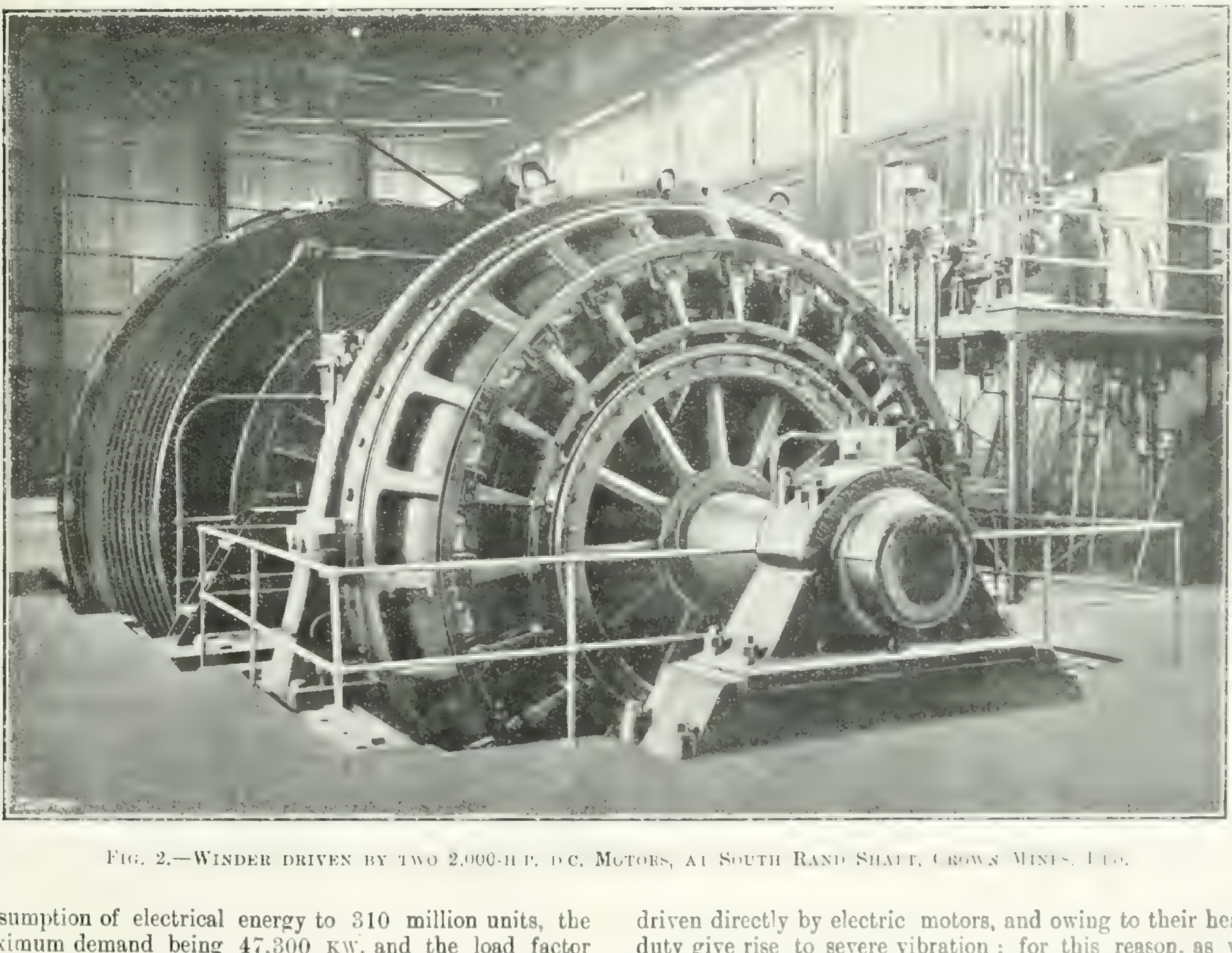


Fig. 2.—Winder driven by two 2,000-h.p. d.c. Motors, at South Rand Shaft, Crown Mines, Ltd.

The most important service is that of winding, as not only is the output of the mines entirely dependent upon it, but also the safety of thousands of men (both white and coloured) who descend and ascend the shafts daily. There are at the present time 38 shafts in use on the mines of the group, many of which have underground winders for the lower depths, in addition to surface winders. One of the largest of the latter is illustrated in fig. 2.

Fig. 3 shows the headgear of the City Deep Mine, with three hoists; the rock excavated at a depth of over 3,000 ft., when raised to the surface, is tipped into bins over the "grizzlies" seen in the foreground, and is then fed upon broad rubber travelling sorting belts. The function of the grizzlies is to permit the small stuff to fall through, while the large lumps roll over the bars, thus roughly sorting the material in the first instance. Some of the sorting belts are seen in fig. 4; they travel very slowly, and Kaffir "boys" standing alongside pick out the useless rock, which is easily distinguished from gold-bearing ore. The latter passes on to the crushers, which reduce it to pieces not exceeding 1½ in. in diameter. The crushers, shown in fig. 5, are driven directly by electric motors, and owing to their heavy duty give rise to severe vibration; for this reason, as will be seen in the view, their axes are placed at right angles, to distribute the vibration over the whole building. The motors driving the crushers are shown in fig. 6.

In the long run, the ore has to be reduced to an impalp-

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* For a description of these stations, see Electrical Review, March 28th, 1913.

able powder, in order to enable the whole of the particles of gold to be extracted. The next process through which it passes for this purpose is illustrated in fig. 7, which shows the upper portion of a battery of stamps. These are steel rods shod with stamps at the lower ends, weighing 1,200 to 2,000 lb., and provided with tappets higher up, which, as shown, are lifted by cams mounted on a rotating shaft. The cams are double, so that each rod is lifted and dropped twice in a revolution, and they are arranged so that the stamps operate consecutively. A very brief period elapses between the dropping of a stamp, which of course occupies a constant interval under gravity, and its next lifting by the following cam; hence, as Mr. Rider pointed out, a slight increase in the frequency of the alternating-current supply to the driving motors involves a serious risk of "camming," that is, receiving the blow of the stamp on the following cam, with disastrous consequences to the latter. Experience has shown that this danger exists at a speed greater than 98 drops per minute, and it increases with any increase in the speed of dropping.

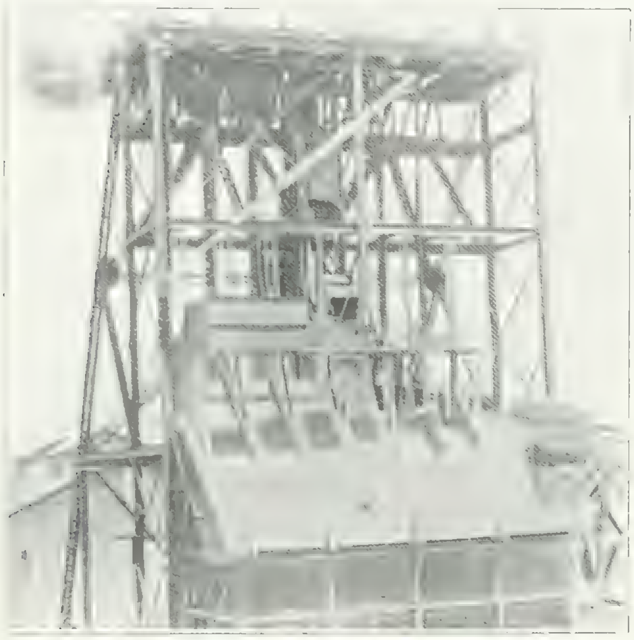


Fig. 3.—Headgear and Grizzlies: City Deep.

Having fixed the output of the stamp mill on the basis of 98 drops per minute for each working stamp, while any increase in the speed is dangerous, any decrease will reduce the output of the mill in the same proportion. As the variation of frequency permitted by the contract with the supply company is 5 per cent. up or down, this has to be taken into account in settling the speed of the driving shaft. During the early period of the power supply considerable trouble was experienced from these causes, which affected all the mills at the same time. As it was afterwards found that the supply was more generally given at or near the higher frequency, the drives were altered to suit, this being the lesser evil.

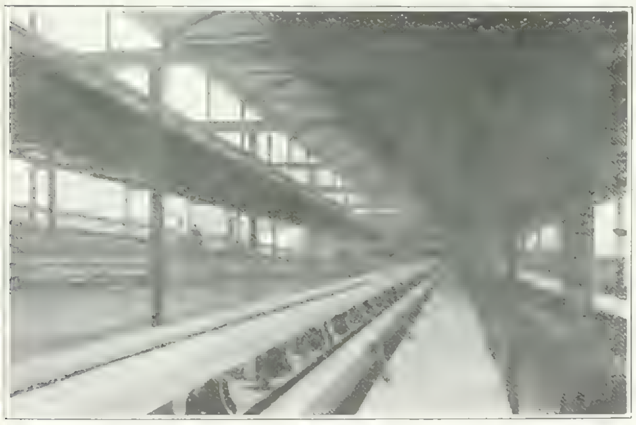


Fig. 4.—Sorting Belts: City Deep.

At this stage water is employed to wash the crushed rock through screens of small mesh, and the mixture passes on to tube mills (fig. 8), in which it is finally reduced to pulp. The tube mill is a cylindrical steel vessel, like a boiler shell, a common size being about 22 ft. long × 5 ft. 6 in. diameter. It is carried upon hollow trunnions, and is rotated at a speed of about 28 R.P.M. The interior is lined either with hard segmental stone blocks or with concrete in which steel pins are embedded. The crushed ore as it comes from the stamp mill in the form of a coarse pulp is fed through the trunnion at one end, together with a number of small selected pieces of ore, called pebbles, about 3 in. cube, which act as grinders, and themselves gradually become reduced to powder. The finished product comes out of the trunnion at the other end, and is then ready for passing over the amalgam tables.

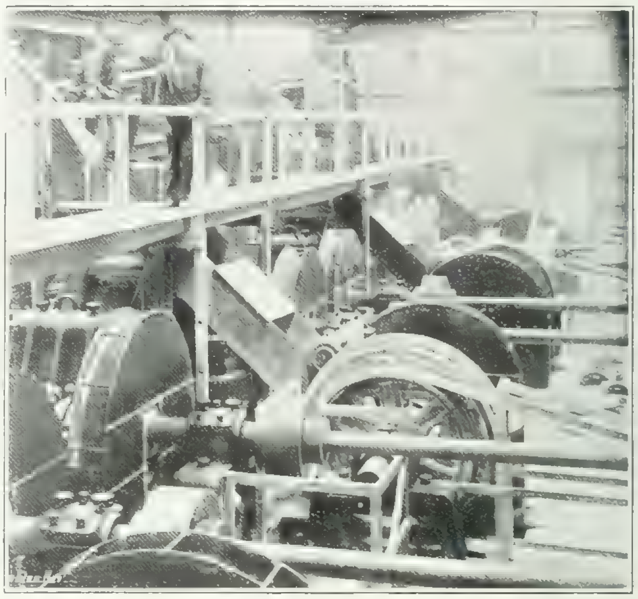


Fig. 5.—Crushers: City Deep.

In fig. 9 are shown motors driving tube mills directly through Citroen spur gearing, with the controlling apparatus on the opposite side of the motor room. The gear ratio, however, was too great for single-reduction gearing to cope with satisfactorily, and in later practice the motors drive countershafts by belt, as shown in fig. 10. The tube mills have a certain amount of end play, so that the gearing should have straight teeth.

The next process is the extraction of the gold, in which electricity plays but a small part. The pulp passes over a series of copper tables, shown on the left of fig. 11, the upper surface of which is amalgamated with mercury, and here the greater part

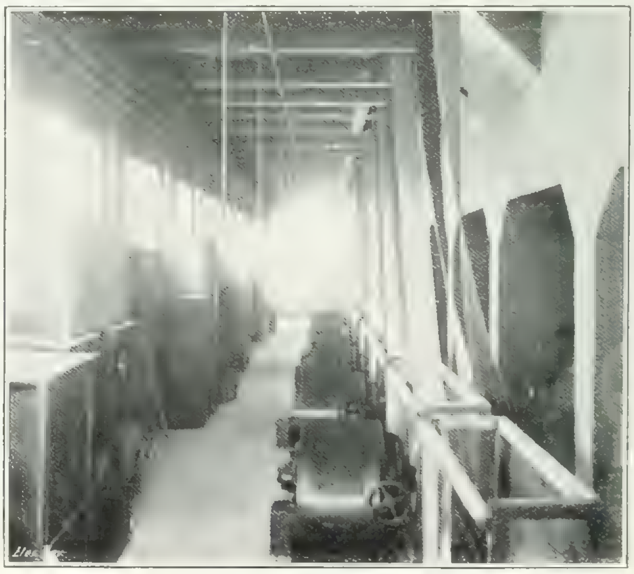


Fig. 6.—Crusher Motors: South Rand.

of the gold is trapped. Periodically the amalgam is scraped off, and the gold recovered by vaporising the mercury. The pulp, after passing over the mercury tables, is further treated by the cyanide process in the large tanks shown in fig. 1, to remove the remaining gold as far as possible. The cyanide solution is then carried to the boxes shown on the right hand of fig. 11, where the residue of the gold is precipitated on zinc shavings. The product is then smelted and the gold recovered.

Winding from deep levels on the mines of the group is effected mainly by three-phase induction motors, but in some cases D.C. motors are used on the Ward-Leonard system. The former are controlled by variable rotor resistances, usually of the liquid type, as shown in fig. 13. The electrodes are in the upper tank, and the electrolyte is pumped up by a centrifugal pump, which determines the rate of rise of level, and therefore the acceleration of the motor, independently of the driver. Various troubles have been met with, and successfully overcome, in the operation of these liquid resistances. More recently electrically-operated contactor switches have been used in conjunction with metallic resistances, and have given very satisfactory results.

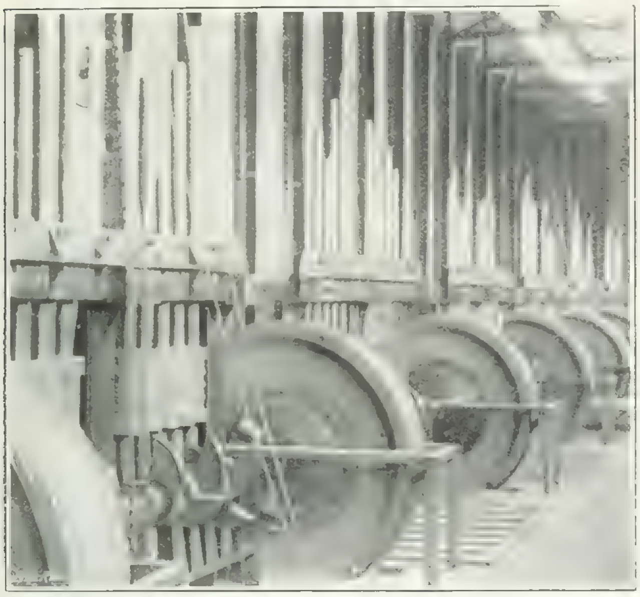


Fig. 7.—Stamp Mill: City Deep.

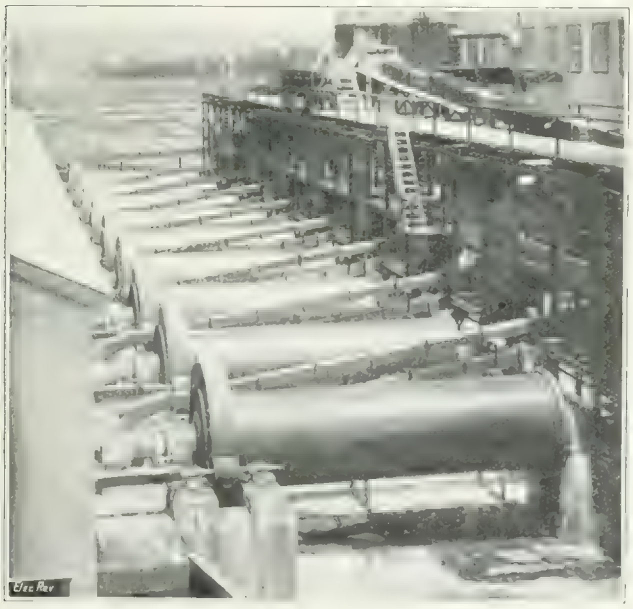


Fig. 8.—Tube Mills: City Deep.

The D.C. motors are controlled by metallic resistances in the field circuit of the generator. One of the latter winders is illustrated in fig. 2, p. 585; this is the largest electric winder in South Africa, and is driven by two motors, each of 2,000 H.P. There are two cylindro-conical drums, each 22 ft. in diameter, which run at 54 R.P.M. and wind a net load of 16,000 lb. from a depth of 3,540 ft. at a speed of 3,500 ft. a minute. There are three of these winders at the South Rand shaft of Crown Mines, Ltd. The motor-generator for the set illustrated runs at 350 R.P.M., and has two generators, working at 500 volts, which are connected in series with one another and with the two winding motors. The current taking at starting is frequently 5,000 amperes. The electrical equipment was made by the General Electric Co., U.S.A.

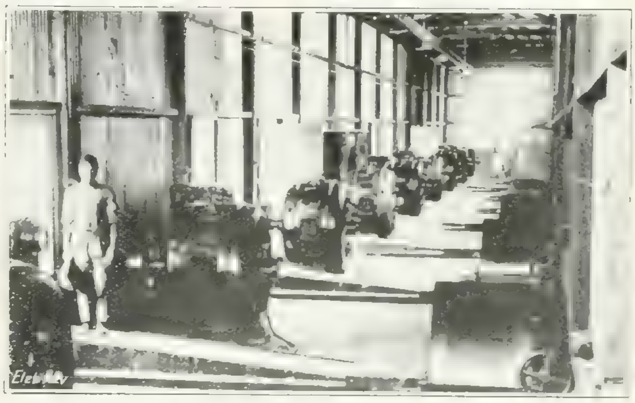


Fig. 9.—Tube Mill Motors (Single-Reduction Drive): City Deep.

While most of the compressed air is supplied by the power company, four of the mines have their own compressing plant. Fig. 14 shows two vertical two-stage air compressors made by Messrs. Belliss & Morcom, Ltd., and driven by electric motors. In some cases existing steam-driven air-compressors have been converted, by grooving the fly-wheel rim for ropes and substituting a motor for the engine (fig. 16).

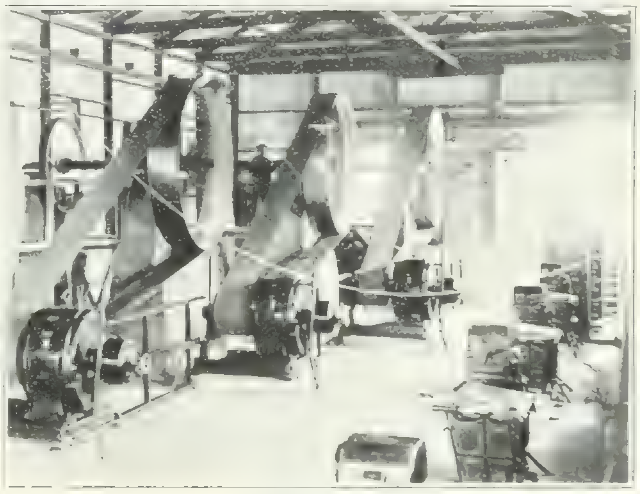


Fig 10.—Tube Mill Motors driving through Countershafting: Nourse.

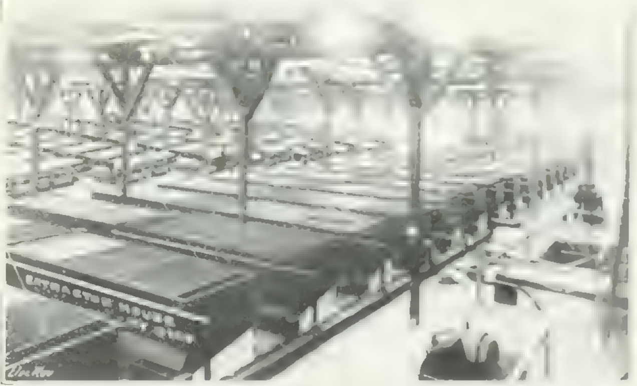


Fig. 11.—Extractor House: City Deep

A direct-coupled compressor at Bantjes is of the high-speed turbine type. It compresses the air up to 7·5 lb. gauge pressure, at which pressure the horizontal rope-driven compressors take it and complete the compression. It was made by Messrs. C. A. Parsons & Co., and has been most successful in operation.

The driving is by three-phase constant-speed motors, and the governing is done by butterfly valves in the main suction pipes, which are controlled by the air pressure, and close as long as the pressure in the receiver is above the normal. As soon as the pressure falls the valves open and the compressors work normally.

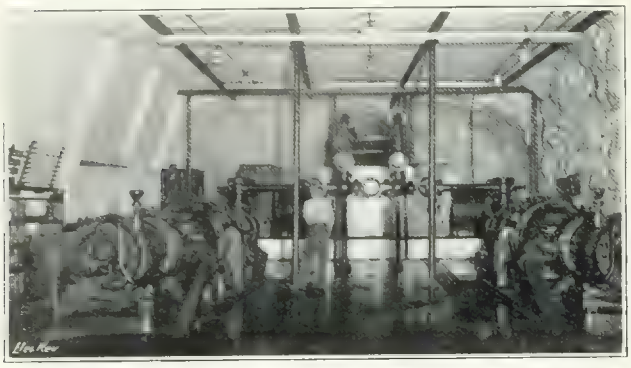


Fig. 12.—Underground Pump Chamber : D. Roodepoort Deep.

The system of pumping water from the mines with Cornish pumps in stages of about 500 ft. has been superseded with great advantage by the plan of allowing all the water to gravitate to the lowest level and pumping it to the surface in a single lift. For this purpose motor-driven geared ram pumps were used until 1912, when it was decided to use high-speed multi-stage centrifugal pumps, with direct-coupled motors, at the South Rand shaft of the Crown Mines, Ltd., and at No. 1 shaft, Durban Roodepoort Deep, Ltd. The plant at both mines is identical, and each consists at present of two pumping units.

One of the underground pump rooms is shown in fig. 12 : each unit consists of a high and low-pressure Sulzer pump, with the motor between them, and lifts 375 gallons per minute to a height of 2,400 ft. The sets run at 1,470 R.P.M., and take about 500 B.H.P. Sets of twice the size are being installed at Crown Mines. The saving in running cost was sufficient to wipe out the whole of the capital outlay in two years. It is not that the centrifugal pump, by itself, has a higher efficiency than the ram pump, but the use of the former renders concentration of large, high-power and high-speed pumping units possible in a minimum of space, with a minimum of attention and very low maintenance costs.

The success of the centrifugal pumping system has been such that large similar schemes are now being considered for other mines of the group.

The power company's electric supply is given at normal pressures of 2,100 volts and 525 volts at the consumers' terminals. Fig. 15 is a view of a switchboard in one of the switch-houses ; it is of the cubicle type, built of reinforced concrete, the high-pressure gear being on one side of the switch-house and the low-pressure on the other. Owing to troubles resulting from installing switches rated merely for the full load of the circuits, the author made a rule that all oil-switches in a switch-house should be of the same size, rated for a current of 800 amperes at 15,000 volts, whether used on 2,100-volt or 525-volt circuits, with the result that trouble in switch-houses has practically disappeared.

Three-core, lead-covered and armoured cables, laid in trenches, are universally used between the main switch-house and the various sub-distribution points on each mine. The points are arranged to suit the local conditions, and are generally interconnected, so that the failure of any main cable does not stop the supply. Link cages, without switches, are provided at the sub-points, so that the sub-circuits can be isolated at any time and the feeders interconnected as may be required.

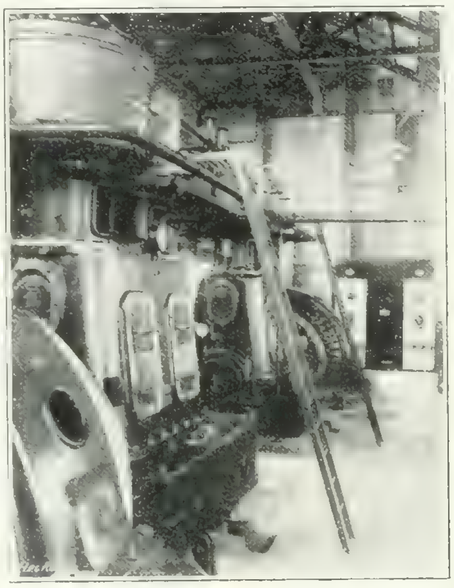


Fig. 14.—Air Compressors and Switchboard D.R Deep.

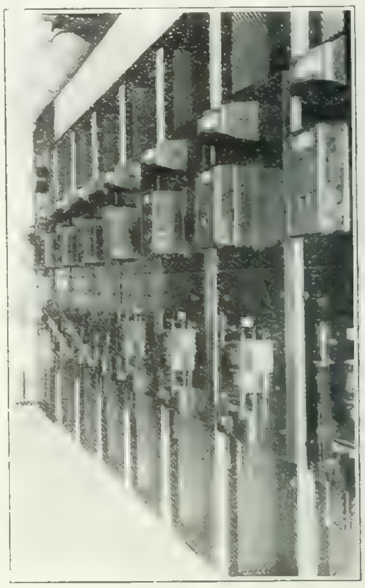


Fig. 15.—Switchgear in Switch-house : D.R. Deep.

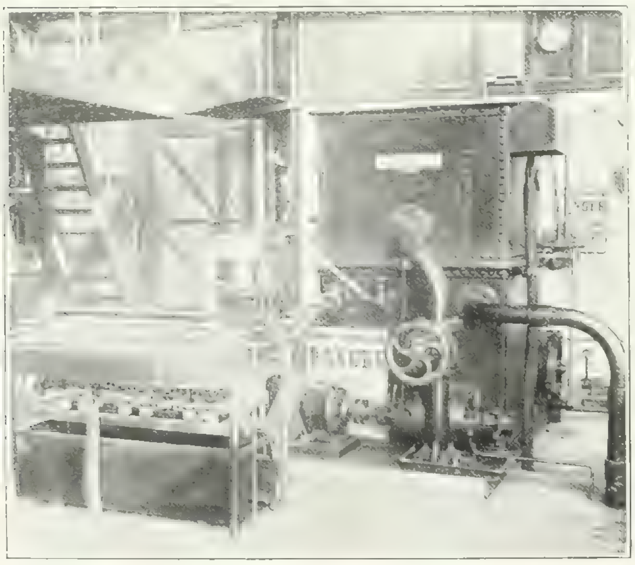


Fig. 13 —Three-phase Control Tank : Crown Mine.

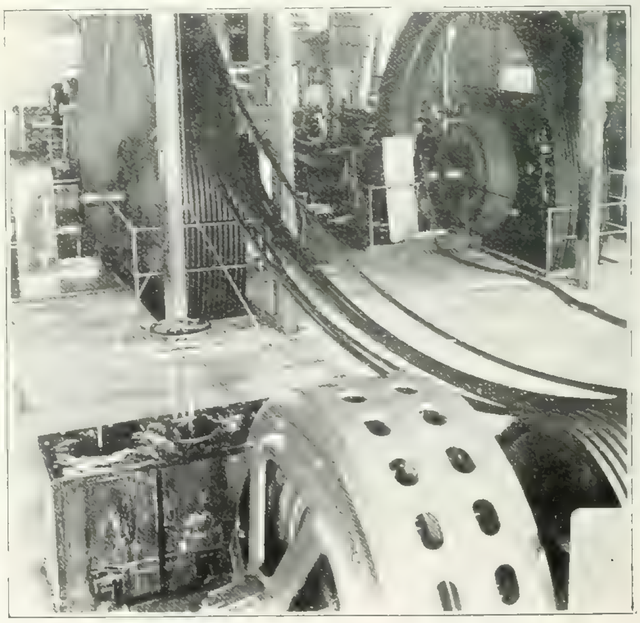


Fig 16.—Rope-driven Compressors : Bantjes.

CONTRACTS CLOSED.

(*Continued from page 584.*)

Aberdeen.—Mr. Thomson has secured the contract for the electrical installation at the City Hospital extension.

Belfast.—The Corporation Tramways Department has placed a contract with Messrs. Siemens Bros. Dynamo Works, Ltd., for carbon filament lamps for twelve months.

Bristol.—The T.C. Docks Committee has accepted the tender of Messrs. W. T. Henley's Telegraph Works Co. for 47 coils of vulcanised I.R. cable, of various sizes.

Colchester.—The T.C. has accepted the following tenders for supplies to the electricity works :—

Stamford & Co., Bagshaw.—Coal elevator, £89.
Pope's Lamp Co.—Metallic-filament lamps.
Joslins, Ltd.—Prepayment installations.
Lucy & Co.—Fuse-boxes.
Paisley Engineering Co.—Castings.
Williams & Co.—Electrical accessories, oils, &c.

Edinburgh. — The Corporation E.L. Committee has settled the coal contract for the coming year at about 4s. 6d. a ton more than was paid last year. The coal bill for next year is increased by £10,000.

Halifax.—The Corporation Electricity Department has placed a contract for 10, 25, and 50-amp. D.P. ironclad switches, required during the next 12 months, with Messrs. J. H. Tucker and Co. The Tramways Department has placed a contract for lampholders, switches, &c., for the same period, with the same firm.

Hampton.—The U.D.C. has accepted the tender of Messrs. Stuart & Moore for fire alarms in Station Road, at £18 12s., with 30s. per annum for maintenance.

Ilford.—The following tenders have been accepted by the U.D.C. for annual supplies to the Tramways Department :—

Messrs. Wiseman.—Trolley heads and harps.
British Westinghouse Co.—Armature coils.
Le Carbone, Ltd.—Carbon brushes.
Scholey & Co., Ltd., and British Thomson-Houston Co.—Pinions and gear wheels.
John Brown & Co.—Tires, steel, and special steel.
B.I. & Helsby Cables, Ltd.—P. & S. substitute tape, and Para tape.
L. Andrews & Co.—Blackley tape.
F. Smith.—Piano wire.
Dussek Bros & Co.—Graphite grease.
A. B. Gross & Co.—Motor grease.
Joslins, Ltd.—Oil.
R. Kearsley & Co.—Varnishes.

Lichfield.—The T.C. has accepted the tender of Messrs. Clive & Co. for alterations to the telephone service in connection with the electric fire alarms, and the provision of poles, relay bell, insulators, lines, &c.

London.—BERMONDSEY. — The undermentioned purchases of coal have been made by the Electricity Committee :—C. Tucker & Co., 10 tons wharf small, 22s. 3d. per ton ; Charringtons, 16 tons nutty slack, 25s. ; W. Moore & Co., 10 tons wharf small, 21s. ; Thorpe, Head & Co., 20 tons wharf small, 20s. ; Myers, Rose & Co., 100 tons Stanley slack, 18s. 9d. ; Bradbury & Co., 30 tons nutty slack, 23s. 6d. ; Thorpe, Head & Co., 60 tons nutty slack, 20s. ; Dinham, Fawcus & Co., 100 tons West Hallam nuts, 25s. ; 100 tons, Sharlston pea slack, 25s. ; 100 tons West Hallam nuts, 25s. The Committee recommends the Council to continue, for a further period of two months, to pay Bradbury, Son & Co., Ltd., the increased charge of 1s. 6d. per ton on the coal contract.

Meter Contracts, &c.—The Swindon and West Hartlepool municipal authorities have accepted tenders of the Bastian Meter Co., Ltd., for the supply of Bastian meters, of from 3 to 10 amperes and 2½ to 5 amperes respectively.

The Electrical Apparatus Co., Ltd., has obtained a contract from the Dundalk U.D.C. for the supply of house service meters for the year ending March 31st, 1916.

Messrs. J. H. Tucker & Co. have recently received contracts for annual supplies of service fuse-boxes from Ilford U.D. Council, Bolton and Blackburn Corporations ; for lampholders from Swindon Corporation ; and for ironclad switches from Dundalk U.D. Council.

Messrs. Chamberlain & Hookham, Ltd., have received contracts from the following towns for the supply of meters for 12 months :—Kirkcaldy, West Hartlepool, Swindon and Pontypridd.

The British Westinghouse Electric and Manufacturing Co., Ltd., have recently received contracts from the following supply authorities for single-phase A.C. house service watt-hour meters :—Bath Corporation ; Beckenham Urban District Council ; Blackburn Corporation ; Bristol Corporation ; Croydon Corporation ; Eccles Corporation ; Ipswich Corporation ; Leeds Corporation ; Rhondda Urban District Council ; Watford Urban District Council ; West Ham Corporation.

Southampton.—The Borough Insurance Committee has accepted the tender of Messrs. H. C. Taplin & Sons for the E.L. installation at the Committee's offices.

Sunderland. — CORRECTION.—In last week's issue, "C.O. two recorders" was, of course, a printer's error for "CO_2 recorder."

Thames Ditton.—The U.D.C. has accepted the tender of Messrs. Stuart & Moore for electric fire alarms at Claygate, at £82 2s.

Windsor.—The T.C. has accepted the tender of the Windsor Electrical Installation Co., Ltd., for the electric light installation at the waterworks and house with 54 lights, at £64, with £22 for an extra lighting main.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, April 23rd. At 8 p.m. At 39, Victoria Street, S.W. Paper on "The Developments of the Navy," by Mr. E. W. Hobbs.

Physical Society of London.—Friday, April 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Paper on "The Self-Induction of Solenoids of Appreciable Winding Depth," by Mr. S. Butterworth.

National Association of Colliery Managers and Association of Mining Electrical Engineers. Saturday, April 24th. At University College, Nottingham. Joint meeting. Paper on "Protective Devices against Lightning and Surges," by Messrs. E. Kilburn Scott and L. F. Fogarty.

Association of Mining Electrical Engineers (Lancashire, Cheshire, and North Staffordshire Branch) and North Staffs. Branch of the Colliery Managers' Association.—Saturday, April 24th. At 3 30 p.m. At Technical College, Stoke. Paper on "Colliery Electric Lighting," by Mr. G. S. Corlett.

Illuminating Engineering Society.—Tuesday, April 27th. At 8 p.m. At the House of the Royal Society of Arts, John Street, Adelphi. Discussion on "Visibility: its Practical Aspects," opened by Messrs. C. C. Paterson and B. P. Dudding.

Institution of Civil Engineers.—Tuesday, April 27th. At 8 p.m. At Great George Street, S.W. Annual General Meeting.

Association of Supervising Electricians.—Tuesday, April 27th. At 8 p.m. At St. Bride Institute, Bride Lane, E.C. Paper on "Lightning Conductors," by Mr. H. C. Hands.

Dynamicables.—Wednesday, April 28th. At Trocadero Restaurant. Anniversary Meeting and Dinner.

Royal Society of Arts.—Wednesday, April 28th. At 8 p.m. At John Street, Adelphi, W.C. Paper on "The Utilisation of Solar Energy," by Mr. A. S. E. Ackermann.

Institution of Electrical Engineers.—Thursday, April 29th. At Victoria Embankment, W.C. Paper on the "Bombay Hydro-Electric Scheme," by Mr. A. Dickinson.

(**Manchester Local Section**).—Tuesday, April 27th. At Engineers' Club, 17, Albert Square. At 7 p.m. Annual General Meeting. At 7 30 p.m. Mr. Dickinson's paper, as above.

(**Students' Section**).—The Annual General Meeting has been postponed from April 28th to May 5th.

Royal Institution of Great Britain.—Saturday, May 1st. At 3 p.m. At Albemarle Street, W. Lecture (I.) on "Photo-Electricity," by Prof. J. A. Fleming, F.R.S. At 5 p.m. Annual Meeting.

NOTES.

Institution and Lecture Notes.—Iron and Steel Institute.—The annual meeting will be held at the Institution of Civil Engineers at Westminster, on May 13th and 14th. In the event of Mr. Greiner being unable to attend, Mr. Arthur Cooper, LL.D. (immediate past-president), will preside. The Bessemer Gold Medal for 1915, which has been awarded to Mr. Pierre Martin (formerly of Sireuil, near Paris), will be received on his behalf by his Excellency M. Paul Cambon, the French Ambassador, who has consented to attend. Prof. Hubert (Liége University) is to deliver an afternoon lecture on "Large Gas Engines." In the programme of expected papers there is one by Messrs. A. M. Portevin and E. L. Dupuy, on "Thermo-Electric Properties of Special Steels." On account of the war the annual dinner will not be held. It is provisionally settled that the autumn meeting will be held in London during the week ending September 25th.

Institution of Electrical Engineers.—The annual general meeting of the STUDENTS' SECTION has been postponed from April 28th to May 5th, at 7.45 p.m., when Sir John Snell will give an address.

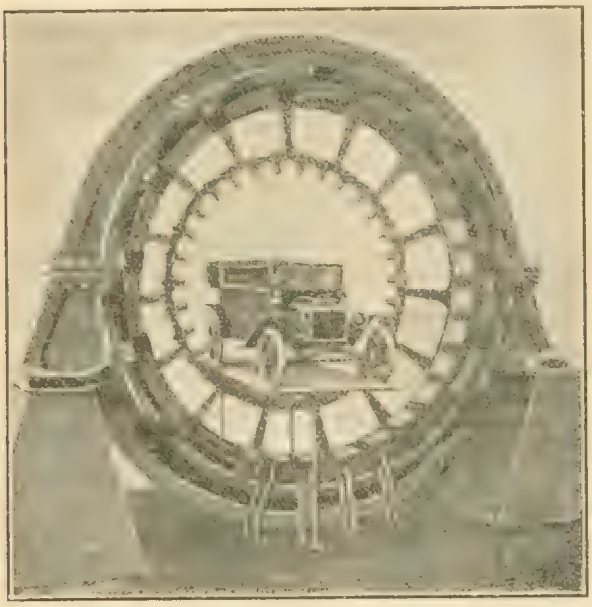
Royal Society of Arts.—On Wednesday last week, Mr. T. Thorne Baker read a paper on "The Industrial Uses of Radium," dealing mainly with the application of the residues of radium factories to agricultural purposes. He stated that the α-rays produced increased vitality and quicker germination of seeds, and that radium emanation accelerated the growth of plants. Salts containing exceedingly small quantities of radium had been used for the treatment of rheumatism with highly satisfactory results, and radium could be used to clot milk in place of rennet. The use of radium to render watch hands luminous in the dark was also described.

The Government and War Munitions.—From a notice which appears in our advertising pages to-day, it will be seen that firms engaged on the manufacture of armament and munitions of war and requiring additional machinery, are requested to communicate with Mr. George M. Booth, Room 367, War Office, Whitehall, S.W., giving particulars

Educational Note. — CRYSTAL PALACE SCHOOL OF PRACTICAL ENGINEERING.—The new course will commence on Wednesday, April 28th. See our advertisement pages to-day.

Large D.C. Generator.—Four large direct-current generators are now being installed in the Detroit plant of the Ford Motor Co. by the Crocker-Wheeler Co., Ampere, N.J. Each of these machines will be directly connected to a two-cylinder tandem gas engine and a compound condensing steam engine.

The maximum diameter of the generator shaft is 34 in.; it is 26 ft. long, and weighs approximately 35 tons. The greatest diameter of the armature is 15 ft. 10 in., and its total weight is 42·5 tons. The armature spider is of cast-iron, and is cast in two parts, each part weighing about 9 tons. Eight bolts are used to hold the spider halves together, each bolt weighing 500 lb., and each fluted nut, of which there are 16, weighing 90 lb. In order to obtain the proper tension on the bolts, each bolt was heated before being placed in position, so that on cooling after the nuts had been tightened the bolt contracted and drew the two halves of the spider together with great force. The laminated core consists of 26,000 separate parts, each part having to be handled separately during the process of assembling. There are 10,000 core laminations and 5,600 core ventilators. The commutator is made up of 630 copper bars insulated from each other and assembled on a cast-iron spider frame. This spider frame is also made in two parts, each weighing 5,000 lb. The diameter of the commutator over the bars is 9 ft. 2 in., and its total weight is 10 tons, of which 4 tons is copper. The completed armature mounted on the shaft is supported on two bearings, each being 33 in. in diameter and 5 ft. long.



Frame of Direct-Current Generator for Ford Plant.

The magnet frame is of cast-iron and has a section resembling an enlarged T-rail section. Like the other large castings, it was cast in two parts, each weighing 20 tons. The outside diameter of the frame is 22 ft. 2 in., and the distance across the base 25 ft. 8 in. Thirty main poles and 30 interpoles were bolted to the inside of the frame after the field coils were in place. The rocker ring to which the brush-holders are fastened is supported by brackets cast on the side of the magnet frame. The rocker ring is of cast-iron, and has an outside diameter of 20 ft. It weighs 4 tons. The machine is equipped with 240 brushes.

The total weight of the generator, including the shaft, is about 135 tons, of which 13 tons is copper. At 250 volts the generator is rated at 15,000 amperes. The normal rating of the machine is 3,750 KW., and the maximum rating is 4,500 KW. The generator operates at a speed of 80 R.P.M., which gives a peripheral velocity of the armature of about a mile a minute. It was necessary to split the large castings in order to meet railroad-tunnel clearances.—*Electrical World.*

Electricity in the Roumanian Petroleum Industry.—Important modifications have recently been introduced in the rules governing the use of electricity in the Roumanian petroleum industry. A *résumé* of the revised regulations follows, and deserves the notice of manufacturers concerned, since Roumania is one of the fields in which advantage may be taken of German paralysis to extend our own trade. Squirrel-cage motors are ill adapted, by reason of their high and invariable speed, to the requirements of the petroleum industry, hence the rule prescribing the use of these machines has been considerably broadened. Step-down transformer stations fed at 1,000 volts, or higher pressure, and all generating stations must be at least as far from any boring as the distances prescribed for boilers and forges in collieries. Where there are no spouting wells, transformers in gas-tight chambers are excepted from this rule. Transformers working at 1,000 volts or lower pressure, and supplying lighting current, are permissible near the well if they and their fuses and switchgear are oil-immersed. In the immediate neighbourhood of the well, one and the same cable must be used for lighting and power. Special switches and fuses for the lighting and motor branches must be located in the motor room and accessible only to authorised persons. Lighting generators or transformers at the well-head must be in fireproof buildings, accessible only to authorised persons. In no case is more than 1,000 volts P.D. permissible between conductors in a sinking. High-pressure circuit-breakers isolating sinkings may be mounted on the poles, if oil-immersed; other switches or fuses may not be so mounted. Lightning conductors with spark gaps are forbidden. An oil-immersed isolating switch must be provided in each well network, for use in case of fire. Single-pole switches are forbidden; multipole switches must be mechanically coupled. Telegraph, telephone and signalling apparatus must produce no open sparking, and must incorporate devices safeguarding possible contact of their wires with high-pressure leads. Only hermetically-sealed glow lamps with armoured protecting globes are permitted in the workings, and in the latter the use of direct-current motors is forbidden. Short-circuited induction motors of the squirrel-cage type should be used whenever possible in the workings. Slip-ring motors are permissible so long as all sparking parts are enclosed in a chamber which is sealed automatically and hermetically. An official certificate is required as to the safety of the motor in a gas-filled space and as to the maximum temperature rise of the controlling resistances. Switchgear or other apparatus capable of producing a spark in the motor room must be oil-immersed, unless the casing is hermetically sealed, and excepting lighting fuses up to 10 amperes capacity. Owners are bound to employ at least one qualified electrician certificated by the authorities; this electrician and the works manager are responsible for the proper erection and operation of the installation. Only equipment sanctioned by the Minister of Commerce and Industry may be installed, hence care should be taken that all necessary formalities are concluded before delivery is made or special expenditure incurred. Full particulars, plans and specifications of proposed equipment should be laid before the authorities, who will advise what alterations or substitutions are required in the event of the first proposals being unsatisfactory.—*Moniteur du Pétrole Rumain.*

Telephony and Telegraphy in the Field of War.—A graphic account of field telegraph and telephone work has been contributed to a Frankfort newspaper by a correspondent who, on the occasion of his presence with the army commanded by the Crown Prince of Bavaria, had an opportunity of inspecting the entire telegraph and telephone system of this particular army in the western area of operations. The exchange for the whole of the traffic was located in a large private house; it was equipped within three weeks, had 95 direct lines and established about 5,000 connections daily. In order to carry out the work, which comprised lines of a total length of 740 miles, 300 men of the First Bavarian Telegraph Battalion were available, and these were able to lay 54 lines in a single day immediately after the exchange was finished. The difficulty of executing the works was increased by the circumstance that French apparatus was employed for the greater part, and this had to be altered to correspond with German requirements and custom, the apparatus being found in French Post Offices. It was also possible to use the French network to some extent, although it was largely destroyed. Notwithstanding all the difficulties the exchange was soon completed, and a network of communication was provided which had direct lines right down to the divisions and rendered possible direct communication with the grand army headquarters and the neighbouring armies.

Each Army corps can be reached by means of five different lines, and from these the divisions can each be called by at least two different lines. Lines from the divisions then lead to the brigades and regiments, and the terminal line proceeds to the trenches, from which every battalion, and, in many cases, every company has a connection to the rear. To these means of communication are added the numerous lines necessary for the artillery, artillery observers in the trenches, &c.

Communication with neighbouring armies is effected by means of two direct lines in each case, whilst two similar lines maintain connection with the grand headquarters. In addition each army corps is connected by direct lines with its neighbouring corps, and each division with its adjoining division. It has frequently been necessary to carry out repairs necessitated by storms, and besides there has to be taken into consideration the much endangered situation of the telephone stations in places where they must be maintained for military reasons, and where they lie within the range of hostile artillery fire. Stations indeed exist which are continuously fired at, and security has to be sought in deep cellars which are made bomb-proof as far as possible. Many lines are shot down, and the places of interruption have to be discovered and the necessary repairs promptly made to maintain communication. The telegraph traffic is effected in this army as at the grand headquarters by the use of the French Hughes apparatus, and the daily work ranges from 900 to 1,000 service telegrams, thus almost, if not entirely, excluding any private messages.

A number of portable stations for wireless telegraphy are also associated with the army. These stations, which are partly hauled by horses and partly by motor cars, have a quiet period in times of fighting for positions, but a great strain is imposed upon them when movements are taking place. The range of the stations is a few hundred kilometres. The lines of the army chief command are connected to the rear with those of the service corps, which are worked by the telegraph service corps, and are then joined further to the rear with those of the general government, which are operated by the Imperial telegraph department.

A central depôt has also been provided for meeting the requirements in telephone and telegraph material of the cavalry, infantry, pioneers, and telegraph troops. The manager of the depôt always has in stock a quantity of the necessary materials. The reserve is kept in trucks on rails, and each box is at once accessible and bears an indication of its contents. The deliveries from the depôt to the troops are effected partly direct by rail and partly by means of heavy motor lorries, which frequently have to be driven almost to the trenches, whilst special depôts are provided for furnishing telephone materials to the artillery.

Buffer Batteries for Alternating-Current Systems.—An illustrated account of experience with buffer batteries on alternating-current systems is given by L. Schroeder in the *E.T.Z.*, the fundamental idea being shown in fig. 1. G is the three-phase generator which supplies energy to the three-phase bus-bars B C, while N is the network; M D is a motor generator, M being the three-phase motor and D a direct-current generator. The latter acts in co-operation with the storage battery A. In the bus-bars a series transformer is provided, the secondary current of which is rectified by means of the synchronous converter R. The direct current which comes from the synchronous converter is approximately proportional to the current in the network, and is used to regulate the booster Z. For this purpose the direct-current from R is passed through the magnetising winding *a b* of the booster. This booster has also a second excitation winding *c d*, which is fed from the battery A. The two excitation windings *a b* and *c d* act in opposition, and are so dimensioned that at the average load in the network the actions of the two windings counterbalance each other, so that the booster is unexcited and the battery is neither charged nor discharged. If the load in the network increases, the action of the winding *a b* is greater than that of *c d*, and the booster is now excited in such a way that the storage battery is being discharged. The battery, therefore, drives the direct-current generator D, and the three-phase alternator M now becomes a generator and supplies energy to the network. On the other hand, if the load in the network decreases below the average value, the storage battery A is charged. For the regulating generator R use is not made of an ordinary synchronous converter, but of a Danielson converter, with the modification due to Woodbridge. This arrangement was used in tests in which the normal load of the network was 35 KW. The battery consisted of 106 cells, with a discharge current of 259 amperes for one hour. The results of the tests are given in fig. 2, in which Curve 1 represents the load of the network in kilowatts, Curve 2 represents the load of the dynamo in kilowatts, while Curve 3 represents the voltage in the network. The abscissæ represent minutes. It will be seen that even though the load in the network was increased to 108 KW.—that is, more than three times the normal load—the buffer battery arrangement acted quite satisfactorily. If the generator suddenly stops work and the battery is forced to supply the whole current, the voltage in the network drops, but can be brought up to its normal value quickly by a simple change of connections.—*Electrical World.*

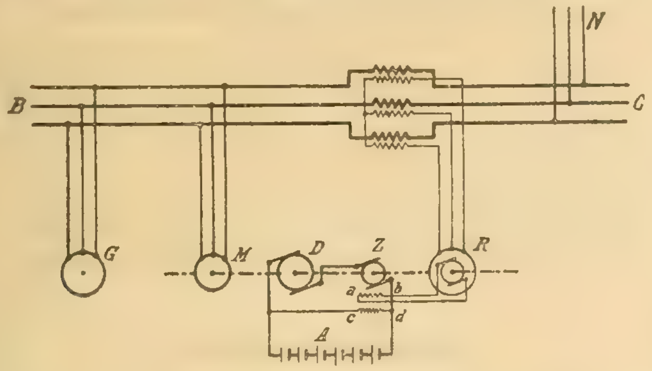


Fig. 1.—Wiring Arrangement for Buffer Battery.

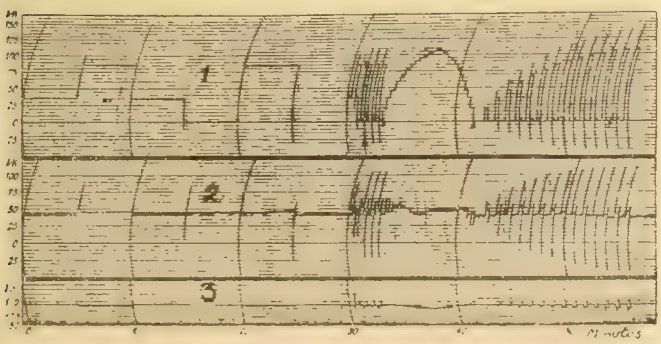


Fig. 2.—Results of Tests.

Shortage of Switchboard Attendants.—Our contemporary, *Electrical Engineering*, has prepared a scheme for enrolling in Electrical Emergency Service as volunteer switchboard attendants for part time, electrical men who are ineligible for active service and are willing to assist in cases of emergency. Particulars may be obtained on application to our contemporary at 203, Temple Chambers, London, E.C.

Parliamentary.—Dewsbury Corporation Bill.—The Omnibus Bill of the Dewsbury Corporation, after being before Mr. W. Middlebrook's Select Committee of the House of Commons on various dates during the past month, was ordered on Friday to be reported to the House for third reading. Mr. Vesey Knox, who represented the Corporation, explained that an agreement had been arrived at with regard to the tramways portion of the Bill. The Corporation were asking for powers to construct additional tramways and for further powers over the existing tramway and electricity undertakings. The Corporation desired to link up the whole system in the borough and secure running powers over the whole of the lines either of themselves or of those with whom they might make them lessees or licensees when the present agreements came to an end in 1933.—Mr. Councillor J. E. Kilburn (chairman of the Tramways Committee) stated that the Corporation were satisfied with the agreement which had been made by the parties concerned.

Sheffield and Rotherham Tramways.—The Select Committee of the House of Lords, presided over by the Duke of Wellington, considered the Bills promoted by the Sheffield and Rotherham Corporations together. Mr. Vesey Knox, K.C., and Mr. Gee appeared for the Rotherham Corporation, and Mr. H. Lloyd, K.C., and Mr. Tyldesley Jones for the Sheffield Corporation. The Rotherham Bill dealt with various matters, and included powers for doubling a portion of the existing track, the laying of a single track in the direction of Maltby, and for making arrangement for through running between Sheffield and Rotherham. The Sheffield Bill contained powers for the construction of new tramways, and for the purchase of the tramway in that part of Tinsley now taken into the city, which belongs to the Rotherham Corporation. Mr. Vesey Knox explained that the only opposed part of the Bill of the Rotherham Corporation was with regard to what was to become of the Tinsley tramway. The Sheffield Corporation proposed in their Bill to purchase this tramway, which was the property of Rotherham until 1926. The two places were competing in tramways, and the Tinsley line was the link between the two larger systems. There had been through running up to September, but in consequence of differences of opinion about halfpenny fares, the through service had been suspended. The Sheffield Corporation threatened to run motor-omnibuses to compete on the route, and the Rotherham Corporation promoted the Bill to prevent this being done. This was followed by the Sheffield Corporation promoting their Bill to compulsorily acquire the Tinsley tramways. After several unsuccessful consultations between the parties to arrive at an agreement, the Committee passed Clause 14 of the Rotherham Bill, which provided for through running, with the addition that nothing in the Act should interfere with the running of motor-'buses by the Sheffield Corporation until such time as the Board of Trade should be able to decide the question. The parties subsequently came to terms as to the wording of the clause, and also as to the principal clauses in the Sheffield Bill, which was referred to the Chairmen of Committees for final adjustment.

"Sole Agents."—"One of Several Sole Agents" writes as follows:—"Some time ago a very plausible person called on us, with what he described as telephone shields for attaching to telephone transmitters to prevent contagion. He laid great stress on the fact that they had been passed by H.M. Postmaster-General on a date stated, and also that if we purchased a small stock we were to have the sole agency, &c. It was a cash transaction, and goods were left, but we afterwards discovered at least three sole agents existed in one small town, and efforts to get in touch with his firm resulted in numerous addresses being reported 'Gone away, no address.' We strongly advise electrical clients and stores to think twice before taking up the 'Sole agency' until they have tried the goods. A 'Sale or return' arrangement would be much better."

A Business Club for London.—Owing to the lack in London of a Commercial Club of national or imperial scope, steps are being taken to meet the want, which is described as a great inconvenience to the manufacturers, merchants, shippers and business men of the British Isles, and is, above all, keenly felt by commercial visitors from our Colonies and foreign buyers visiting the metropolis for business purposes. The Council of the British Empire Industrial League have given serious consideration to this matter, and are making arrangements to found in London the British Empire Commercial Club on such a basis as will supply what cannot be otherwise regarded than as a metropolitan, national and imperial requirement. It is hoped that the Club will receive the hearty and generous support of our manufacturers, exporters and wholesale and retail merchants, and other leading men connected with business.

War Office Contracts and Workers' Badges.—In the House of Commons, on Tuesday, Mr. Baker stated that arrangements were complete for the issue of badges to workmen engaged on War Office contracts, but it had been decided to limit them to skilled workmen engaged in the manufacture of munitions of war. Mr. Terrell asked if "munitions of war" included electrical equipment in the field, and Mr. Baker replied that he thought the answer would be in the negative.

Fatality.—John Sterling, who was employed at the coal-cutting machine at Derryloanhead Pit, Derry, was found dead in the mine on Monday morning, having apparently been killed through coming in contact with an electric cable

Electrical Prosperity Week.—The Society for Electrical Development, U.S.A., has, as already stated, decided to hold an "Electrical Prosperity Week" during the first week in December next, and has appointed a strong Committee to conduct the preparatory campaign, Mr. H. W. Alexander having charge of the publicity work, and Mr. J. M. Wakeman being the general manager. Local agents have been appointed to handle the campaign in 50 centres, and every known device will be employed to ensure its success. It is stated that "this big movement will unquestionably be the greatest educational and sales campaign ever carried on in the history of the industry."

The scale upon which the Society is preparing for its great campaign is evidenced by the fact that £10,000 has been allocated to special expenditure for advertising purposes, in addition to a still larger outlay on other items. The money will be provided out of the regular subscriptions of the Society's members. Leading electrical manufacturers and dealers have also declared their intention of spending large sums on national publicity. The week will date from November 29th to December 4th, 1915. Advisory Committees have been appointed on general publicity, advertising, exhibitions and lectures, and on local displays, and local Committees will also be formed. It is anticipated that fully £100,000 will be spent on this, "the greatest campaign in trade history," before its close.

Copper.—Mid-monthly returns, as tabulated in Messrs. H. R. Merton's statistical circular, show an increase in European visible supplies of 315 tons. English supplies, since March 31st, show a decrease of 210 tons. From the figures relating to detailed supplies, it appears that European arrivals from North America appear to be slightly lower than for last month, though very considerably higher than the quantity for November, 1914, or February, 1915, in fact they promise to exceed the supplies for any month of the last eight, except March. Supplies from Spain and Portugal to England and France for the fortnight are at a rate of double the pre-war average, but it is probable that this rate will not be kept up, shipments from these countries always varying considerably from month to month. Chile shipments are considerably above pre-war average; Australian, however, are below. Total deliveries are not at such a high rate as last month but at a higher rate than any other month since July.

Appointment Vacant.—Switchboard attendant (30s.) for Plymouth electricity works. Particulars are given in our advertisement pages.

The Coal Supply.—Last month a deputation representing the industries which are large consumers of coal waited upon the Board of Trade, and drew attention to the abnormally high price of coal, with a view to obtaining the intervention of the Government, and, if possible, the fixing of fair prices. Up to the present but little benefit has been derived from this action, though a Committee appointed by the Board of Trade has published a report which bears out the statements made by the deputation. At a meeting of the Manchester District Institution of Gas Engineers on Tuesday last week, reported in the *Journal of Gas Lighting*, the question was discussed, and it was agreed that influence ought to be brought to bear upon members of Parliament with a view to urging the Government to take immediate action in the direction of restricting the export of coal, facilitating transport by rail, and preventing unnecessary increases in the price of coal for next year's requirements.

The meeting also recommended that a conference of gas and electrical undertakings throughout the country should be called as soon as possible.

Commenting on this subject, our contemporary laments the inaction of the Board of Trade, and regards the outlook as very serious, particularly in view of the apparent inability of the authorities to appreciate the importance of the question. The demand of the miners for a 20 per cent. war bonus increases the gravity of the situation, and the *Journal* rightly condemns the self-seeking tendency which is so manifest, at a time when every man should put his shoulder to the wheel. The attitude of the coal-owners is especially reprobated, as it is stated that they are endeavouring to make exorbitant profits, beyond all reason.

The *Journal* supports the proposal that the gas and electricity industries should join forces, and suggests that the central organisations of the two industries shouuld take immediate action towards this end.

We cordially welcome the suggestion, and trust that it may be quickly carried into effect. Recent articles in our columns have indicated the difficulties that are being met with by electricity works, and unless strong action is taken there is every likelihood that these difficulties will become more acute, very much to the detriment of the industry.

It rests with the Council of the Institution of Electrical Engineers to take the first step towards holding a National Conference, and station managers who desire relief from the present burden, and safeguards against additional burdens, ought to lose no time in pressing their views upon that body by letter and by personal representations to its members.

Electric Vehicle Committee.—The question of increasing the sales of the *Journal* was considered at the meeting held on April 15th, the Committee feeling that electricity supply undertakings might do much more in the way of utilising the *Journal* for distribution among prospective users in their districts.

It was reported that many undertakings were restricting their expenditure on publicity material during the war, owing to the regulation of the Government prohibiting further capital expenditure on ordinary mains extensions, and also limiting expenditure generally. It was resolved to point out to the undertakings that the adoption of electric vehicles did not necessarily entail any extension of the mains or plant. The supply was entirely an "off-peak" load, and undertakings on that account should, at the present time, use every endeavour to make known the advantages of electric vehicles. Undertakings are to be asked to make use of the publicity mail cards prepared by the Committee, the demand for which has been very small indeed, and confined to a very few undertakings up to the present.

Those undertakings in the Metropolitan area that charge more than 1d. per unit for electric supply to vehicles have been asked to come into line with the Committee's recommended tariff of 1d. per unit, but no satisfactory reply has been received from any undertaking to which the letter has been addressed.

It was reported that certain undertakings had found it necessary to advance prices all round owing to the increased cost of coal, &c. It was decided that where such advance in price was only of a temporary nature, the undertaking concerned should still have its name in the list in which it at present stands on the tariff sheet of the *Journal*.

As there are vehicles not fitted with the standard receptacle which come to certain stations for charging, the Committee decided to insert a paragraph in the next issue of the *Journal*, advising electric supply undertakings to do what they can to persuade the owners of such cars to have the standard receptacle fitted.

The secretary was also instructed to get into touch with the American manufacturers of electric vehicles, pointing out the necessity of fitting the standard receptacle.

Another meeting had taken place between representatives of the Tungsten Lamp Association and the E.V.C. Technical Sub-Committee regarding the standardisation of metal-filament lamps for use on electric vehicles. It was decided to adhere to the recommendation that the lamps used should be for a pressure of 12 volts, and in accordance with the requirements of the British Engineering Standards Specification No. 69.

Further progress has been made with the preparation of the report upon battery charging equipments and methods of charging, and it is hoped shortly to have it ready for issue.

The next meeting of the Committee has been fixed for May 11th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—An interesting presentation took place at Blackpool electricity works on April 15th, when a token of friendship in the shape of a kit bag was given to Mr. E. Hardman, who is leaving the staff to take up a position with a Yorkshire electrical car company. Mr. Parkinson made the presentation.

Mr. J. H. Sparrow, Southsea, has been appointed switchboard attendant at the Bermondsey electricity works. There were six applications for the post.

Mr. Francis D. Larcombe has resigned his position as control engineer for the Yorkshire Electric Power Co. after ten years' service to take up a position on the commercial organisation of the British Westinghouse Co., Manchester.

Mr. Fowles, of Erith, has been appointed chief assistant electrical engineer to Aylesbury U.D.C. There were 42 applicants.

Mr. H. M. Theaker, shift engineer of Manors Power Station, Newcastle on-Tyne Corporation Tramways, was married to Miss Maud Robinson, of Mossley, nr. Manchester, at Scouthead, Oldham, on April 14th.

Tramway Officials. — The Southampton Tramways Committee has unanimously resolved to appoint Mr. W. T. Robson, A.M.I.E.E., of South Shields, as tramways manager, at a salary of £400 per annum.

Mr. J. J. McMahon, electrical engineer in the overhead department of the Manchester Corporation tramways, who, as reported in our columns recently, was a passenger on the *Aguila*, which was torpedoed by a German submarine, reached Manchester safely last week, and was welcomed back by a small party of Councillors and tramway officials. Mr. McMahon was picked up by the ss. *Lady Plymouth*, bound for Madeira, and, when the vessel reached that port, he felt so shaken by his experience, that he decided to return at once.

General.—Mr. G. Jackson, of the technical staff of the British Insulated and Helsby Cables, Ltd., Helsby, has been presented by his colleagues with a handsome set of carvers upon the occasion of his marriage. The presentation was made by Mr. A. E. Bayles, chief of the technical staff.

Mr. John F. Skinner, Mitchelstown, has been appointed electrician at the Clonmel Lunatic Asylum.

Mr. M. Barrington Baker, A.M.I.E.E., has completed his contract for the Crown Agents in Zanzibar, and is now proceeding to Hong Kong as chief assistant engineer to the China Light and Power Co., Ltd.

Obituary.—E. J. Ljungberg.—We regret to read in the *Ironmonger* of the death which occurred on April 5th, in Stockholm, of Mr. E J. Ljungberg, managing director of Stora Kopparberg Co., of Falun, aged 73. The company with which the deceased was connected was one of the oldest and largest trading Corporations in Scandinavia. "Mr. Ljungberg thoroughly mastered the working of the various departments, both from the technical and the commercial point of view, and was responsible for many schemes and improvements for increasing the productive capacity of the company's extensive properties. He it was who first installed the plant for the manufacture of pig-iron by electricity. He was one of the ablest men his country has ever produced, and has justly been described as the 'grand old man' of Swedish industry and trade."

Mr. J. A. MacLellan.—The death occurred on April 14th, at Newton Abbot, of Mr. John Alexander MacLellan (of Messrs. Alley & MacLellan, Ltd., of Glasgow), at the age of 61 years.

The *Times* reports the death, at the age of 83 years, of Mr. H. M. Matthews, M.I.C.E., who was selected to examine and report on the lighthouses of the coast in 1878.

The death has taken place, at the age of 62 years, of Mr. Wm. Franklin, who had for many years been connected with the electrical department of Messrs. W. T. Henley's Co., Ltd., at Woolwich.

By a printer's error in our last issue, we stated that the late Mr. David Smith became secretary of the United River Plate Telephone Co. in November, 1914. This should, of course, have read 1904.

NEW COMPANIES REGISTERED.

Crombie's Patents, Ltd. (139,979).—This company was registered on April 16th, with a capital of £4,000 in £1 shares (2,000 10 per cent. non-cum. participating preferred), to acquire and turn to account a certain invention relating to improvements in apparatus and processes for the purification of liquids and the recovery of solids contained therein, to carry on the business of electricians, electrical engineers, suppliers of electric apparatus, etc., and to adopt an agreement with L. H. Raw. The subscribers (with one preference share each) are: W. C. Smith, "Montague," Durley Road, Bournemouth West, gentleman; L. H. Raw, Blomfield House, London Wall, E.C., engineer. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Solicitors: Francis & Johnson, 19, Great Winchester Street, E.C.

H. L. V. Pearn and Co., Ltd. (139,951).—This company was registered on April 14th, with a capital of £1,000 in £1 shares, to acquire from A. E. Lamkin, of 86, Springfield Road, Brighton, electrical engineer, the benefit of certain inventions, to develop and turn to account the same, to carry on the business of electricians, mechanical engineers, suppliers of electricity, etc., and to adopt an agreement with the said A. E. Lamkin, F. H. Hadow, and H. L. V. Pearn. The subscribers (with one share each) are: A. E. Lamkin, 86, Springfield Road, Brighton, electrical engineer; H. L. V. Pearn, 134, Queen's Park Road, Brighton, gentleman; F. H. Hadow, 15, Harrington Gardens, S.W., gentleman. Private company. The number of directors is not to be less than two or more than five; the first are A. E. Lamkin, H. L. V. Pearn, and F. H. Hadow (chairman). Qualification, £100. Secretary, G. O. Gilland. Registered office, 3-7, Southampton Street, Strand, W.C.

Pearson's Electric Miners' Lamp Co., Ltd. (139,974).—This company was registered on April 15th, with a capital of £5,250 in 5,000 participating pref. shares of £1,000 each and 5,000 "B" shares of 1s. each, to carry on the business of manufacfurers of and dealers in electric miners' safety lamps, accumulators, batteries, switchboards, charging boards and stands, electric light bulbs and fittings, lamps, radiators, condensers, and all other electrical appliances, etc. The subscribers (with one participating pref. share each) are: G. J. B. Porter, 2, Wardrobe Place, Doctors' Commons, E.C., solicitor; H. A. P—(?), 7, St. Kilda's Road, Stoke Newington, N., secretary; W. H. J. Welch, Namona, 349, Wanstead Park Road, Ilford, factory manager; J. Baker, 77, Lyndhurst Avenue, Streatham Hill, S.W., clerk; W. J. White, 2, Melrose Avenue, Mitcham, traveller; E. Mills, 48, Arodene Road, Brixton Hill, clerk; F. W. Godwin, 34, Madeira Road, Streatham, S.W., clerk. The first directors (to number not less than two or more than seven) are G. J. B. Porter, E. F. Hilton, B. R. Beale, G. Pearson, and L. R. Pearson. Qualification, 100 shares. Solicitors: Farrar, Porter and Co., 2, Wardrobe Place, Doctors' Commons, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Reduction Co., Ltd.—Particulars of £25,000 debentures, created February 9th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Midget Lamp Co., Ltd.—Particulars of £800 debentures, created April 8th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged, the company's property, present and future, including uncalled capital. No trustees. A memorandum of satisfaction in full on April 8th, 1915, of debenture dated December 30th, 1911, securing £100, has also been notified.

CITY NOTES.

Evered & Co., Ltd.

The directors report, after providing for debenture interest £1,390, and income tax £555, a net profit of £7,639, plus £2,116 brought forward. They recommend a dividend of 4 per cent. free of income tax (£6,830), writing off plant £1,000, and carrying forward £1,925. The death is recorded of Mr. J. D. Davenport, who had been a director since 1886. The directors regard the result of the year's trading as on the whole not unsatisfactory, bearing in mind the exceptional conditions that obtained after the outbreak of war. Up to the end of July, the course of business had been much upon the lines anticipated in the last report; and while uncertainty as to the duration and effect of the war renders it impossible to form any trustworthy estimate for the present year, shareholders will be interested to know that the company has in hand large contracts for war material, that will be a set-off against the direct and indirect losses to be expected in the company's normal trade. The company's debentures fell due for payment on April 1st, 1915, and, although not affecting the figures for the year under review, it may not be out of place to mention here that the sum of £20,600 has been renewed for five years by agreement, and the balance, £9,350, paid off. The directors have elected Mr. Edward T. Read to a seat on the board. Plant and premises have been maintained in good and efficient condition, and stocks taken at or below cost.

Annual meeting: April 28th.

Johnson & Phillips, Ltd.

The profit on trading accounts, etc., for 1914, after providing for bad and doubtful debts, and after charging to revenue more than £7,000 for maintenance of buildings, plant, etc., is £37,119, plus £12,755 brought forward. There fall to be deducted: Directors' and other remuneration, £1,862; interest on debenture stock, £6,085; debenture sinking fund reserve, £6,823; interest on second debentures, £2,500; depreciation on machinery and plant, etc., £8,158; interest on loan, £150. A dividend of 5 per cent. on the ordinary shares will absorb £8,750, leaving £15,546 to be carried forward.

Annual meeting: April 29th.

Babcock & Wilcox, Ltd.

The directors report that the net profit during the year amounts to £402,947, plus £73,835 brought forward, making £476,782. After deducting the interim dividends of 3 per cent. on the preference shares, 2½ per cent. on the second preference shares, and of 5 per cent. on the ordinary shares, amounting to £90,431, there is a balance of £386,351, from which the directors recommend that the following dividends be paid for the half-year ending December 31st, 1914, viz.:—3 per cent. on the preference shares £3,000, 2½ per cent. on the second preference shares (from both of which income tax is to be deducted) £4,459, 9 per cent. on the ordinary shares (free of income tax) £149,400, placing to the reserve fund £150,000, granting to the staff pension fund £10,000, and leaving a balance to be carried forward of £69,492. The business followed its usual course in 1914 until the war broke out. After this, the volume of new orders for stationary boilers decreased. The company has been able to manufacture some war material, required by the Government, at its Renfrew works, and having suitable buildings available at its tube works at Dumbarton, has equipped these with tools and appliances for machining shells, which are forged at the Renfrew works. Regular operation of this equipment has now commenced. The works at Renfrew have been well maintained, and plant and machinery have been added there to provide increased output of Government orders. The activity of the works and administrative organisations is unremittingly and preferentially devoted to Government requirements. About 800 of the staff and workmen have joined the Forces, and the board contributed to the maintenance of their dependents, and to the various war charities, upwards of £7,000 to the end of 1914. In common with other engineering firms, the company's output has been interrupted by strikes and other labour restrictions, and it has been hampered likewise by the scarcity of skilled men owing to so many joining the Forces. Apart from affecting the cost of Government work, these labour troubles affect the cost of the company's other contracts, particularly those entered into some time before the outbreak of war, which are now in course of being carried through.

Annual meeting: April 28th.

Anglo-Portuguese Telephone Co., Ltd.

The directors' report for the year ended December 31st, 1914, states that the assets and liabilities in Portugal have been made up at the exchange ruling on that date. Provision has, as usual, been made to safeguard the company from any serious consequences arising from fluctuations in exchange during the current year. The profit and loss account shows a gross revenue of £71,339, of which operating, management and general expenses absorbed £42,651, and royalties to the Portuguese Government £2,024, leaving a gross profit of £26,664. After providing for debenture interest £2,046 and sinking fund £1,554, the amount available for disposal, including £6,870 brought forward, is £29,934. Of this it is proposed to place £2,500 to exchange fluctuation account and to apply £10,000 to the formation of a renewals fund. In October last the directors paid an interim dividend of 3 per cent. less income tax amounting to £4,462. They now recommend the shareholders to declare a further dividend of 5 per cent., less tax, making a total distribution of 8 per cent. for the year 1914. This will absorb £7,500 and leave a balance of £5,472 to be carried forward. The directors have decided to appropriate £90,000 of the reserve fund to the reduction of the capital expenditure account. Further depreciation is adequately covered by the unappropriated reserve fund and the renewals fund. The managing director, Mr. F. W. Kerr, visited Lisbon in January for the purpose of inaugurating the company's new North Exchange, the successful opening of which was attended by representatives of the Government and local authorities and the British Minister. Mr. Gill, the company's consulting engineer, on a recent visit to Lisbon, reported that he was pleased with the condition of the North, Central, and Trunk Exchanges at Lisbon.

Annual meeting, April 23rd.

Oriental Telephone & Electric Co., Ltd.

The directors report that for the year ended December 31st last, including £43,221 brought forward, and after deducting the interim dividends paid on the preference and ordinary shares, and making the necessary provision for redemption of the debenture stock and other charges as shown in the net revenue account, the amount to be dealt with is £78,128. The directors recommend a final dividend of 3 per cent. (less income tax) for the year on the preference shares, absorbing £1,500, a final dividend of 6 per cent. (free of income tax) on the ordinary shares issued, making 10 per cent. for the year, requiring £10,759, transferring to reserve account £5,000, to staff pension fund £2,009, and carrying forward £58,869. The revenues and the number of new subscribers at the various exchanges belonging to this company have increased during the year in every instance, as is the case with the subsidiary companies. The Bombay Telephone Co., Ltd., has further increased its dividend to 16 per cent., whilst the Telephone Company of Egypt, Ltd., the Bengal Telephone Co., Ltd., and the China and Japan Telephone and Electric Co., Ltd., have paid the same dividend as last year, viz., 10 per cent., 7 per cent., and 5 per cent. respectively. To meet the cost of further large extensions and improvements, the Bengal Telephone Co. during the year has increased its capital by an additional Rs. 1,000,000 in Rs. 100 shares, of which one half were issued. This company subscribed and paid for 2,209 of these shares at par, thus raising its holding in the Bengal Co. to 7,750 shares. The new exchange premises of the company at Port Louis, Mauritius, were opened in May last. New subscribers continue to join, and a small sub-exchange has been opened at Moka. It will shortly become necessary to lay an underground cable from Port Louis to Curepipe in order to provide a thoroughly efficient trunk telephone service between these two places and other up-country exchanges.

Annual meeting, April 28th.

Potteries Electric Traction Co., Ltd.

The capital expenditure during 1914 amounted to £12,072. The revenue amounted to £129,855. The traffic receipts, which amounted to £115,083, show an increase of £5,158. After deducting all expenses chargeable to revenue, including £11,303 for debenture and other interest, there remains £35,825, as compared with £38,529 for 1913. Adding £749 brought forward, there is a balance available for distribution of £36,574. There is to be placed to reserve account £6,500, and to renewals account £10,000. A dividend at the rate of 5 per cent. per annum on the preference shares absorbs £12,250, a dividend at the rate of 2½ per cent. per annum on the ordinary shares will absorb £6,125, and there is to be carried forward £1,699. The reserve account will then stand at £29,500, and there will be a credit balance on the renewals account of £26,520.

Negotiations were commenced during the year and are proceeding with the Stoke-on-Trent Corporation, with the object of securing the postponement by the Corporation of their right to purchase certain portions of the company's undertaking in the years 1917 and 1918. The omnibus service commenced in 1914 was extended during the year to other outlying towns and villages. The receipts from the omnibuses are included under the heading of traffic receipts in the revenue account. Since the close of the period covered by this report the War Office have impressed six of the company's omnibuses, and owing to the difficulty in replacing them at the present time the services have had to be curtailed. On the outbreak of war Mr. G. F. M. Cornwallis West, the late chairman, was recalled to the Colours, and has since retired from the Board. Mr. R. J. Howley, one of the managers of the B.E.T. Co., Ltd., was elected a director and appointed chairman. Messrs. Stephen Mear and F. W. Chanter are the directors retiring by rotation, and offer themselves for re-election.

	1913.	1914.
Miles open—Route miles ..	31.68	31.73
Single line .	21.88	21.33
Double line	9.80	10.40
Passengers carried	21,610,714	21,842,310
Average receipts per passenger ..	1.22d.	1.26d.
Average working expenditure per passenger	.70d.	.77d.
Proportion of expenses to receipts .	57 p.c.	61 p.c.
Cars in stock	110	110

Clevedon, Portishead and District Electric Supply Co., Ltd.

The annual meeting was held on the 14th inst., Mr. Thomas Richards presiding. The Chairman said that they were looking forward to an increase of business in the ensuing year. The directors had recently made a contract with the Bristol Corporation for the supply of electricity in bulk, and an arrangement had already been made with the South Liberty Colliery Co., at Long Ashton, to supply them with electrical power upon mutually advantageous terms. The residents of Long Ashton being desirous of having an electric lighting supply for their village, the company hoped to arrange for this extension, as the colliery was in the immediate vicinity. It was also proposed to extend the mains for the delivery of current from this source to Portishead, with the hope of being able to arrange with the Docks Committee for the supply of electricity for power and lighting at the Portishead Docks, negotiations for which were in progress. In any case, it was desirable that the cable should be extended to Portishead from Long Ashton, because this would afford facilities for the supply of electric light to the residential suburb of Leigh Woods, and the villages of Abbot's Leigh, Pill, and Portbury, adjacent to which the cable would be laid. These contemplated extensions would require additional capital, and after consideration the directors thought that rather than issue debentures at present, as intimated in the report, it would be better to offer preference shares of £1 each, bearing interest at 6 per cent. per annum. Financial arrangements had already been made to the extent of £9,000, and it was hoped shareholders and their friends would subscribe the remaining £3,000 to make up the total of £12,000, the approximate cost of the proposed extension, the sanction of the Treasury having been received for the issue of additional capital to this extent.

Mr. Napier said in comparing the revenue of the present quarter with that of the corresponding quarter of last year, it would be seen that there was a 20 per cent. increase.

Mr. Frank Christy reviewed the progress of the company, and referred to the negotiations for the contemplated extension. With regard to the South Liberty Colliery, he felt they had made an agreement which was equitable to both sides, and they were daily expecting the confirmation of the necessary Order from the Board of Trade for the work to be begun. It was anticipated that if no delays occurred this service would be installed early in the autumn.

Windsor Electrical Installation Co., Ltd.

Sir W. Shipley presided recently at the annual meeting. After referring to the death of Mr. Riley, who had been a director for nearly twenty years, he said that the war had, of course, adversely affected the financial position of the company, both in regard to receipts and working expenses. In Windsor they had suffered more severely than many towns owing to the Government lighting restrictions and the earlier closing of licensed houses, and by the Court not taking up its residence there as usual. Up to the war they had about 3,000 additional 8-c.p. lamps either connected or waiting—which was a record for recent years—and the total connections for the remainder of the year were about 900 lamps. Their revenue did not show an appreciable decline; while there had been a large increase in cheap power units sold, the revenue from the more profitable units had considerably declined. Receipts from the sale of current showed a good increase for the first half-year, but that was more than wiped out by decreases in the latter half, notwithstanding the benefit derived from the occupation of houses by the military authorities. The higher working costs were largely due to increased cost of fuel. Wages were higher, as nearly the whole of the station staff had joined some branch of the military service, and their places had been filled by others at wages ruling considerably higher than at the outbreak of war. They might have to consider the advisability of slightly increasing the price of current. In recommending a reduced dividend they had done what many companies had been compelled to do, but taking all the facts into consideration the result might be regarded as satisfactory. Their financial position was quite sound, and the increased business that they were now getting would show in the accounts directly the Government lighting restriction was removed, so that they had cause to be hopeful that the improvement in the results would be resumed.

Mr. H. L. Prior seconded, and the report was adopted.

Musselburgh and District Electric Light and Traction Co., Ltd.

The profit for the year 1914 was £7,547, and after deducting therefrom debenture interest, amount set aside for redemption of debentures, allowance to dependents of employés on active service, and depreciation on furniture, fittings, plant and tools, there remains a balance of £2,447, plus £257 brought forward. There is to be put to reserve and renewals account —tramways £2,000, and lighting £500, leaving £204 to carry forward.

Tramway Undertaking.—There is an increase of £673 in the profit as compared with 1913, but the traffic receipts since the declaration of war were seriously affected, particularly during the holiday season. The motor omnibuses purchased in 1905, the value of which stood at £2,003, have been scrapped, and the cost charged to tramways reserve and renewals account, but the amount which the directors recommend should be transferred to this account practically counterbalances the amount taken out.

	1913.	1914.
Total revenue	£16,356	£16,604
Traffic revenue	£16,116	£16,381
Passengers carried	2,440,770	2,507,681
Car miles run	411,302	400,322
Average receipts per car mile	9.40d.	9.82d.
Average receipts per passenger	1.58d.	1.57d.
Cost of energy per car mile	1.99d.	2 01d.
Percentage of operating costs to traffic revenue ...	67.03	63 34
Percentage of operating costs to total revenue ...	66.04	62.50

Lighting Undertaking.—There is a decrease of £180 in the profit as compared with 1913. The receipts showed an increase of £235, but there was an increase in the expenditure of £425, principally under the heading of repairs and maintenance. The directors, however, are satisfied that this expenditure has been justified by the state of the plant generally at the present time, and they are advised that there should be a decrease under this heading during the current year. During 1914, Dr. Loewenfeld resigned his seat on the board, and the vacancy was filled by the appointment of Mr. R. Watson, who for some time past has been the commercial manager of the company at Musselburgh, and formerly secretary of the company.

The annual meeting was held on April 15th at 3, Laurence Pountney Hill, E.C., Mr. L. B. Schlesinger in the chair. The Chairman said that the tramway portion of the undertaking continued to show progress, but had it not been for the war that progress would have been much more marked. The traffic receipts from January 1st to the beginning of August showed an increase of nearly £700 over those for the corresponding period of 1913, but from the date war was declared there was a decrease in the receipts, and at the end of the year the actual increase had fallen to £250. Owing to the war the daily average receipts showed a decrease. Had times been normal there was every reason to believe that the increase of £700 at the beginning of August would have been increased to certainly over £1,000 by the close of the year. The receipts this year up to date showed a decrease of £700 compared with the corresponding period of 1914. That decrease was due not only to the effects of the war, but also to a strike of the company's employés, which, he was glad to say, was now ended. With regard to the electric lighting undertaking, it was satisfactory to note the increased revenue. Part of that increase was due to a temporary supply to some stores in Musselburgh owing to the breakdown of their plant. The supply was, however, still being given, and was likely to be taken for some weeks yet. There had also been a satisfactory increase in consumers for both lighting and power. Notwithstanding the increased revenue there was a decrease in the net profit of £180, due principally to expenditure on repairs and maintenance subsequent to the appointment of the new engineer. The board were advised that there should be a decrease under this heading during the current year unless something unforeseen happened. If the lighting undertaking did as well during the current year he thought they would have reason to be satisfied, owing to the increased price which they were now having to pay for coal, oil, and materials of every description. They had a contract with the Musselburgh Town Council for street lighting, but the lighting had been considerably reduced in accordance with instructions received from the military authorities, and the question of a rebate to be allowed to the Council in regard to the reduced consumption was now being discussed. Proceeding to deal with the accounts, the Chairman pointed out that in the balance sheet the cost of the omnibuses which were purchased in 1905 had been written off the reserve and renewals account. Those 'buses, he said, when originally purchased were not of the high standard of efficiency reached to-day. They were absolutely out of date and practically worthless, and it was better to get them out of the accounts. They were, however, recommending the addition of £2,000 to the reserve and renewals account to replace that item. The lighting reserve and renewals account had been charged with the cost of installing a new traction battery, which was giving satisfactory results and which would mean a considerable saving to the company. The debenture capital outstanding was now £87,500 against £88,200, £700 having been redeemed during the year. The directors had made allowances to dependents of the company's employés on active service.

Mr. W. B. Cownie seconded the motion, and the report was adopted.

Richardsons, Westgarth & Co., Ltd.—The report for 1914 states that the accounts, after providing £19,045 for maintaining buildings and fixed and loose plant, show a profit of £66,170. The results are very satisfactory, considering the difficulties encountered, and the fact that no assistance has been obtained from Government work during the period. The contracts booked before the war for delivery in 1915 are on the moderate basis of profit then prevailing, and most of them have had to be suspended owing to the cessation of mercantile work in the shipyards. This will result in accumulated interest charges, while the contracts during ultimate completion will have to bear increased working charges, as well as the war bonus of 4s. per week on wages, thus rendering the present position one of considerable uncertainty.

Direct United States Cable Co., Ltd.—The directors' report for the year ended March 31st, 1915, states that the reserve fund account shows a balance of £476,986, as compared with £451,491, an increase of £25,495. This is due to the cost of cable repairs having been exceptionally small during the past year, and while the directors are pleased to report that the cables are now in good working order, they believe, in view of past experience, it is in the best interests of the company to continue the policy of building up the reserve fund to such a figure as will provide for any contingency. Three quarterly interim dividends of 2s. each per share (less income-tax), amounting to £33,643, have been declared and paid during the year, and a final dividend of 2s. per share (less tax) is now proposed, making a total distribution of 4 per cent. for the year.

Annual meeting: April 27th.

Calcutta Tramways Co., Ltd.—The report for 1914 states that the revenue, including interest on investments and deposits, amounts to £109,035, plus £8,405 brought forward. A final dividend of 6s. 6d. per share, making 9½ per cent. for the year, is recommended, transferring to reserve for depreciation, &c., £15,000; to staff provident fund, £1,258; and carrying forward £7,566. In view of the exceptional taxation rendered necessary by the war, income-tax will in future be deducted from all dividends paid.

Potteries Electric Traction Co., Ltd.—For 1914 the revenue amounted to £129,855. The traffic receipts at £115,082 show an increase of £5,157. After deducting all expenses chargeable to revenue, including £11,303 for debenture and other interest, there remains £36,824, as compared with £38,528. The directors recommend placing to reserve account £6,500, to renewals account £10,000, a dividend at the rate of 2½ per cent. per annum on the ordinary shares, carrying forward £1,699.

Anglo-American Telegraph Co., Ltd.—Interim dividends for the quarter ended March 31st, 1915, 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax at 2s. 1d. in the £, payable on May 1st.

Montreal Light, Heat and Power Co., Ltd.—The directors have declared a dividend of 2½ per cent., being at the rate of 10 per cent. per annum, for the quarter ending April 30th.

Kaministiquia Power Co., Ltd.—The directors have declared a dividend of 1½ per cent., or at the rate of 6 per cent. per annum, on the Common stock, for the quarter ending April 30th.

STOCKS AND SHARES.

Tuesday Evening.

Taken as a whole, the main feature of Stock Exchange markets during the past week has been one of steady improvement and better prices. To this it cannot be said that the news from the various fronts has contributed in any great measure. Mystery overhangs the various operations, and the man in the street chafes against the absence of information as much as he is annoyed, rather than perturbed, by the various rumours afloat.

Important relief to the financial situation has been afforded by further sensational rises in American Railroad shares. At first blush, there may seem to be no connection between these and such securities as electrical supply shares, for instance. Briefly put, however, the position is that the rises in Americans have led to large sales of the shares by English holders, who have received the money and want to invest it in domestic issues. At the same time, the exchange between the two countries is assisted by the share-purchases of the United States, which help to offset the supplies ordered in this country from Brother Jonathan in connection with the war. This latter consideration, affecting, as it does, the rate of exchange, is of value to all those who have commercial transactions with the States. The recovery in the price of copper has stimulated business in copper shares, and the rubber market, after a slight set-back, has made another forward movement on a small quotable scale, but accompanied by a substantial amount of support.

Mexican matters, too, are much less gloomy than they were—at least so far as the financial aspect of them is concerned. Lay readers of the news may be inclined to wonder where the beneficial change in the situation has occurred; but, whatever its cause, the fact remains that practically all securities connected with Mexico have advanced during the past few days. Mexico Tramways bonds of both classes are 5 points higher, and the Firsts are 10 up since the suggestion was thrown out here to the speculator that this particular security offered tempting scope for his peculiar talent. Mexican Light and Power Common are firmer at 20½, the preferred at 42, and the bonds stand about 46 and 29 for Firsts and Seconds respectively.

Canadian Industrials also are having their turn of better markets. Large orders for British munitions of war have been placed with some of the Canadian undertakings; and Stock Exchange expectation, at any rate, looks hopefully for a wide distribution of the orders already secured and to come. (Incidentally, it may be interpolated that the Edison & Swan Co. is said to be making a new kind of small projectile for use by the British Army.) Canadian General Electric Common shares have strengthened to 91, a gain of several points on the week, and the 7 per cent. preferred rose to 107. A little business is being done in British Columbia Electric Railway issues.

With Mexican and Canadian affairs shaping more cheerily, it is meet that the Brazilian companies should also be advancing in public favour. The dramatic rises which have occurred in Brazil Tractions since Easter were not repeated; but the market is a hard one, and as there were a great many selling orders at 60, the mere touching of this price enabled a good number of them to be executed, leaving the way clear for further advance when the buyers return to the attack. Maybe it is not altogether outside the scope of our province to add that the market for nitrate shares has developed more strength than it has exhibited since the war started, this in its turn producing improvements in Chilean Government and commercial bonds and shares.

The Home Railway market declines to be left behind in the quiet confidence which is acting as a stimulus to securities. investment and speculative alike. Some there are who regard the Government's concession to the railways as likely to turn out of no great value, but that the investing public as a whole do not share this pessimism is shown by the way in which prices of Home Railway stocks are quietly mounting. In this advance Metropolitans have shared to the extent of a point, and Districts are ¼ better; though, on the other hand, there are no changes worth mentioning in Central London or Underground Electric Railways descriptions.

The Telegraph market is good all round. Indo-Europeans went up 4 points to 55. The sellers who had been worrying the market for some little time, pressing shares with a persistence worthy of a better cause, succeeded in getting rid of them; and as soon as these orders were finished, a sharp rebound took place. The Company's repetition of its previous dividend—making £3 5s. for the year—aided the rally. Great Northern Telegraphs are £1 higher at 30, and the company has achieved the noteworthy performance of being able to increase its dividend from 20 to 22 per cent. Anglo-American Telegraph preferred and deferred are both substantially better, declaration of the usual quarterly dividends on the first-named and of 15s. on the ordinary stock having brought in further buyers. Eastern Telegraph rose a point. Western shares went up 5s., and an improvement of 1s. or so in West India and Panama advanced the price of the shares to 26s. 3d. Globe preference hardened to 12¼, so that the yield on these shares is now reduced below 5 per cent. It is not a little surprising that, in the midst of a European war, securities such as those afforded by the telegraph industry should be maintained at prices that yield on the pre-ordinary classes something under 5 per cent. in the case of a good many.

County of London preference again rose ⅛, while City preference fell ¼ to 12¼, and Metropolitan debenture executed one of its five-point movements, this time in a retrograde direction, the price falling to 75. The Manufacturing group is a little easier, the principal feature being weakness in Edison and Swan shares. The fully-paid are 7s. 6d. lower at 35s., and the partly-paid fell a florin to 12s. 6d. British Westinghouse preference are also a trifle down.

Babcock & Wilcox show reduced profits, which have led to the dividend being lowered to 14 per cent., against 16 per cent. a year ago. The price of the shares at 52s. shows comparatively little change, and the report will re-assure holders of Babcock shares that they need have no fear as to the soundness of their investment. The Vickers report is also out, and the price of the shares hardened a trifle to 37s. 3d. Armstrongs are expected to declare their dividend any day now; some expect 12½ per cent., the same as a year ago; others think the company will increase the distribution to 15 per cent.

Rubber shares have benefited from the expectation that there will be an early rise—to 2s. 6d. at least—in the price of the product; while the December reports now making their appearance show that some of the companies, at any rate, have a good chance of lowering their costs to the neighbourhood of 8d. per lb. The economist will doubtless point to the improbability of an article capable of being placed on the market at 8d. a lb. selling, under normal conditions, at anything like three and a half times that figure; so that those who look ahead have some reason for their faith that rubber will come down eventually. To the strength of the copper market reference has been made already, and most of the leading copper shares have responded to the week's advance in the price of the metal.

Regret and sorrow have been expressed in the Stock Exchange at the sad death of Baron Reuter. Many House firms used to subscribe to a special service of the Agency, and men with the latest "Reuter" were always centres of much attention in exciting times. The price of Reuter's £10 ordinary shares is nominally about 5, but they seldom change hands nowadays.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend, 1914.	April 20, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	8¼	—	£6 1 8
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4½	—	5 11 1
do. do. do. 4½ Pref. ..	4½	4⅛	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	14½	—	6 4 2
do. do. 6 per cent. Pref. ..	6	12¼	— ¼	4 18 0
do. do. 5 Deb.	5	112	—	4 9 3
do. do. 4½ Deb.	4½	98	—	4 11 10
County of London	7	11⅜ xd	—	6 3 1
do. do. 6 per cent. Pref. ..	6	11½	+ ⅛	5 4 6
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	97	—	4 12 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1¾	—	6 18 0
do. do. 6 per cent. Pref. ..	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	3½	3	—	5 16 8
do. 4½ per cent. Pref. ..	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	75	— 5	4 13 4
St. James' and Pall Mall	10	8	—	6 5 0
do. do. do. 7 per cent. Pref.	7	6⅝	—	5 9 10
do. do. do. 3½ Deb.	3½	80	—	4 7 6
South London	5	8	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7½	—	6 0 0
do. 4½ Pref.	4½	4⅞	—	4 12 4

TELEGRAPHS AND TELEPHONES.

	Dividend, 1914.	April 20, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	106	+1¾	5 13 0
do. Def.	1½	23	+1	6 10 4
Chile Telephone	8	6⅝	—	6 0 9
Cuba Sub. Ord.	5½	8¾	—	6 5 9
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	13	—	5 7 8
do. 4 Deb.	4	92	—	4 7 0
Eastern Tel. Ord...	7	135	+1	5 3 6
do. 3½ Pref.	3½	73½	—	4 15 3
do. 4 Deb.	4	[illegible]	—	4 7 0
Globe Tel. and T. Ord.	6	11½	—	5 4 4
do. Pref.	6	12¼	+ ¼	4 17 9
Gt. Northern Tel.	22	30	+1	7 6 [illegible]
Indo-European	65/-	55	+4	6 0 0
Marconi	20	1⅞	—	10 13 4
New York Tel. 4½..	4½	99½	+ ½	4 10 3
Oriental Telephone Ord.	10	2	—	6 0 0
do. Pref.	6	1 3/16	—	5 1 1
Tel. Egypt Deb.	4½	88½	—	5 1 8
United R. Plate Tel.	8	6¼	—	6 8 0
do. Pref.	5	5	—	5 0 0
West India and Pan.	1¼	1 5/16	+ 1/16	5 0 0
Western Telegraph	7	13⅝	+ ¼	5 2 8
do. 4 Deb.	4	93	—	4 6 0

HOME RAILS.

	Dividend, 1914.	April 20, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented ..	4	77	—	5 4 0
Metropolitan	1¼	30½	+1	4 2 0
do. District	Nil	17½	+ ¼	Nil
Underground Electric Ordinary ..	Nil	1 13/16	—	Nil
do. do. "A"	Nil	5/6	—	Nil
do. do. Income ..	6	81	— ½	7 8 3

FOREIGN TRAMS, &c.

	Dividend, 1914.	April 20, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref. ..	5½	4½	—	6 9 5
do. 2nd Pref.	5½	3⅞	—	7 2 0
do. 4 Deb.	4	83½	— ½	4 15 9
do. 4½ Deb.	4½	90	—	5 0 0
do. 5 Deb.	5	89	—	5 12 4
Brazil Tractions	6	59	—	10 3 4
Bombay Electric Pref.	6	10⅝	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	80	—	Nil
do. 5 per cent. Bonds ..	Nil	65	+5	Nil
do. 6 per cent. Bonds ..	Nil	85	+5	Nil
Adelaide Sup. 6 per cent. Pref. ..	6	5¼	—	5 14 3
do. 5 Deb.	5	103	—	4 17 1

MANUFACTURING COMPANIES.

	Dividend, 1914.	April 20, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	52/-	—	5 7 8
British Westinghouse Pref.	7½	1 15/16	— 1/16	7 15 0
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	99	—	6 1 3
Callenders	15	19	—	8 6 8
do. 5 Pref...	5	4⅞	—	5 2 7
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	8 3/16	—	4 14 1
Edison & Swan, £3 pd.	Nil	12/6	— 2/-	Nil
do. do. fully paid	Nil	1¾	— ⅜	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	5	13/6	—	7 5 6
do do. Pref. .. .	7	1	—	7 0 6
Gen. Elec. Pref.	6	10	—	6 0 0
Henleys	20	14½	—	6 18 0
do. 4½ Pref.	4½	4⅞	—	4 12 4
do. 4½ Deb.	4½	97	—	4 13 9
India-Rubber	5	9⅛	—	5 9 7
Telegraph Con.	20	87	—	5 8 6

Shropshire, Worcestershire and Staffordshire Electric Power Co.—At an extraordinary general meeting to be held on May 3rd, resolutions are to be submitted for the following purposes, says the *Financial Times* —

(1) Dividing each of the existing £5 shares into shares of £1 each, so that the share capital will consist of 900 000 ordinary shares of £1 each, of which 300 000 shares have been issued and fully-paid up; (2) converting 150,000 unissued ordinary shares of £1 each into 150,000 preference shares of £1 each, entitled to a cumulative dividend of 6 per cent, and to priority for capital without further participation; and (3) authorising the borrowing on mortgage of an amount not exceeding £100,000.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MARCH, 1915.

The returns of electrical export and import business for March show a satisfactory state of affairs from the British manufacturers' point of view.

Thus the exports for the month reached a total value of £391 850, as compared with £256,519 in the previous month, and £364 562 in January.

The imports of electrical material, on the other hand, have gradually fallen off since January, the March total being £203,759, as against £217,500 in the previous month. The re-exports dropped from £23 216 in February to only £8,297 in the month under review.

As regards exports from this country, the improvement in value seems to have been general, but the telegraphic and machinery sections in particular show considerable increases, the lamp sections remaining practically stationary, and carbon exports showing a decline.

Machinery and lamp imports showed a considerable falling off, while cable and telegraphic imports were higher. Imports of electrical material from the United States have been steadily falling off since January, and only reached £129,381 in value in the month under review. Dutch imports—principally lamps—remained at a high level, and French, Italian, and particularly Swiss imports, increased considerably in value in March.

The most prominent purchasers of electrical material from this country were Japan, India, New South Wales and France.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephone cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,196	3,625	47	153	285	1,362	4,445	22	194	32	658	3,636	15,645
Germany	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies ...	486	2,384	883	11	12	28	224	100	168	...	153	345	4,794
Belgium	20	...	...	...	...	...	...	...	...	...	...	...	20
France	1,217	800	1,863	175	36	24	1,668	1,066	846	69	9 629	17.298	34,691
Portugal	203	1,260	71	105	...	651	537	1	...	...	181	1.721	4,740
Spain, Canary Isles and Spanish N Africa...	187	176	269	16	...	...	576	23	18	...	1	425	1,694
Switzerland, Italy and Austria-Hungary ...	1,182	...	120	...	32	2,278	833	480	18	68	4,161	...	9,172
Greece, Roumania, Turkey and Bulgaria ...	4,112	...	26	27	...	...	...	...	15	...	...	10 175	14,355
Channel Isles, Gibraltar, Malta and Cyprus...	137	119	661	146	...	199	193	...	...	...	...	88	1,543
U.S.A., Philippines and Cuba	892	...	37	...	...	124	1,002	...	18	...	...	210	2,283
Canada and Newfoundland	505	16	597	1,399	...	166	1,910	16	958	...	...	35	5.605
British West Indies and British Guiana ...	19	...	256	91	...	...	745	...	343	...	541	1,297	3,292
Mexico and Central America	44	19	105	79	...	...	27	30	13	...	77	21,000	21,394
Chile	329	1,154	8	357	...	...	500	16	30	...	...	32	2,417
Brazil	42	605	1,168	447	10	163	1,166	38	116	...	...	...	3,755
Peru and Uruguay	...	400	...	40	...	...	37	...	...	...	...	5,005	5,482
Argentina	229	2.754	472	251	...	906	4,33	7,003	904	...	1,842	37	18,733
Colombia, Venezuela, Ecuador and Bolivia...	11	65	3	266	...	...	32	433	...	...	...	589	1,399
Egypt, Tunis and Morocco	387	539	97	61	...	197	1 2986	9	133	...	196	748	3,663
British West Africa	73	3,631	2	61	...	...	201 6	15	178	...	161	489	6,626
Rhodesia, O.R.C. and Transvaal	215	1,005	272	552	115	52	62 9	...	63	...	6	...	2,963
Cape of Good Hope	292	654	847	313	86	261	2 2 5	4,668	380	33	851	3.297	13.931
Natal	468	3,367	244	320	86	28	2 009	141	78	70	54	55	6,920
Zanzibar, Brit. E. Africa, Mauritius & Aden	133	30	40	95	19	...	...	...	12	...	7	253	589
Azores, Madeira and Portuguese Africa ...	88	81	105	67	...	49	873	...	515	...	50	100	1,928
French African Colonies and Madagascar...	...	...	...	...	...	...	31	...	...	...	...	...	31
Persia	412	577	1,825	...	55	...	11,526	139	17	...	74	20	13 645
China and Siam	961	1,338	2,353	136	...	349	946	37	486	14	1,256	528	8.404
Japan and Korea	532	...	243	94	...	423	10.072	95	616	26	27	29,419	41,547
India	3,606	6,792	4,649	2,250	65	2,553	13 369	2,743	2,261	206	2,407	59	40,960
Ceylon	198	69	211	...	...	22	587	64	1,066	36	...	557	2,810
Straits Settlements, Fed. Malay States and Sarawak	983	199	941	132	...	570	4.094	51	386	67	15	544	7,982
Hong Kong	494	413	534	13	...	...	1,104	10	12	69	...	...	2,649
West Australia	...	567	239	190	...	1,085	1,822	14	401	...	...	173	4,491
South Australia	168	430	644	56	11	553	2.652	105	31	...	831	383	5.864
Victoria	886	6.154	1,077	712	12	1,083	9.564	947	1,009	71	836	183	22 533
New South Wales	376	8 467	1,682	873	68	1,162	10 237	4,029	9,967	23	1,034	465	38.383
Queensland	146	443	88	145	...	94	1,031	299	45	...	230	239	2,960
Tasmania	...	482	30	97	...	...	112	...	...	...	...	...	721
New Zealand and Fiji Islands	757	675	1,197	878	...	532	3.104	646	459	...	807	1.066	10,121
Total, £	21 986	49.290	23,893	10,608	892	14,914	97,562	23,217	22,056	784	26,147	100,471	391,850

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephone cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	133	...	231	11	2,089	...	8,458	546	1,021	1,934	2,458		16,881
Germany	...	...	...	...	...	...	...	...	...	...	...		...
Holland...	265	...	...	11,394	525	...	478	...	753	...	23		13,438
Belgium	...	...	...	...	...	...	...	...	...	...	...		...
France	220	320	630	335	138	205	548	60	4,906	1,803	258		9 423
Switzerland	913	270	81	347	266	1,560	19,014	...	...	1,306	...		23 787
Italy	80	8,664	...	...	98	...	116	...	...	114	...		9,072
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...		...
United States	6,098	2,977	1 030	1,048	1.313	208	32,259	73,598	6.831	1,929	2 090		129 381
Total, £	7,739	12.231	1,972	13,135	4.429	1.973	60,873	74,204	13,511	7,086	4,829		201.982

Additional imports.—Spain, glow lamps, £16 ; carbons, £851 ; Canada, glow lamps, £20 ; arc lamps, £253 ; meters, £50 ; goods, £40 ; machinery, £547.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephone cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above... ...	1,795	62	...	520	...	873	1.873	...	60	232	2,882		8,297

Total Exports: £391,850 Total Re-Exports: £8,297 Total Imports: £203,759

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

REVIEWS.

American Electricians' Handbook: a Reference Book for Practical Electrical Workers. Compiled by **Terrell Croft.** London: Hill Publishing Co. Price 12s. 6d. net.

The handbook now before us is of what is known as "pocket size," though few will be found to carry such books with them as a habit. It can be put into the pocket when it is desired to take the book on to a job, and we suppose that must be the meaning of the expression.

It consists of six sections, running into 709 pages, of which 19 double-column pages are devoted to the index. This is a good feature, as a complete index is one of the most important parts of a work of reference, such as this book announces itself to be. There are 792 illustrations.

The first section deals with fundamentals, and it is possible that this part of the book is unnecessarily elaborate. Our readers will acquit us of any tendency to belittle the importance of theoretical knowledge to the practical electrical worker for whom the book is designed, but the exposition of somewhat strained hydraulic analogies is of very little value. The inclusion of 36 pages on the properties and splicing of conductors under "fundamentals" is surely an example of extreme latitude as to the meaning of the word.

Some of the definitions given in this section of the book do not fit in with what, in our time, was generally taught in English technical colleges. One example will suffice. Resistivity is the resistance of a centimetre cube of a metal, and is the same as specific resistance. Mr. Croft says that the resistance of a circular mil-foot is often called the resistivity. We do not think it advisable that authors should give meanings of their own to words already in use, although Humpty Dumpty did so in "Alice in Wonderland."

The spelling of "coulomb" as "columb" throughout is probably due to the author's patriotism.

The second section deals with generators and motors, and will be of considerable use to practical men engaged in the installation or repair of this class of machinery.

The third section discusses outside distribution, and the fourth, interior wiring. As in most American books, considerable space is devoted to overhead construction and pole lines, and many useful tables, illustrations and details are given of the apparatus and accessories required in this work. Underground mains also receive a fair share of attention, and it will be found that all the more generally used systems are discussed. In the interior wiring section we are given a list of the standard symbols adopted by the National Contractors' Association and the American Institute of Architects. These seem very useful, and are calculated to save time and to render diagrams and plans more easily understood. We think some such system of conventional signs might well be adopted in this country.

We do not find any consideration of the earthing of metal conduit. It would be well if, in a future edition, instructions were given as to how to make the conduit electrically continuous, and how to earth it, with reasons why, in certain cases, this course is advisable. The suggestion as to an emergency or burglar circuit on page 518 is interesting, being seldom if ever met with here.

Reference is made on page 537 to bell-ringing transformers, and the author says: "A bell-ringing transformer meter, a good one, will last for ever." We are not quite sure what is meant by this. So far as we know there is only one alternating-current meter which combines a transformer for bells with its normal functions. This is of a Continental type, and when introduced into Great Britain did not seem to fill any felt want. Further, it is scarcely in the hands of the consumer or his contractor to choose what meter shall be put in. That is the business of the supply authority.

Transformers are dealt with in Sec. 5, and persons dealing with such apparatus will find much assistance from it. We may remark, in passing, that in fig. 48, page 631, a *sash*-pot is shown. This should presumably be *dash*-pot. As in the earlier section on outside distribution, much attention is given to overhead work and the fixing of transformers on poles.

The sixth and last section deals with illumination, but tells us nothing new. We are rather glad to see that the system of indirect lighting is not laboured so much as has been the tendency in recent years. A little diffusion is very pleasant, but too much of it is very trying.

The compilation of such a handbook is a matter of considerable labour, and, on the whole, the author has performed it well.

American Handbook for Electrical Engineers. By **Harold Pender**, Editor-in-Chief. London: Chapman & Hall, Ltd. Price 21s. net.

A handbook is presumably a cross between a pocket-book and an encyclopædia. At any rate, such is the impression one naturally receives at a first glance through the present work. It contains more than 2,000 pages of closely-printed matter, and, as a reference book for practising engineers and students of engineering, exceeds, with regard to quantity of material, anything we have hitherto come across. Its editor-in-chief is Professor of Electrical Engineering at the University of Pennsylvania, and he has had associated with him 26 assistant and associate editors, all experts in the various branches of which they treat. Nor does the book confine itself to electrical engineering only, for it includes a great mass of data on those mechanical and civil details which are in any way related to the electrical, and with which up-to-date electrical engineers would be expected to keep in touch.

The work, in addition to being remarkable for the great quantity of matter it contains, has several novel features incorporated with it. As the book is primarily intended for the practising engineer, all theoretical discussions have been segregated into separate articles, and only sufficient theory is given in subjects dealing with practical matters to render the context plain. Numerous mathematical tables and relations are given, among which may be mentioned articles on logarithms, trigonometric functions, hyperbolic functions, exponential functions, derivatives, integrals, indeterminate forms and equations. The matter is arranged in encyclopædic fashion; that is, the articles are taken in alphabetical order, an arrangement which appears to us eminently reasonable in consideration of the vast quantity of data presented. One plan of treatment has been followed wherever possible, the method especially applying to articles dealing with apparatus and machinery, as follows:—(*a*) General description and definitions; (*b*) brief statement of application; (*c*) principle of operation; (*d*) design; (*e*) testing; (*f*) performance; (*g*) specifications; (*h*) installation; (*i*) operation; (*j*) dimensions, weights and costs; (*k*) bibliography.

Cost data have received much attention, and the editor very justly points out in this connection that students and recent technical graduates are sadly lacking in even the roughest idea of the price of apparatus and structures; it is chiefly to supply a rough idea of such costs that the cost curves and figures are given wherever possible. For it is the hope of those who have compiled the volume that teachers in technical schools may find many of the articles suitable as bases for courses of lectures. We are inclined to think that this desire has been successfully achieved, more especially in the electrical than in the mechanical and civil departments, and that teachers will find the book of great help in preparing lessons which will contain the gist of the matter under consideration uninvolved by cloying masses of by-products. The bibliography at the end of each article is also very useful, but it is only intended to direct the reader to more extended information in treatises and current periodicals and does not make any pretence to completeness.

The preparation of the volume has occupied approximately three years, and none of the plates were cast until the summer of 1914. Before casting, all the galleys were revised, and in some instances large sections of the articles were re-written.

Such a work, involving as it does a tremendous amount of labour and care, it were almost invidious to criticise. The perfect condensing down of subjects interconnected like those of engineering, so that nothing essential is omitted and nothing superfluous admitted, is a task at which the superman might very reasonably quail. And it is going far to say that this condensing down has been generally done, in the present case, with method and acumen.

The brevities of the pocket-book and the verbosities of the text-book have both been evaded, and the result is something that has real and lasting value. Perhaps under the title of Electron Theory a little more might have been given, as this particular subject appears to us, especially in view of its comparative newness and its undoubted importance for the future, to have been unduly condensed. Likewise, under the headings Steam and Thermodynamics, a little fuller explanation might have been supplied regarding entropy and its applications and the entropy chart in general, and perhaps a few typical problems might have been briefly worked out. But these are details which detract little from the value of the work as a whole. The handbook is well worth its price, though the purchaser, of course, has to remember that it is written from the American point of view and agreeable to the practice of that country.—W. J. C.

Laboratory Course in Electrochemistry. By Oliver P. Watts. 1914. London: Hill Publishing Co. Price 4s. 2d. net.

This small volume of practical methods of electrochemistry forms a very useful addition to the ever-increasing bulk of this branch of Science. It is intended for students who have access to an up-to-date laboratory equipment, and for use as a supplement to explanatory text-books. The author opens with a short preface, in which he states that the manual has been designed primarily for his classes in the University of Wisconsin, but he hopes that it will also be of use elsewhere. The introduction contains a short account of the necessary laboratory equipment, based on the apparatus at the disposal of the author. This description, although interesting, is too brief to be of great utility. Many useful hints are contained in this section of the book, but its undoubted value is impaired by lack of detail. The author then continues with the usual stock instructions to students, which are admittedly beneficial when carried out.

The experimental part of the book is introduced after this point. This section constitutes the chief feature of the manual, and contains 133 selected experiments. Each one is clearly and simply described, but no explanation of the expected result is given, although apposite questions are asked to test the student's comprehension of his subject. It is clear, therefore, that this manual is intended chiefly for students working under tuition, its main object being to induce a careful analysis of the results.

The first experiments illustrate the phenomena accompanying the electrolysis of aqueous solutions, which naturally include the resistivity of electrolytes and errors due to polarisation. Faraday's law is clearly elucidated, and is followed by a demonstration of the use of coulombmeters.

The next pages are devoted to the measurement of electromotive force, and in this section the author describes a very simple and cheap form of potentiometer, which is well worth copying. Experiments illustrating the phenomena of over-voltage and passivity are included here.

The corrosion of metals is next dealt with, preceding a description of the separation of metals from alloys and complex solutions. There is also a very brief account of electrochemical methods of analysis, but this is intentionally incomplete.

A considerable section of the book is devoted to electroplating, and the electrodeposition of pure metals and alloys. There are also numerous recipes for the colouring of metals. These are without doubt of great interest, but scarcely come within the scope of a manual devoted to electrochemistry.

The concluding experiments describe the preparation of a few inorganic compounds. The book closes with an appendix of tables and an index. The experiments are copiously illustrated with diagrams and curves. The treatment is simple but clear throughout, and the book undoubtedly forms a very useful addition to our electrochemical literature, and may be recommended with confidence to all students desiring a general knowledge of practical electrochemistry.

MAIN-LINE SIGNALLING ON RAILWAYS.

By W. C. ACFIELD.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, March* 31*st*, 1915.)

(*Concluded from page* 567.)

Semi-automatic signalling.—This term denotes a manual system of control in combination with an automatic signalling system, by which signals placed beyond the limits of ordinary working are controlled partly from a signal-box and partly by track-circuited lines. It is used for splitting up long block sections, the control from the signal-box enabling the customary "normal danger" system to be maintained on steam-operated railways. The portion of the line between the starting or advance signals of the rear and the home signal of the advance sections is divided up, and the semi-automatic stop and distant signals are placed in the most suitable positions to suit the gradients. There are two ways of dealing with the problem, viz.:—

(a) By making the semi-automatic signal act as an advance signal to the rear section, in which case ordinary block working is maintained.

(b) By making the semi-automatic signal act as an outer home signal to the advance section (see fig. 4), in which case the ordinary block system between the rear and advance signal-boxes is dispensed with and the traffic is worked by bell code-signals.

The latter system has certain advantages over the former, inasmuch as a train entering the semi-automatic area is more under control of the advance signalman, because, in the case of a train over-running signals, the advance signalman has the opportunity of stopping the train by placing detonators on the line in cases of emergency. Moreover, a bell code is more convenient than a block system. In either system the track circuits are divided up, and in order to comply with the standard clearance regulation the usual overlap of a quarter of a mile is provided to all signals in the semi-automatic area, the signals being replaced to danger upon the train leaving a track-circuited section.

It is not advisable to work semi-automatic signals a long distance from signal-boxes on account of the difficulty in regulating wires affected by temperature variations; the signals are therefore worked by motors, controlled by switches on the levers in the signal-boxes.

Fig. 5 shows the form of track indicators for semi-automatic signalling, as used on the Midland Railway. In semi-automatic signals such as those described, a difficulty must arise in foggy weather in getting fog-men to the distant signals, and in order to safeguard against such conditions instructions are issued that semi-automatic signals must not be relied upon, but means are not generally used to enforce the instructions. The case can, however, be met, with small extra expense, by providing what is termed a fog lever in the signal-box in advance, which upon being pulled over links up the various track-circuited sections as one long section and renders it compulsory for the signalman to lower the semi-automatic signals before the starting signal in the rear can be lowered for a train to leave that section.

The term semi-automatic is also applied to signals of automatic-signalling installations where there are crossover roads or connections with sidings worked manually or by power from a signal-box; but so long as the points are not used the signals continue to be operated by the passing of trains over the track-circuited lines.

This arrangement is very flexible in working and can be adapted to manual interlocking frames of the ordinary pattern, the points being operated by rodding as usual and the signals electrically, the signal lever when reversed closing a contact in the signal circuit. The signal circuits are so arranged that when it is unnecessary to operate the points, the signal levers may be and are generally left in the reverse position; the signal control is then governed solely by the track-circuited lines to which the signals apply and become entirely automatic, thus enabling block or lock-and-block instruments to be dispensed with. This has the merit of enabling existing signal-boxes and locking frames to be retained, where necessity arises, when installing automatic signalling on steam or electrified lines, and very considerably reduces the cost of installation as against "scrapping" existing locking frames and providing power frames working points. It thus places the reconstruction of signalling systems within reasonable reach of railway companies at a comparatively lower cost.

Automatic signalling.—The object to be attained by the use of automatic signals, unlike that of manual block signals, is to compel a signal being put to danger behind each train on a double line of railway, and cause it to remain in that position until the train has gone a certain distance beyond that signal. In the case of single lines the same object is attained with the addition that at all times a signal governing movements in the direction opposite to that in which the train is moving must be displayed in the danger position some distance ahead of the train.

Automatic signalling is an admirable substitute for the block system, the signal movements being governed by electric or pneumatic agency, controlled by the passage of a train into, through, and out of the block section to which the signals apply; this is effected by the action of the train alone operating the track-circuited sections of the lines controlling such signals, the ideal arrangement of automatic signals being such as to secure the maximum capacity for train movements over a given length of line, bearing in mind the effect of gradients and curves on the traffic. Two systems of automatic signalling are used, viz. :—

(a) Normally danger.
(b) Normally clear.

The normally danger system, in which the signal stands continually at danger except when trains are required to pass along the line, agrees with the normal position of a mechanical or manual system, and complies with the standard practice of the block regulations as laid down for traffic working. After being placed to danger by the train entering the section, the signals remain in that position until they require lowering for the following train, this being done by the approaching train lowering the signals if the section ahead is not occupied for traffic in the same direction. This system necessitates greater complications in the electrical connections, as the track circuits have to be so arranged as to lower the signals in addition to replacing them to danger.

In normally clear systems the entering of a train into the track-circuited section places the signal in the rear to danger, and the clearing of the block section, by the passage of the rear wheels of the train out of it, resets that signal to the clear position, ready for a following train in the same direction to approach. Those in favour of this system contend that the electrical connections are fewer and more simple, and from a maintenance point of view less costly. There is much to be said in favour of the normally clear system, because, after all, automatic signals differ considerably from mechanical or manual systems, as they simply indicate to drivers that the section or sections ahead are clear and are an indication of the condition of the line ahead.

In all automatic-signalling installations there is the risk of trains being unduly delayed at signals in the event of failure of the apparatus, in which case the signal would remain at danger. To provide against such a contingency it is customary to allow drivers to pass the signal in the danger position after coming to a stand and waiting a prescribed time, as laid down in the rules and regulations of working. After starting again the driver is allowed to proceed cautiously, being prepared to stop at or before reaching the next signal. If the next signal is at clear he may proceed at regular speed until reaching the next signal at danger.

Fig. 6 shows an arrangement of automatic signals for one road on a double line of railway. Single lines of railway can be worked by means of automatic signalling instead of by train staff or tablet systems, but up to the present the author is not aware that such an arrangement is in use in this country.

Overlaps.—These consist of an extension of a track circuit from 100 to 440 yards ahead of a signal, such track circuit and its extension, when occupied, securing the signal in the rear at danger.

Overlaps are used to guarantee that a space is provided between one train, standing at or passing a signal, and another train in the rear—instead of relying on the thickness of a signal post to give protection—and comply with the regulation that a second train must not be allowed to approach the rear signal until the preceding train has passed at least a quarter of a mile beyond the governing signal. Thus the track circuit between two signals extends ahead of the signal, from 100 yards to 440 yards, the length being regulated to suit the gradients, speeds, and curves of the railways, whether steam or electrified working is in operation.

Power signalling.—This is a means of operating an interlocking system of points and signals by some form of power other than manual, in which levers for moving points or signals by levers, rods, and wires, are supplanted by levers or slides which close or open valves or electric circuits. The levers or slides are small and are placed close together, so that the length of locking frames and signal-boxes is at once reduced, and they can be placed in confined places, without disturbing the lay-out of the roads in large stations or yards.

There are many advantages in power-working as against other methods, as several sets of points can, if necessary, be operated by one lever, and more than one signal can be operated per lever by the aid of a selector arrangement, so that on the whole the total number of working levers can be very materially reduced.

There is a further advantage attained in relation to facing points, as the Board of Trade requirements in regard to the maximum distance for working the same by power have been relaxed, this distance being extended to 300 yards from the signal-box. This concession alone is most helpful in the laying out and planning of works, and thus recommends itself to railway engineers.

The essential features of a power system are that the operation of all points and signals, etc., must be ensured, and that the possibility of any movement not being completed must be guarded against.

In power systems the locking in one direction must be counter-locked in the other direction. For instance, the fact that a release of a bolt lock on a ground frame does not prevent the lever effecting the release being replaced; and therefore the lever in the ground frame thus released and working the points must in a like manner operate a back-lock on the lever in the signal-box. Detection of signals and points is, however, easier and more elastic than in manual systems on account of the absence of the regulation of wire connections, and lends itself to overcome many difficulties experienced in the manual system.

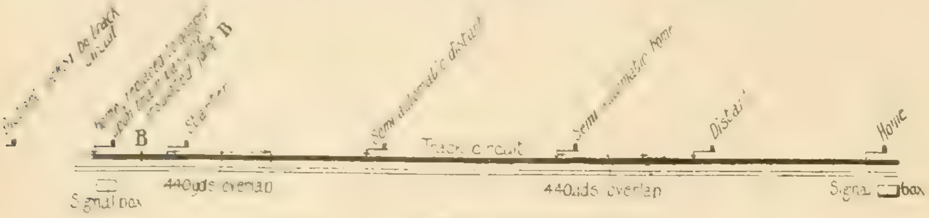


Fig. 4.—Semi-automatic Signalling.

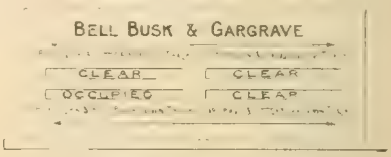


Fig. 5.—Track Circuit Indicator.

A large number of signal-boxes have been installed in England, and the largest installation is stated to be that at the Glasgow Central Station of the Caledonian Railway. It consists of 338 working levers controlling 112 points and 245 signals, and has proved its value. The levers in the locking frame, after being moved sufficiently far to operate the points, cannot be moved completely over, owing to a stop termed a "check lock," which is electrically removed when the points have gone properly over, after which the lever is free to be moved over completely. The mechanical locking of the tappet type then allows the necessary signal levers to be pulled over. If for some reason due to the points not working properly, the point lever cannot be moved right over, the signals for the particular route cannot be lowered. A somewhat similar arrangement is provided on the points, and compels the signal being properly placed to danger before the signal lever can be restored completely to its normal position. The signalman is thus advised of any failure due to the signal not going to danger, and locks up the apparatus so that further movements are impossible.

The mechanism for operating the points is placed outside the 4-ft. way, and consists of an escapement bell crank, the plain end being connected to the stretcher rod of the points, and the escapement end operated by means of a slide with a projection or roller connected to the piston rod. Air is admitted to the cylinder at one or the other end and gives the necessary movement to the slide operating the bell crank, which is also connected to the locking bar. The total movement of the slide produces three distinct movements of the mechanism: first, the locking bar is lifted; secondly, the points are moved; and thirdly, the locking bar is lowered. It therefore follows that if any wheels are on the locking bar the points cannot be moved.

Electrical detectors are connected to the tongues of the points, thus ensuring that the points are completely set in one direction or the other, and they indicate to the signalman that the points are properly over, by the clearing of the stop on the previously mentioned lever in the signal-box. The operation of signals is somewhat on the same lines, air being admitted into one end of the working cylinder by means of pin valves operated by electro-magnets.

In electro-pneumatic installations where the lines are track-circuited, illuminated diagrams are installed instead of the signal-box diagrams usually provided. The roads, points, and signals are exhibited on glass which is opaque all over except the roads. Electric lamps are placed behind the roads in the diagram, and are partitioned off in lengths to correspond with the track-circuited sections, and are so controlled by the track-

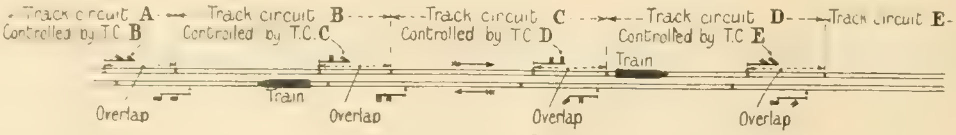


Fig. 6.—Automatic Signalling.

circuit relays as to be always alight, except when the circuit is opened owing to the presence of a train in the section. When the lights go out the signalman is advised, by the darkened portion of the roads, that the section is occupied. By this means the signalmen in the signal-boxes from which the points (or signals in some cases) cannot be seen, are able to perform their duties, and are yet able to cope with the traffic although the latter is practically hidden from view. It also enables the signals and points to be manipulated with remarkable rapidity.

All-electric systems.—In view of the perfected electric motors now in use, and the fact that only one kind of power is desirable, this system recommends itself to the signalling world generally. The point mechanism in all cases is operated by motors, and the signals by motors in some types and solenoids in others; but the general tendency is to use motors for all purposes.

There has been a great deal of discussion as to the use of "check-lock-return-indication" *versus* "constant-detection." The check-lock, as previously described, prevents the signalman pulling the lever in the signal-box completely over, or restoring the same until the return-indication has removed the lock on the lever, whereas in constant-detection the lever can be pulled completely over without having to wait for the return-indication. This alone must expedite the signalman's movements and enable the work to be done with greater rapidity. The constant-detection breaks down all signal circuits from the moment the lever in the signal-box is moved from one position to the other until the points have been properly operated, and should any points be moved or interfered with by accident or design, the signal circuits affected by the position of the points cause the signals to go to danger, if off, or to be held at danger as the case may be.

A great advantage of the constant-detection principle, although the system is perhaps more costly in installation, is that it enables a failure of detectors to be easily located, and thus saves much running about on the part of the signal fitters and consequent loss of time. From experience of others it may be contended that this method is preferable, as most troubles can be located in the lever frame in the signal-box instead of having to be sought for on the ground. This perhaps will appeal generally as one of the vital points of power signalling, as electricity is doubtless the coming motive power for operating points and signals.

All-electric system with dynamic indication.—This interlocking system is a somewhat novel departure from other systems of power-worked installations as regards the means of detecting in the locking frame the normal and reversed positions of the points, in order to make certain that the movement of the points corresponds with the position of the lever in the signal-box.

The stroke of the lever is divided into two movements. The first movement locks all conflicting levers and operates the point mechanism; but in the second and final movement the stroke of the lever can only be completed when the point mechanism has done its work in operating the points. This final movement can be made after, and only after, the dynamic indication has been received certifying that the operated function has assumed a position corresponding with that of the lever in the signal-box.

When the points are to be operated the first movement of the stroke of the lever in the signal-box permits current to flow to the motor, thereby causing the mechanism to move the points to the opposite position and lock them in that position. When this movement has been completed, the circuit through the switch motor is automatically changed, the motor being disconnected from the battery and connected in a closed circuit including the indication magnet. At the same time the armature terminals are reversed for indication purposes, this leaving the motor connections in the proper position for the next operation. The motor now becomes a dynamo, and with the momentum acquired during the operation of the point movement generates a momentary current which energises the indication magnet, this permitting the final movement of the lever in the signal-box to be completed, releasing such levers hitherto locked. The movement of the points can be reversed at any portion of the travel by the operator at will, and the lever movement completed upon the points assuming a position corresponding with that of the lever, irrespective of the direction of the first movement made by the lever.

The complete point operation, and the final movement of the lever, can be accomplished in from 2 to 2½ seconds, the indication being practically instantaneous with the completion of the point operation.

The indication that the points have moved correctly is given by a current generated by the momentum of the motor, and can therefore be obtained only after the actual operation of the point mechanism, no additional power being required for the indication that the points are properly set to allow of the required signals being lowered to give permission for a train to proceed.

Discussion.

Mr. A. **Hurst** (President of the Institution of Signal Engineers), in opening the discussion, explained a fundamental difficulty of designing signal apparatus which was due to the necessity of making it comply with conflicting conditions. When high and low speed traffic passed over the same rails, the signalling must be suited to the requirements of the high-speed traffic, and this was not always the most suitable for low-speed traffic. Ideally, two distinct systems of signalling were required to suit the two cases, but this was not practical, and in consequence the design of signal systems resolved itself into finding the best compromise. With regard to electrical apparatus, the engineer must not think that because his apparatus worked well in the laboratory it would also work well on the road, because disturbing factors were often found in practice which were not suspected until failure was experienced under actual working conditions. As an instance of this kind of thing, he mentioned that if the engineer in repairing a line put in a new length of rail, the electric signalling apparatus ceased to operate until the skin of the rail had been removed.

Mr. A. F. **Bound** mentioned that in all-electric signalling one unit of energy would operate from 500 to 600 signals.

Dr. **Kapp** demonstrated a model of the Railophone method of signalling and explained the operation of the Kapp-Kramer relay.

Mr. T. S. **Lascelles** (communicated) said that enthusiasts for power signalling schemes fell into the error of supposing that men could be reduced to a negligible quantity and the speed of working vastly increased. The electro-mechanical system now being extensively adopted in the U.S.A. enable many of the advantages of power signalling to be obtained without the troubles of maintenance and operation that were liable to attach to power-worked points.

Mr. W. J. **Thorrowgood** (communicated) stated that the advantages of track circuits were obvious, and no doubt extensive use would be made of them in future. The weak spot was the fact that there were a number of vehicles fitted with Mansell wheels (*i.e.*, wooden block wheels). Such wheels failed to operate the track circuit apparatus. The difficulty could be overcome by bonding the hub to the rim. The use of sand by drivers should be discouraged, as the accumulation of sand on the rail was likely to introduce considerable resistance between the rail and rim of the wheel and thus cause even a heavy engine to fail to operate a track circuit.

Mr. A. E. **Tattersall** (communicated) stated that in his opinion the alternating-current system would eventually supplant the direct-current in track circuiting in this country, especially in large installations, for the following reasons: (1) It afforded an economical system of power transmission, and the main could be utilised for other purposes than signalling, such as power and lighting; (2) the question of track insulation did not enter to nearly such a large extent as in direct-current systems; (3) extraneous currents could be fully guarded against by using suitable frequency relays or employing some form of apparatus embodying the principle of resonance.

Mr. **Whysall** (communicated), in referring to the author's statement as to the debatability of a signalman being able to attend to more roads under power systems than under manual signals, referred to the fact that during the rush hours on the District Railway 98 trains per hour were passed through Earl's Court Station. There were four roads through this station. All these trains were signalled by one man operating a power frame. A signalman doing the same work with a manual frame would be exhausted towards the end of his shift.

TRADE STATISTICS OF SIAM.

The following figures, showing the imports of electrical and similar goods into the port of Bangkok during the year ended March, 1914, are taken from the recently issued official trade statistics; the figures for the year ended March, 1913, are included for purposes of comparison and notes of any increases or decreases are given. Imports stated to be from Singapore and Hong Kong are for the most part the products of other countries shipped *via* these two ports.

	1912-13. Ticals.	1913-14. Ticals.	Inc. or dec. Ticals.	
Parts of lamps.—				
From Singapore ..	3,000	17,000	+	14,000
,, Hong Kong		6,000	+	6,000
,, United Kingdom ...	32,000	22,000	–	10,000
,, Germany ...	18,000	21,000	+	3,000
,, United States ...	7,000	5,000	–	2,000
,, Other countries ...	13,000	14,000	+	1,000
Total ..	73,000	85,000	+	12,000
Lamps.—				
From Singapore	13,000	58,000	+	45,000
,, Hong Kong	-	33,000	+	33,000
,, United Kingdom ..	46,000	66,000	+	20,000
,, Germany	67,000	50,000	–	17,000
,, United States	2,000	3,000	+	1,000
,, Japan	114,000	93,000	–	21,000
,, Other countries ..	15,000	7,000	–	8,000
Total	257,000	310,000	+	53,000

	1912-13. Ticals.	1913-14. Ticals.	Inc. or dec. Ticals.
Electrical goods and apparatus.—			
From United Kingdom ...	136,000	297,000	+ 161,000
,, Germany	412,000	575,000	+ 163,000
,, United States ...	37,000	155,000	+ 118,000
,, Singapore ...	2,000	24,000	+ 22,000
,, Sweden ..	6,000	2,000	− 4,000
,, Italy	14,000	12,000	− 2,000
,, Austria	-	5,000	+ 5,000
,, Holland	2,000	1,000	− 1,000
,, France . .	2,000	25,000	+ 23,000
,, Japan ..	3,000	1,000	− 2,000
,, Other countries ...	4,000	27,000	+ 23,000
Total	618,000	1,124,000	+ 506,000
Scientific instruments and apparatus.—			
From United Kingdom ...		36,000	—
,, Germany	Not	92,000	-
,, Austria	shown	11,000	-
,, Other countries ...	separately	39,000	—
Total	—	178,000	—
Manufactures of brass.—			
From Hong Kong ...	10,000	469,000	+ 459,000
,, United Kingdom ...	76,000	58,000	− 18,000
,, China	317,000	102,000	− 215,000
,, Germany	44,000	76,000	+ 32,000
,, Japan	26,000	12,000	− 14,000
,, Other countries	16,000	51,000	+ 35,000
Total	489,000	768,000	+ 279,000
Manufactures of copper.—			
From Hong Kong	4,000	2,000	− 2,000
,, United Kingdom .	41,000	22,000	− 19,000
,, China	74,000	—	− 74,000
,, Other countries . .	10,000	34,000	+ 24,000
Total	129,000	58,000	− 71,000
Steam machinery other than milling and marine.—			
From United Kingdom ...	877,000	See below for new classification.	—
,, Germany	90,000		—
,, United States ...	—		—
,, Other countries ...	26,000		—
Total . .	993,000		
Machinery other than steam.—			
From United Kingdom ...	217,000		—
,, Germany	60,000		—
,, United States ...	46,000		—
,, France	6,000		—
,, Other countries ...	66,000		—
Total . .	395,000		—
Rail locomotives.—			
From United Kingdom ...		9,000	—
,, Germany . ..		89,000	—
		98,000	-
Prime movers other than road locos., marine, milling and agricultural machinery.—	See above for old classification.		
From United Kingdom ...		113,000	—
,, United States		23,000	—
,, Germany		6,000	—
,, Other countries		5,000	—
Total .. .		147,000	—
Machinery unenumerated, including detached parts, and not including textile or sewing machines.—			
From United Kingdom ...		881,000	—
,, Germany		124,000	—
,, United States .		56,000	—
,, Other countries ..		33,000	—
Total .. .		1,094,000	—
Machine belting.—			
From United Kingdom ...	33,000	59,000	+ 26,000
,, Germany	22,000	33,000	+ 11,000
,, Other countries ...	3,000	3,000	—
Total	58,000	95,000	+ 37,000
Iron and steel wire manufactures.—			
From United Kingdom ...	47,000	49,000	+ 2,000
,, Germany	83,000	23,000	− 60,000
,, Belgium	108,000	17,000	− 91,000
,, Other countries ..	20,000	12,000	− 8,000
Total	258,000	101,000	− 157,000

	1912-13. Ticals.	1913-14. Ticals.	Inc. or dec. Ticals.
Railway material.—			
From United Kingdom ...	848,000	336,000	− 512,000
,, Germany	669,000	302,000	− 367,000
,, Belgium	88,000	76,000	− 12,000
,, United States ...	1,000	617,000	+ 616,000
,, Other countries ...	9,000	44,000	+ 35,000
Total	1,615,000*	1,375,000	− 240,000

* Included cars or trucks for railways or tramways.

Cars or trucks for railways or tramways.—			
From Germany	Included	165,000	—
,, United Kingdom ...	under	44,000	—
,, United States ...	railway	8,000	—
,, Other countries ...	material.	3,000	—
Total	—	220,000	—
Caoutchouc manufactures, other than tires.—			
From Singapore		46,000	—
,, United Kingdom ...	Not	41,000	—
,, Germany	shown	14,000	—
,, Other countries ...	separately.	6,000	—
Total	—	107,000	—

Note: £1 = about 13 ticals.

TRAIN DISPATCHING BY WIRELESS.

In a paper on "Train Dispatching by Wireless," read at the New York Railroad Club, on February 19th, by Mr. L. B. Foley, superintendent of telegraph, telephone and wireless, Lackawanna Railroad, New York, the following statements were made:—

"The wireless apparatus aboard the train is of one kilowatt rating, and similar in principle and operation to that at the fixed stations. The motor-generator on the train is operated on thirty volts direct current from the car-lighting generator, which carries on its line a set of storage cells. This motor-generator draws about forty amperes, and provides 500-cycle alternating current at 250 volts for the radio transmitter, including a ten-unit quenching gap, three glass-jar condensers of .002 microfarad each, and the usual radio frequency transformers. The antenna current is about thirty-five amperes.

"We can communicate from a moving train to a fixed station a distance of 130 miles. Owing to the low antenna of the passenger cars, we have not as yet been able to transmit a greater distance from the train, but are able to receive messages on the train from a fixed station at a distance of 200 miles. On the train the aerial or antenna is formed of phosphor-bronze wire arranged in four rectangles, one on the roof of each of the four forward cars lengthwise, with an additional wire lengthwise, and all parallel with the top of the car, each rectangle being carried on porcelain insulators at the corners and centre of each car, with wire link connections between the cars. The wires clear the top of the cars about eighteen inches, being low on account of bridges and overhead interferences; therefore the radiating power is limited. The lead is taken from the middle of the train antenna through the inside of the car, near the roof, into a compartment two by four feet, which contains the wireless telegraph apparatus and the operator.

"The required voltage was obtained from the train-lighting system, and after the first trip on the train it was found that the operation of the train installation did not in any way interfere with the track signals. The speed of the train, or its change of direction while en route, does not have any effect on the transmission or reception of signals, and communication to and from the train is not retarded while the train is passing through tunnels.

"The train radio service has been used for various purposes, such as reporting the number of passengers on board destined to connecting lines, for providing additional cars, or cutting out cars at divisional points, or ordering an ambulance at next train stop for persons taken ill on the train. Commercial telegrams for passengers are handled. In one instance a telegram was filed by a passenger on the train for a resident in the city of Scranton, the message transmitted to destination, delivered, and the reply received by the sender in twenty minutes.

"The wireless telegraph can be depended on between fixed stations, and between moving trains and fixed stations. There are many uses for the wireless telegraph in railroad train operation. It enables the dispatcher to communicate direct with the train, and train orders can be transmitted as accurately and reliably as by telegraph or telephone. The wireless, together with a selective device, can also be used for setting signals at distant points.

"The wireless telegraph serves as an auxiliary method of communication, in addition to the telegraph and telephone, in the event of interruption to wire facilities, and has already proved its practicability and efficiency under such conditions.

not only between fixed stations, but also between a moving train and fixed stations, and the results obtained by the Lackawanna during the past year have been valuable in many ways. It is the company's intention to extend the service over the entire system.

"We have not found it necessary to go outside of our own organisation to obtain operators that can handle wireless equipment and wireless messages. Our wireless office at each divisional point is located within a few feet of the dispatcher's office; and in the event of total wire failures on any part of the road, the wireless is immediately resorted to, operators at divisional headquarters being instructed to listen for a period of five minutes, and if no one is calling, then to call the nearest wireless station for a period of five minutes. This results in the various stations getting into communication with each other in a very few moments. We no longer fear sleet storms, which are becoming more frequent, and which annihilate pole lines of the strongest construction.

"The fact that we are obliged to carry a telegraph operator on each train equipped with wireless telegraphy, or employ a trainman that is a telegrapher, led us to take up the development of the wireless telephone. We have obtained some favourable results, having talked from a fixed station to a moving train a distance of fifty-three miles."—*Telegraph and Telephone Age.*

[The Lackawanna installations were described in our issue of March 20th, 1914.—Eds. Elec. Rev.]

EUROPEAN MARKETS FOR ELECTRICAL SUPPLIES.

The following are extracts from certain reports which have recently been collected by the American Government from Consular Officers in various centres for the benefit of the electrical manufacturing firms in the United States. The main portions of these reports have not been published, but are being reserved for inspection by American firms.

GREECE (SALONICA).—Recent political changes which have brought Macedonia under the control of a people imbued with progressive ideas constitute a factor favourable to the extension of trade in modern technical appliances of all kinds. Salonica, the commercial centre of Macedonia, is the only city in the Province which at present has an electrical plant. Current is generated by three crude oil engine sets, which have a current-producing capacity of 2,400 h.p.

A Belgian company operates the local power plant, as well as the tramway and municipal lighting systems. (The cars used on the tramway were built by a well-known American concern.) In the past nearly all of the company's electrical supplies have been imported from Belgium. As the trade of that country is now paralysed, it would seem an opportune time for manufacturers to place themselves in communication with this firm. In Salonica electricity is used less than other agents for illuminating purposes, candles, petroleum, and gas predominating. There can be noticed, however, a steady increase in the employment of modern methods of lighting; shops, cafés, hotels, and some of the newer residences have electrical installations, and a slight gain is evident in the use of electric bells and private telephones. Salonica has no public telephone service; it is thought that if such service is installed it will probably be undertaken either by the Government or under strict Government supervision. The European war has brought all local construction work to a standstill, and until more normal conditions prevail there will be little opportunity for large sales of electrical materials in this district. This state of affairs, however, should not deter manufacturers from taking an immediate interest in this market and from bringing their products to the attention of the prospective buyers. Entering into consideration are telephones and all construction materials, wire and cable, arc lights, electric lamps, ceiling, wall, and stand fixtures of inexpensive material, wiring supplies, bell systems, annunciators, and novelties, constructed for a minimum of 220 volts, direct current. Local dealers in electrical materials have imported in the past from Germany, Belgium, and Austria-Hungary, but are willing to purchase from America provided the terms offered are as favourable as those of European manufacturers. No special electrical apparatus is in demand here, but some dealers have expressed a desire to place upon this market a line of electrical novelties, such as curling irons, toasters, hot plates, and sadirons, all of which are not well introduced as yet. A concession has been granted recently to a group of English capitalists to construct an electric plant capable of developing 60,000 candle-power at Cavalla, the Macedonian city, ranking next to Salonica in importance. The plant is to be owned and operated by the company, but the municipality reserves the right to purchase the installation at any time after ten years' operation.

The religious community of Mount Athos, Macedonia, is contemplating giving a franchise to a Greek syndicate to install an electric light plant at that place. Still another town in Macedonia is considering the erection of an electric light and power plant, but the plans therefor have not yet matured. Hydro-electric development has not yet been attempted in Macedonia. Several spinning and flour mills are operated on a small scale by simple hydraulic power. It has been estimated by engineers that waterfalls in Macedonia are capable of producing a total hydraulic force of 20,000 h.p., while only 4,140 h.p. are now being used. When economic and political conditions in the country are definitely adjusted the hydraulic energy now going to waste will doubtless be directed into commercial channels. Most of the mill-owners are not now inclined to install electrical machinery, which, they claim, is unnecessary and expensive. One or two millers, however, have expressed the opinion that hydro-electric machinery could be profitably employed. Firms seriously contemplating the introduction of electrical goods in this district could not do better than send thoroughly competent representatives, who speak French, to consider the situation at first-hand. The next best method of entering this market is through correspondence, descriptive literature, etc., in French. Importers prefer quotations c.i.f. Salonica. Under normal conditions terms would be part-cash with order—sufficient to cover freight and expenses—and the balance cash against documents on arrival of merchandise.

SCOTLAND (GLASGOW).—There is at present an unusual opportunity for the sale of electrical scientific instruments in Glasgow, due to the fact that in the past nearly all such instruments were imported from the Continent. The same may be said of tungsten filament lamps which, prior to the war, came principally from Germany and Austria. The supply of tungsten on hand is said to be all but exhausted. Another product that is affected by present conditions, and one that offers American manufacturers an excellent opening, is the arc light carbon electrode. Owing to the elimination of Continental competition, the local selling price of carbons has risen 175 per cent. There is only one firm manufacturing carbons in this country at present, and the Government has first claim on its output. The carbon that had the largest sale before the war was the product of an Austro-German firm. This electrode was very popular for all purposes, and little other was used in this country owing to its low price. American carbons, it is said, have not been well regarded here. They are reported to be good and bad in parts, like an imperfect pencil, so that the arc lamp burns satisfactorily until a bad section of the electrode is encountered, when the light splutters and goes out. A satisfactory carbon at a fair price will always find a profitable market here.

SPAIN (MADRID).—There is in Madrid a strong demand for electrical goods, accessories and supplies of all kinds, and it is believed that practically every article in this line can be sold here—but not on the terms usually asked by American exporters. The Spanish merchant has been accustomed to at least 90 days, and he will not trade on any other basis. For example, a Madrid concern recently sent its representative to the American Consulate relative to a transaction in electrical supplies that had been started by this office, and which involved a fairly large amount. The entire negotiation fell through because of the American exporter's insistence for cash against documents. The Madrid merchant stated to the Consul that he still had some German stock on hand; that he would use it until it was exhausted; and that he would then close his shop until the war was over and Germany again entered the market. This attitude is general in the Madrid district.

SPAIN (ALMERIA).—A canvass of the leading dealers in electric light accessories at Almeria discloses the fact that, although general stocks are in no way depleted as yet, such articles as bulbs, wires, wall switches, and lamp supports are not being supplied with any degree of promptness by Spanish dealers or by the foreign firms that heretofore have monopolised this trade. Almeria is a seaport of 50,000 inhabitants; it has good water communication with the other ports of Spain, but lacks direct service with the United States and some countries of Europe. The local consumption of imported articles, excepting certain classes, is insufficient to warrant direct trade therein, it being more advantageous for local merchants to order foreign-made goods from importers located at Barcelona or Madrid, who offer much more attractive terms than American exporters, and are in position to quote prices c.i.f. Almeria. The latter fact is an important consideration with the local dealers. In view of the present inability to draw all electrical supplies from the usual sources, it is believed that there is now an opportunity here for placing American goods. For the reasons already set forth it is thought that the best plan to reach this trade might be to designate a general agent in Barcelona or Madrid, whose salesmen could cover this district.

Metropolitan Association of Electric Tramway Managers.—A meeting of the members of this Association was held on the 16th inst., at the Municipal and County Club, Whitehall Court, Whitehall, S.W., when there were present Messrs. Ullmann (East Ham), chairman, Fell (L.C.C.), Schofield (Leyton), Moffet (West Ham), Harvey (Ilford), Stokes (Bexley), Mackinnon (L.U.T.), and Goodyer (Croydon), hon. secretary. Letters and telegrams of regret at inability to attend were received from Messrs. Bruce (L.C.C.), Murray (Walthamstow), Williams (Erith), Pott and Hammond (M.E.T.), Mason (South Met.), and Birkett (Southend-on-Sea).

INDIAN NOTES.

[From our Special Correspondent.]

The War and Electrical Contractors.—Whether due to the consequences of the war or other causes cannot be defined, but a good few small electrical contracting firms in Bombay and Calcutta, and elsewhere through India, have gone bankrupt or disappeared within the last six months. Factors and commission agents at home take serious risks in doing business direct with small firms and bazaar contractors, unless their *bona-fides* are established beyond doubt. Even doing such business through banks is not entirely satisfactory, as very often consignments are refused and thrown back on the home buyer, who often has to dispose of his goods in India at a severe loss rather than have them returned. Now that German and Austrian goods are no longer procurable, manufacturers at home may expect all sorts of inquiries from Indian "firms" of high-sounding name, but before doing any serious business it would be well to have payment in advance. These remarks apply only to comparatively small firms of short standing—there are many old-established firms whose integrity is beyond reproach, and whose business has been built up on a sound basis.

Metal Lamps.—The very unwise game of "beggar my neighbour" is being played just now by firms from whom one would expect better in connection with the sale of metal filament lamps Three such firms have offered to deliver on rail 900 miles from Bombay or Calcutta, 40-watt 220-volt lamps at one rupee per lamp in quantities above one thousand. In the face of increased importing charges one wonders how it can be done, and if it pays.

The Mails.—Mails to India now take, instead of the usual 14 days to Bombay, about 21 days, or even more. This is not to be wondered at, nor do people complain; in fact, considering the position in the Suez Canal and round the southern coast of England, it is surprising that we get our mails with the regularity that we do. A good many home firms make a habit of sending duplicate letters by following mails from home, which seems to be a sound practice.

Fewer Catalogues with Fuller Details Recommended.—Firms in America are inundating India with business circulars and lists, and electrical firms especially are busy in this direction. Both English and American firms make the same mistake in common, namely, they do not give sufficient particulars as to prices, discounts and deliveries. It would save money in postage and printing if fewer catalogues and lists were sent out giving better selling particulars and lowest rates f.o.b. home ports, or c.i.f. India, to a select number of serious firms, whose names can be found in any universal directory.

The Dominions Royal Commission.—The fourth interim report of the Royal Commission on the natural resources, trade, &c., of the Dominions was recently issued; the Commission had reached Newfoundland and Eastern Canada when war broke out, and the members were recalled, and the Commission decided to suspend its sittings until peace was concluded. The report points out that British manufacturers make no organised bid for the trade of Newfoundland and the Maritime Provinces of Canada, which has been largely captured by the United States, but could probably be recovered. The importance of Newfoundland as a cable centre is emphasised, and the report suggests that when existing concessions for landing rights come to be renewed or new ones are sought, the Colony should consult with the Governments of Canada and Australasia, as well as with the Imperial Government, before a decision is reached. A cable and landlines connecting St. John's with Canso belong to the Government of Newfoundland, and may form part of a future State-controlled route between the United Kingdom and Canada. The report states that the island enjoys excellent facilities for communication by cable at cheap rates with Great Britain and Canada, though there are certain anomalies that need rectification. There is also a wireless service in operation between the United Kingdom and Newfoundland, and several coastal stations have been erected.

Liverpool and District Electrical Masters' Association—A very successful informal evening of this Association was held at headquarters on Wednesday, 14th inst. As a good number of the members of the Association are with the Colours the attendance was not as heavy as usual, but the occasion gave the company an opportunity of expressing their appreciation of the patriotism of the members. The principal toast was "Absent Members at the War," and it was heartily received. Quite a feature of the evening was a stirring speech by Sergt. A. B. Gregson (Lanc. Fortress Royal Engineers), the chairman of the Association.

Zeppelin Raid and Lighting.—As a result of the airship raid on the N E. Coast last week, several cities were suddenly deprived of electric light for a time, and much inconvenience resulted. At Newcastle both electric lighting and tramway services were suspended; at York the electric lighting supply was cut off for a time, and in Leeds and Hull similar precautions were taken, but the tramways were apparently not seriously interfered with.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

5,168. "Magneto ignition for internal-combustion engines of motor vehicles and the like engines." J. W. T. Cadett & C. Percy. April 6th.

5,174. "Microphone." E. M. C. Tigerstedt. April 6th. (Convention date, April 9th, 1914, Germany.) (Complete.)

5,175. "Magneto ignition for internal-combustion engines of motor vehicles and the like engines." J. W. T. Cadett & C. Percy. April 6th.

5,184. "Electric-light systems more particularly adapted for vehicles." R. Bosch (firm of). April 6th. (Convention date, June 8th, 1914, Germany.) (Complete.)

5,200. "Electro-magnetically-operated devices." E. T. R. Murray & G. F. Shotter. April 6th.

5,201. "Circuit breakers, current limiters, excessive current indicators, and the like for electric circuits." E. T. R. Murray & G. F. Shotter. April 6th.

5,224. "Electrically-operated reversing-mechanism for planing machines and the like." R. McK. Robertson & J. Lennox. April 7th.

5,260. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., N. Shuttleworth, & G. M. Brown. April 7th.

5,261. "Device for testing the actual available working current in electric batteries or cells." A. A. Lyon. April 7th.

5,292. "Cord grips for electric-lamp holders or other electrical fittings wherein grip cords are employed." R. Wheeler. April 8th.

5,307. "Electro-magnetic switches." British Thomson-Houston Co., Ltd. (April 8th.) (General Electric Co., United States.)

5,319. "Process of and apparatus for adjusting electricity meters." O. T. Blathy. April 8th. (Convention date, April 9th, 1914, Germany.) (Complete.)

5,323. "Miners' electric safety lamps." J. G. Patterson. April 8th.

5,342. "Receiving arrangement for wireless telegraphy." Ges. fur Drahtlose Telegraphie m.b.H. April 9th. (Convention date, April 9th, 1914, Germany.) (Complete.)

5,351. "Electrically-heated hot-air syringe for dental or surgical use." J. M. Vaughan. April 9th. (Complete.)

5,371. "Manufacture of electrical condensers." Marconi's Wireless Telegraph Co., Ltd., & C. Mitchell. April 9th.

5,373. "Method of and means for amplifying electric potential variations." British Thomson-Houston Co., Ltd. April 9th. (General Electric Co., United States.)

5,385. "Intercommunication telephone systems." International Electric Co., Ltd., R. G. le Noir, & E. Funcius. April 9th. (Complete.)

5,395. "Electric batteries." H. G. C. Thofehrn. April 9th. (Complete.)

5,412. "Electric lamps and holders for the same." T. Smith. April 10th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

29,622 Electrical Resistances. J. Collinson. December 23rd. (July 17th, 1914.)

1914.

4,017. Electric Heaters. J. R. Quain. February 16th.

4,131. Train Electric Control Systems. B. Starie. February 17th.

4,542. Electrically-driven Pendulum Contact-makers and Breakers for the Control of Current for Electro-medical purposes. E. E. Greville February 21st. ((Addition to 11,274/13.)

4,758. Electric Lamp Stand. F. W. Golby (Wizard Electric Lamp Co.). February 24th.

6,424. Electrically-operated Steering Gear and Analogous Apparatus. W. H. Scott. March 13th.

7,218. Electrical Impulse Transmitters and the like. Betulander Automatic Telephone Co. & G. H. Bryant. March 21st.

7,311. Means for supporting Electric Incandescent Lamps. G. Weissmann. March 23rd. (March 31st, 1913.)

7,561. Shock-absorbers for use with Electric Lamps. M. Camillerapp. March 25th. (April 1st, 1913.)

7,907. System of Operating Electric Control Mechanisms for Printing Telegraphs and the like. Western Electric Co. (Western Electric Co.). March 28th.

7,974. Telephone Transmitters. C. H. Pritchard. March 30th.

8,526. Electrical Indicating Apparatus. H. M. Harding. April 4th.

9,065. Method and means for Protecting Apparatus on Alternating-current systems. A. G. Collis and Crompton & Co. April 9th.

9,213. Electric Cooking Ovens. I. T. Negus & L. Negus. April 14th.

10,516. Electric Safety Control Apparatus for Steam Engines and other prime movers. R. Campbell. April 28th.

20,132. Electric Resistance Controllers. A. H. Curtis, — Mackley, and Igranic Electric Co., Ltd. September 24th.

20,308. Apparatus for Converting Electric Currents. Ester & Co., Ltd., and A. P. Strohmenger. September 29th.

23,495. Electric Resistance Furnaces. G. Gmür-Zehnder. December 3rd.

1915.

767. Door Lock and Contact for Electric Elevators. H. P. McColl. January 18th. (January 23rd, 1914.)

1,376. Electric Cooking Ovens. I. T. Negus & L. Negus. January 28th. (Divided application on 9,213/14, April 14th.)

1,869. Vapour Electric Devices. S. W. Farnsworth & O. P. Schuster. February 5th. (February 5th, 1914.)

THE

ELECTRICAL REVIEW.

VOL. LXXVI. APRIL 30, 1915. No. 1,953.

ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS. April 30, 1915. [No. 1,953.

	Page
German Electrical Concessions in Russia	605
Copper	606
The Engineering Industry and the War	607
The Fight in the Factory, by "Commercial"	609
Good Lighting and its Effects, by V. H. Mackinney	610
New Electrical Devices, Fittings and Plant (*illus.*)	611
Legal...	613
Parliamentary	614
War Items	614
Business Notes	616
Notes	623
City Notes	625
Stocks and Shares	629
Share List of Electrical Companies	630
Market Quotations	630
Rational Rating for Filament Lamps, by S. M. Powell (*illus.*)	631
The Prevention of Electrolysis in Boilers	633
The Power Supply of the Central Mining-Rand Mines Group, by J. H. Rider (*illus.*)	633
Measurement of Wireless Signals	637
Electrical Supply Trade in Brazil	637
The Lubrication of Ball Bearings, by Arthur V. Farr ...	638
Foreign and Colonial Tariffs on Electrical Goods	639
Indian Notes	639
New Patents Applied for, 1915	640
Abstracts of Published Specifications	640
Contractors' Column	Advertisement page xxii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C

Telephone Nos: Holborn 933, Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80); other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co. Gresham Street.

AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

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ROME: Loescher & Co., Corso Umberto I, 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132 Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

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GERMAN ELECTRICAL CONCESSIONS IN RUSSIA.

As we have suggested already in discussing the future electrical position in Russia, a great deal may depend upon the attitude that the Russian Government assumes in regard to the German-owned electrical concessions and undertakings that have been operating for some years to the financial benefit of Germany from an investment point of view, and to the commercial and engineering advantage of that Empire by providing orders for electrical machinery and apparatus.

A number of years ago British commercial engineers and financiers spent no end of money and time upon negotiations to secure for this country concessions of first-rate importance in Russia, but for various reasons they were not successful. In those days it was not for want of trying that we failed to secure both concessions and contracts for British firms. There can be little doubt that one of the most potent of the adverse influences that were at work was that exercised by German electro-financial concerns, and as the Russian Government pursues its inquiries into the position of particular undertakings, it becomes more and more obvious how effectively that influence was employed.

From what has lately appeared in our pages, it will have been observed that the Russian diplomatic world has been very much exercised respecting revelations that have been made, as the Government has, through the channels of a special Council, investigated the actual facts in regard to the character of the Petrograd Electric Lighting Co. of 1886, to which we referred last week. As we stated then, the Russian Government would hardly proceed with the liquidation of the company unless fully convinced of the almost entirely German nature of the undertaking. How much interest is being taken in the matter in Russia may be gathered from the fact that a copy of the *Novoie Vremya* recently received devotes four pages of one issue (*Daily Telegraph* size of page) to the matter. It seems that when the company was formed nearly thirty years ago it had a capital of only a million roubles, and it was established to carry out a concession granted to a German engineer by the then Minister of Finance. The company wanted its statutes based on German laws, but the said Minister desired it to operate according to Russian statutes. It seems not to have occurred to him that a German company operating with German money, through head offices in Berlin, was not a Russian concern, simply because for its Russian operations it rested on statutes more or less adapted to Russian law. As the concern prospered, its operations and capital rapidly grew until, in the spring of last year, the latter reached 10,000,000 roubles, and a fresh issue of 10,000,000 roubles was made in Berlin about that date, all of which reached the coffers of the Deutsche Bank, in accordance with orders given, two months before the war, by the Administration of the German Reichsbank, to detain foreign payments.

The concern acquired new markets in Russia, operating in Petrograd, Moscow, Pietrokoff and Lodz, while it also extended its tentacles to embrace the utilisation of the famous Imatra Waterfalls of Finland. All of its endeavours appear to have been distinguished by that enterprise and confidence that came from its ability to count upon the powerful support of German diplomatic agents, and in this spirit, it appears from the *Novoie Vremya*, the managers of the company discarded the requirements of the Russian statutes and neglected the interests of Russian electricity users, with the result that there was frequent friction between the management of the company and the town authorities. The Moscow town councillors were particularly energetic, and in consequence relations became strained, and whenever it was sought by the Council to smooth matters over, these efforts were unsuccessful because the representatives of the Moscow branch were always able to say that they were without instructions from Berlin.

The situation eventually involved the intervention of the administrative powers, and in August, 1914, the Governor of Moscow appointed a special committee to examine the accounts and position of the said company and to maintain a watch over all its doings. This Committee submitted a comprehensive report to the Governor throwing light on the previously unobserved activity of German contractors in general, and of the 1886 company in particular. It was found that the Moscow administration and the Petrograd board were, right down to the war, in direct communication with the 1886 Electric Lighting Company in Berlin (Gesellschaft für Elektrische Beleuchtung vom Jahre 1886, Berlin), to which they applied for instructions.

It was also decided that the Berlin company should control the construction of the new house of the Russian 1886 company, in Moscow, for which purpose a German architect was sent to superintend the construction of the house, and, subsequently, the Berlin control extended to such small matters as the engagement of employés of the company. Financially, the report shows that the Deutsche Bank of Berlin was at the head of the concern, and kept the funds of the company; further, when the question arose of the issue of fresh capital, a consortium of German banks was convoked in Berlin, at which all details of the issue were settled. The Committee supposes that all the 10,000,000 roubles resulting from the issue made in the spring of 1914 remained in the Deutsche Bank, in current account. A shortage of cash occurring, the Moscow branch applied at the beginning of July to the Petrograd house for money to pay its accounts; but it was informed that this could not be done, as the money that should have reached them out of the last operation was in the Deutsche Bank, Berlin, and that prudence should be observed in respect of expenditure.

As to the nationality of the shareholders there can be no doubt that most of the shares are in German hands, and only an insignificant number in Russian hands. Some of the nominally Russian shareholders are actually German, and, in actual fact, Russian shareholders own about 100,000 roubles value only—that is, about one-third per cent. of the total capital.

All the foregoing leads to the conclusion that the 1886 company is practically only in name a Russian company; both financially and administratively it is a German concern, and it is considered that the systematic evasion of any examination of the state of things in the Moscow branch, thanks to the special system of book-keeping, inspires no confidence that its further operations will not be prejudicial to Russia; and that therefore the 1886 company should be pronounced inimical to Russian Imperial interests and should be liquidated.

On the foregoing grounds the Government has been petitioned by the Town Council to arrest the activity of the company, but according to the Russian paper referred to, though the nature of the company has been fully exposed, and the members of the Government and the Town Council have unanimously agreed on the need for the earliest possible liquidation, there is no evidence of steps having been taken to carry the decision into effect.

British electrical firms are entertaining great hopes regarding the future of electrical engineering in Russia, and in view of that fact it is of interest to know as much as possible regarding the actual character of the past German operations there, which had given them so strong a hold on the market, and also to observe the official attitude toward German-owned concerns, and to see whether, even now that the above report has been made, the liquidation recommendations will be actually carried into effect. It is hardly conceivable that the Russian powers in authority were in deep ignorance of the German character of the company, though they may not have known to what an extent the best interests of Russia were subordinated to those of the Germans concerned in the matter. No doubt the Russian authorities will see fit to assume control of the company, and include the matter when terms of settlement are under consideration at the end of the war. It may be that Belgian, French and British parties will then have a better opportunity than they have hitherto had in connection with the exploitation and conduct of electrical concerns in Russia.

Meanwhile, however, it is significant, as stated in our "War Items" to-day, that transfers of German-owned electrical undertakings in Russia are already being conducted in Belgium. It is reasonable to anticipate that such transactions will not be recognised by the Russian Government.

Copper. The upward movement in the copper market seems to know no end, the rise sustained during the recent two or three weeks exceeding £10 a ton, while the indications seem to suggest the strong probability of a further advance in the near future. Far from showing any signs of a reaction, the tone remains as firm as ever, and producers in North America appear confident that the market will abate none of its firmness for a long time to come. It is abundantly clear that all estimates which were formed last Autumn as to the probable effect of the war upon the metal markets were based upon a serious misconception, and the tendency at the present time is to look for a further advance in values in all directions. Certainly production has fallen below the necessities of the buying which has been going on, and it must not be forgotten that a considerable proportion of the copper utilised in ammunition does not usually come back in the form of old material at a later date.

The prime consideration dominating the market at the present time is, of course, the large outlet which exists in connection with war requirements, and there should be a considerable increase before long in the production of refined copper available for this purpose. There seems to be no limit to the capacity of consumption, however, and there can be not the least doubt that the stocks of refined material awaiting disposal have been very much reduced during the last few months. It is only a few weeks ago that prominent American copper interests were booming the wisdom of the policy of small output and big price, but they seem to have been swept off their feet rather by the remarkable broadening in demands, and the tendency in all directions now involves a distinct increase in production. Very large quantities have been booked for export in the the United States within the last month or so, and the European demands show not the least signs of being reduced. Prices are reaching a very high level, and there has been a good deal of speculation initiated, but for all this the foundations of the market appear to be quite sound. The last few days have witnessed a good deal of new buying, both of refined copper and of warrants, and while the speculative element is not liked, the fact cannot be concealed that part of it comes from influential American quarters—the significance of which it would be foolish to disregard.

There has not been much passing in the general consuming trades, for all the plant available is running on Government work. American opinion inclines strongly in favour of record prices being attained, the opinion being based not only on the consumption for war purposes both in America and Europe, but also upon the fact that the home trade demands in the United States have lately begun to improve considerably, and there can be little doubt that if domestic consumption across the Atlantic reverted to anything like the average of the best months of last year, prices would receive a further sharp fillip.

THE ENGINEERING INDUSTRY AND THE WAR.

The reassembling of Parliament has been followed by the inevitable opening of the floodgates of oratory. When the Houses were not in session we dared to hope that we should soon have some measure of relief from rumours that were so prevalent and persistent in certain circles. What the Censor, and the War Office behind that authority, did not see fit to divulge, might perchance escape the lips of some speaker in the Lords or Commons in some unguarded moment. The newspapers which are continuing to show irritation at having to suppress so much information that reaches them, are "agin the Government" whenever they are able to detect an opportunity for criticism, and they have found occasion to exercise their privilege in connection with statements made by different Ministers on the subject of the output of munitions of war. Now the majority of us have had quite enough of oratory for the present—we want to attend to the very important business that we and our Allies have on hand. And unless our Parliamentarians can show tolerable agreement in their policy and attitude toward things that are of vital moment, it were better that they should cross to Flanders and leave the "business" to men of "few words." Of critics and advisers all Governments that have attempted anything have had their share, and so many new problems have arisen during this European war period that the number could hardly be expected to decrease. The list of Special Committees that have been appointed from outside as the months have passed by, and the conferences that have taken place between members of the Government and authorities in financial and other walks of life, have shown the willingness of the Government to take advantage of the expert knowledge that has been lacking in its own immediate political circle. But we are bound to say that, if there have been too many critics, those who cast the blame therefor upon the Government—whoever that may mean—for keeping us in the dark, have our sympathy. It is not well in days such as these, when the issues involved are so enormous, that the people should have any want of confidence in those at the helm, and we profoundly trust that circumstances will speedily remove the grounds for grievance. To that end let us have no more speaking than is really essential, providing opportunities for untimely quibbling or for efforts to make the statements of those who are working together to find ways and means for bringing this gigantic struggle to a successful issue, appear to be irreconcilable. We are reminded that Carlyle (in the "Latter Day Pamphlets") asked his readers to consider a body of 658 miscellaneous persons set to consult about "business" with 27 millions, mostly fools, assiduously listening to them and checking and criticising them. "Was there ever since the world began—will there ever be till the world end—any 'business' accomplished in these circumstances? The beginning of all business everywhere, as all practical persons testify, is decidedly this: That every man shut his mouth and do not open it again till his thinking and contriving faculty have elaborated something worth articulating . . . . . This is the preliminary fundamental rule for business."

We were told a short time ago on very excellent authority that "shells—more shells!" were what we must have. Instead of every man who, by any stretch of the imagination, had anything whatsoever, direct or indirect, to do with the production of these, proceeding to increase his individual output, we found ourselves involved in discussions which certainly did not immediately assist matters. We revived all the old controversy about drink. Every manufacturer, we suppose, knew well enough, by more or less lengthy experience, that drink was a handicap both to worker and to employer in normal times. But it was the fact that the workers had many thousands of their own brothers and sons fighting in the trenches, and if they had been allowed to know the truth there would probably have been strong influences at work among themselves to reduce drinking. We have never thought in normal times that the British workman would submit to his individual liberty being interfered with in this connection, any more than we have regarded him as willing to listen to reason concerning industrial quarrels, because his personal interests have always been paramount for him. But we have never lived in times like these before—may we never do so again!—and abnormal times call not only for exceptional measures from the nation, but for abnormal effort on the part of each individual having even a remote part in fighting the most abominable foe of recent centuries. The reports regarding the effect of drinking upon output have varied very considerably. One deputation to Mr. Lloyd George showed that the weakness occasioned employers extreme concern. Other authorities say that they have had no adverse experience from drinking. Some say that better wages have enabled men to work only four days a week, and, self-satisfied, they have delayed the operations of others by absenting themselves the rest. Some of the works owners have complained that if men will insist on having their Saturday half-holiday (which we think they surely should dispense with now that they know the facts of the situation) their machinery lies idle when it might be operating. Some authorities have affirmed that long hours and continuous work wear men out if they have no Sunday rest, so that they become more susceptible to the drinking and Saint Monday habit. And so, by these and many other expressions of opinion, have we been brought into a state of chaotic thought regarding a social problem, and a big economic one, too, that has exercised ministries, Parliaments, social reformers, and, indeed, all of us more or less, for many decades. It will be a thousand pities if we spend our energies in time of war trying to find a quick solution for what the years have proved to be one of the most complex and involved of all our national problems. We are confident in the assurance that powers are already in existence for dealing with the matter in time of emergency, and we believe that the firm hand of Lord Kitchener may be relied upon for dealing in an appropriate manner with the men who are traitors to their country and to their brothers on active service. We see difficulty in the way of a Government, which has given us the term: "not drunk in a police court sense," dealing with men who go back to work incompetent or inefficient because of fuzziness, but the Minister for War may exercise means that Cabinets view in other times with disfavour, yet which in time of emergency would have the moral support of practically the entire nation.

We are living in very heart-searching times, and we hope that this process of self-examination which the recruiting poster, the recruiting sergeant, the drum-beat of the highway, the message from the trenches, all induce, will bear fruit in the increased production of munitions as well as in the enlisting of fit men. The recruiting poster, the drum-beat of industry, and the call for "Shells! - More Shells!!" might do much to influence the mind of the industrial worker, and lead, in conjunction with suitably restricted hours for public houses, to a greater moral force being brought into the factory fight, a fight within the man himself in order that he may do his best. "Be no longer a Chaos . . . Produce! Produce! Were it but the pitifullest infinitesimal fraction of a product, produce it, in God's name. 'Tis the utmost thou hast in thee: out with it, then. Up, up! Whatsoever thy hand findeth to do, do it with thy whole might." Words of Carlyle these—in the "Everlasting Yea!" chapter of the *Sartor Resartus.* Written in another connection it is true, but how fitted to the present emergency—they would almost do for an Industry Recruiting Poster! They are, of course, not in keeping with the tenets of Trade Unionism as we have all known it. Limitation of output!—part of the gospel of Trade Unionism—how does that sound in these days of war? It has done its work—nobody can deny the character undermining effects of that damnable teaching. The British workman *at his best* is a fine fellow, and he can beat his class in other industrial nations, but you cannot have a work-limiting, suspicious, grudging policy or tendency controlling or influencing men for years without it leaving its after effects. Now is the time for the British workman to patriotically assist the land of his birth in her hour of trial by shaking himself as free as he can of those limitation shackles. Would that he would abandon them once and for all, and always do his utmost, then we should have little cause to fear the ruthless competition of the enemy in trade and manufacturing. At any rate, let us have freedom from these abominable self-imposed restrictive handcuffs when British blood is flowing out in Flanders. We are glad to learn from one of the daily papers that "an agreement has been come to between the Federation of Engineering Employers and the Amalgamated Society of Engineers for temporarily relaxing such trade union rules as tend to restrict output." Unquestionably trade unionism, like every other part of our national life, is passing through its trial, and though it may seem premature to utter it, we will indulge a hope that it may, in respect of this output restriction question and some other matters, come through the fire refined, an altogether more creditable part of British national life, fostering the growth of a co-operation between employer and employé in manufacturing competitively and successfully for the good of all, so that Britain may have its full share of trade despite all comers.

The direction in which this output limitation has been leading has been witnessed at times in recent years in the intention which some workmen have expressed, without a trace of shamefacedness, to adopt a definite policy of doing as little as they can. An ingenious alternative to striking this—they would go in and take their money and simply do as little as they possibly could. To what depths of moral depravity we threaten to fall if this policy of common dishonesty be permitted—we cannot conceive of its being actually countenanced—by Trade Union organisations. We suppose that it would be considered impolitic to pursue this very distasteful subject at the present time, but it is useless shutting one's eyes to the facts, and, in our own opinion, if there has been shortcoming on the part of workers in producing manufactures, it has been in the case of a number of them the inevitable consequence of this output limitation policy, and its still more reprehensible offspring—the will to adopt deliberate slacking instead of striking. The strike habit, which for years past has been gaining a tighter hold upon industrial workers, has lately shown itself at its very worst. These men know what is right or wrong at a boxing match—would they not with one voice swear one unanimous oath if either were hit when he was down? Have they not shouted "Foul!" at football? Is there not honour even among thieves? Yet when their brothers are engaged in deadly struggle, when the land of their birth is fighting for its very existence—they are willing to assist the most rapacious and dishonourable foe that ever planted iron-heel in European soil? Cartoons are more forceful than oratory or written words, and they have played a fine part in recent events. They might be used to get the truth and very necessary arguments into the heads of all who are "producing" munitions to-day. In one very effective cartoon a British khaki-clad hero, back from the front, is pictured in conversation with a discontented striking workman. "What would you have said of us in the trenches if we had struck for better pay?—but that's what you've been doing!" We are all of us having to carry sacrifices to-day—shall we justify Carlyle's description and strike? The British workman, when he complains of the cost of living, knows well enough that his services are so necessary that he can work overtime, and seven days a week, if he will, and get a bulging purse which will more than pay the increased cost and leave him something over for any bad days that may follow later.

We indeed hope, now that a little light has been poured upon the situation, and the pressing necessities are becoming better appreciated, that the men will everywhere trample down their own weaknesses—drink, strike, ca' canny and dishonesty—and "deliver the goods," carrying into immediate practice the "Aye!" which, at Mr. Asquith's meeting on Tyneside, thundered out their resolution to do their best.

But not drink and labour disaffection alone are responsible for any apparent failure to "deliver the goods" as quickly as they were required. That it was not dreamt that ammunition would be used at such a rate as, for instance, at Neuve Chapelle, is a factor that it would be uncharitable to overlook. It is easy to criticise the powers in authority for what they have not done, and that we may leave to others or to a more appropriate occasion. Sufficient to say that actual requirements for the armies in the field have exceeded everybody's calculations. The figures given by Mr. Lloyd George go to show that we have increased our rate of output at a greater rate than any of us had reason to suppose, but still the mobilisation of our industries is necessary in order that we may keep ourselves and our Allies supplied, and strong men and representative committees have been appointed to see that the thing is done. Not only have the industries to be mobilised, but the workers have to be found to keep every available piece of productive machinery employed.

When the call to the Colours was issued, from the ranks of the skilled engineering workers, and the miners, men left their places by hundreds of thousands—it was not foreseen that for what has proved to be an engineers' war, all our engineering labour would be required. It is stated that recruiting for the Army took 30,000 men from the Tyneside engineering district, and the question of bringing back from camp and from the Front some of these whose services are essential in the factories, has been under discussion; indeed, we believe that some have already been called back. Our own pages have borne evidence to the large drafts that have been made on the employés of engineering firms and companies in Manchester and other industrial districts, and we can only suppose that if it had been possible to foresee the engineering nature of this war, and the extent to which dependence would be placed upon us for the supplies of our Allies, many of these would have been dissuaded from going. Yet the recruiting sergeant is still active round our engineering shops! We are informed that Lord Kitchener sets no limit whatever upon our requirements, and it was stated in Parliament last week that that man was serving the cause most patriotically who was producing to the utmost of his power. Then why continue to draw them off from already hard-pressed factories where this producing is in progress? This mobilisation of works and workers has occasioned no little anxiety among the owners of small factories, who are fearful lest their men and machinery may be commandeered for service in bigger factories where it is more convenient to manufacture what is needed. An appeal has been made to municipal authorities to release for factory service as many as possible of their employés who are now engaged on things that, comparatively speaking, do not matter. When the great municipal strike at Leeds took place it was found that it was possible to dispense with certain classes of labour, and the appeal now made promises to lead to the release of thousands of men from other cities for productive operations in important manufacturing centres. These experiences may incidentally teach us some lessons regarding the more economical conduct of municipal affairs.

We believe that on the whole it has been shown that manufacturers are prepared to do their utmost to hasten the coming of victory by placing their resources at the disposal of the Government. We believe also that some of the difficulties due to want of organisation are rapidly disappearing, and if only the workers can be induced to "do their bit" with the same energy, zeal and self-sacrifice as characterise the conduct of our Forces in the Field, there will be little further cause for complaint. But it requires little special knowledge to observe that, in the present condition of affairs, many of our undertakings are too busily engaged upon Government needs to be able to make any important headway with efforts to "capture" our enemies' trade. Commercial and selling staffs which have an undesired measure of relief from their accustomed vocations are doubtless not neglecting that matter but are looking well ahead.

THE FIGHT IN THE FACTORY.

By "COMMERCIAL."

A noticeable feature of many of the recent annual meetings of manufacturing firms has been the oft-repeated statement that Government orders were on hand, such orders occupying the attention of a considerable part of the works' plant and labour. Usually these requisitions are in the general run of the products of the firm in question: in other cases —and these are not a few—men and machinery are being utilised to make certain articles or parts which are quite out of the beaten track. A motor-car works turns to special ordnance; an engine works to aeroplane parts; a locomotive works makes armoured trains; and so on. The man in the street may, or may not, be aware of all this business topsy-turvydom. He may meet people who have laboured seven days a week for months on end, making ships, guns, shells, cables or cartridges. He may have seen the inspecting officers of H.M. Government sleeping on the test bed of some engine works, where engines are being tested for this or that battleship. The cumulative effect of war upon work in the factory is, however, much greater and more complex than some people seem to imagine, and many new problems have arisen which are quite alien to the ordinary every-day perplexities of business. Of these, two are most important and most difficult of solution, the supply of labour and of material. Another which is, perhaps, only an aggravation of an old trouble rather than a new one, is the organisation of output in accordance with customers' requirements.

Readers of the Electrical Review were recently asked to bear in mind, when inquiring for delivery, that Government orders were obliged to have preference in the factories, and that patience should be exercised in a more than usual degree when manufacturers were tardy in delivery. This request was, as Euclid says, "self-evident, and required no proof." At the same time, for the information of some, it may be well to enlarge upon the three points already mentioned in this connection, to indicate generally the conditions under which factories are running to-day, and the troubles of the manufacturer. Naturally, these three items form the same difficulties for factories generally, the only modifications being that for different industries and localities, the most acute problem is not the same, but varies according to circumstances.

Labour was none too plentiful before August, 1914, and Government requirements (in the case of which the writer has experience) necessitated both extra plant and a partial double shift. Machine hands, unlike poets, are not born but made, and the required number had to be trained in as short a time as might be. The arrival of new machinery and its installation saw the establishment of a night shift, with the inevitable division of the available men. This was only done at the expense of a stoppage of other machinery for periods of a few days, and no little ingenuity was wanted to make things fit. Eligible workers enlisted or were called up to join their Reserve or Territorial units, and older workers were absorbed from industries upon which the war has fallen as a blight. The old business adage of modern rush, "too old at forty," has gone by the board. The age limit for engaging workers, if it has not vanished in toto, is at least twice the figure of pre-war days, employers' liability and other obstacles notwithstanding. The gaps in the ranks of men have so far as practicable been filled up by girls. A forty-eight hour week has, for the bulk of the machinery, mysteriously expanded into about two-and-a-half times its normal term. The works staff remains as before: yet the amount of supervision is more than doubled. The percentage of sick has increased, and the cause is not drink. Long hours and night work have claimed their toll in the works "casualty" list. The new order of things is now on trial, and time will show its efficiency. So far as labour is concerned, the emergency has been met and tackled, as engineers say, with a fair measure of success. The maximum output, if not now achieved, should be only a matter of a short time. Whether the new machinery will always be running 21½ hours per day is another matter, depending upon a rather large number of problematical "ifs." That is our risk.

The supply of raw material has been, and still is, an undertaking of somewhat precarious nature, as uncertain as the weather. One firm's raw material is another firm's finished article. Concurrently with the sudden jump in the demand there has come in some materials a serious check in the continuity of supply, and sometimes even in the quantity there has been a deficit. Copper and lead are obtainable in spasms, and the arrival of these metals again depends upon another series of "ifs." Among these are: if the ship were not commandeered by the War Office or Admiralty *en route;* if it were not torpedoed by the enemy; if it could be unloaded when docked. Actually, one boat was so commandeered, and ran about the world with copper in her hold until she was released and able to come home and unload her cargo. Another was dry-docked with copper aboard which could not be unloaded owing to dock-labour trouble. Other goods were only to be bought in comparatively small quantities, and for delivery at such dates as would only allow a hand-to-mouth sort of existence in the shops where they are used. Matters have certainly improved of late, and suppliers are working strenuously to cope with the abnormal demand, but even now assurance is lacking that one material or another will not suddenly run dry, and temporarily put out of commission this or that department. Further, when one must earmark, for Government orders only, the whole supplies of a particular commodity or some special size or class of raw material, it is not easy to see where the ordinary customer comes in. This has been done in certain sections of electrical engineering, and is still being done. Then the question of the apportioning of the output becomes a little more clear. The old story of the three essentials to success: First, audacity; second, audacity; and third, audacity; is adapted to war requirements, and it is "war urgency" every time. The other people are the regular old-standing customers, and new-comers, some of whom (whisper it) have always previously bought from Germany. There should be no doubt as to which of these obtains priority after His Majesty's orders are filled. The sum total, however, amounts to a deal of work, and even with overtime and double shifts it is not easy to arrange for anything even approaching strict rotation of manufacture. Especially is this the case with small orders and stock lines, which, in the ordinary course of events, are turned out promptly. Stocks run out, and in the general pressure are quite a time in their renewal. An extra quantity of sweet reasonableness is therefore needed on the part of buyers who cannot get their stuff delivered. Things are bad no doubt, but the shop is open on this side of the English Channel, but what of the other side? There are many who do not complain overmuch, and there are the others. One gentleman writes: "Work overtime if necessary," as though to offer us the "open sesame" for a quick dispatch of his requirements. Another says: "This order was placed on a rush basis"; he apparently forgets that there are others on the same basis for the battlefield or the submarine. However, these small touches add to the gaiety of nations. Other orders come in with a penalty clause attached, and some of these from our Colonial Governments. One wonders what would happen if one of these penalty lots were torpedoed on its way to the Antipodes. To penalise manufacturers in peace-time is justifiable, but the war has lasted long enough for the penalty clause to have been jettisoned long before now, and it is questionable whether a penalty could be enforced at present, even though the order had been booked during the term of the war.

From this bald statement of the case one may, to some extent, appreciate the accumulation of troubles under which factories have been working for the past few months. Orders can be dealt with subject to the conditions indicated and to the limitations involved. Nobody can pretend to anticipate the extent of Government requirements or the time of Government demands. It is on this account nearly impossible to promise with any degree of accuracy the time required to execute other orders, and bearing this in mind one will doubtless lend the toleration asked for in the Review article to which reference has already been made.

GOOD LIGHTING AND ITS EFFECTS.

By V. H. MACKINNEY.

(*Abstract of paper read before the* Yorkshire Local Section of the Institution of Electrical Engineers *at Bradford, April 14th*, 1915.)

It is somewhat singular, seeing that so much care is devoted to the natural lighting of buildings, that the provision of artificial light does not receive more care. Not infrequently when buildings are erected the artificial lighting is left to the very last, and the amount expended on it is quite out of proportion to its importance. Yet in the present age artificial light plays an important part. Much of the labour of to-day is done by artificial light; most people find in the evenings their main opportunity for social enjoyment and recreation. During recent years educational authorities have been making special efforts to better the lighting of schools.

Bad lighting, by adding to the strain of labour, causes fatigue and general deterioration in health, even when it does not directly affect the eyes; it is also directly responsible for a large number of accidents. Accidents are always a source of loss, not only because of the compensation paid to the injured, but also because of the disorganisation to which they give rise. It has been proved that unsatisfactory lighting is often a cause of spoiled work, and that it slows down the speed of operators and limits the output. In a certain factory tests were recently made before and after an improvement in the lighting, and it was found that the output had been increased by 11 per cent. The cost of lighting is almost always a minute fraction of the wages bill—in many industries less than 1 per cent. —so that even a small increase in output would more than repay the relatively small cost of putting the lighting on a satisfactory basis. The finer the quality of the work, and the more skilled the operators, the more serious are the results of poor illumination. In the textile factories of the North the weavers migrate to those mills that are known to be well lighted, and desert those where the illumination is notoriously bad; they know that they can earn more when the illumination is satisfactory. A clerk working in insufficient light is apt to make mistakes, and no one can foresee how serious the consequences of such a slip may be. Show-window lighting has become a fine art, and up-to-date merchants fully recognise the value of well-lighted windows as an advertisement.

It is not such an easy matter to say exactly of what good lighting consists; only long experience can show exactly how much light is needed for different classes of work, and only the skill of the trained lighting expert can secure that in any installation this correct amount will be provided. Another fundamental rule is that the light should be directed where it is needed. Proper shading is one of the first requisites in successful illumination. The reflection of surroundings plays an important part in the resultant illumination, and it is quite possible to obtain an increase of as much as 80 per cent. over the calculated values due to reflection from the walls and ceiling, if the room is within reasonable size and the surroundings are light in character. The following table indicates the amount of assistance one may expect from different surroundings:—

Condition of ceiling.	Condition of walls.	Increase over calculated illumination.
Very dark	Very dark	0 %
Medium	Very dark	15 %
Medium	Medium	40 %
Very light	Very dark	30 %
Very light	Medium	55 %
Very light	Very light	80 %

The following average foot-candle intensities are recommended for the various classes of service indicated:—

Art gallery (walls)	5·0
Automobile showroom	6·0
Bank (general)	2·0
Bath (public)—	
Dressing rooms	1·0
Swimming bath	2·0
Billiard room (general)	1·0
Billiard table	15·0
Courts—	
Squash	6·0
Tennis	6·0
Church	3·0
Desk	4·0
Drawing office	8·0
Drill hall	3·0
Engraving	10·0
Factory—	
General illumination only where additional special illumination of each machine or bench is provided	1·5
Local bench illumination	4·0
Complete (no local illumination)	4·0
Garage	2·0
Gymnasium	2·5
Hospital—	
Corridors	0·5
Wards (with no local illumination supplied)	1·5
Wards (with local illumination supplied)	0·5
Operating table	12·0
Laundry	1·0
Ironing table	4·0
Library—	
Stock room	1·5
Reading room (with no local illumination)	4·0
Reading room (with local illumination)	1·0
Market	3·0
Moving-picture theatre	2·0

Museum	3·0
Office (general)	4·0
Power house	2·0
Railway carriage	2·0
Reading (ordinary print)	4·0
Reading (fine print)	6·0
Residences—	
Porch	0·5
Hall (entrance)	1·0
Drawing room	1·5
Sitting room	1·5
Dining room (general)	0·5
(Local on table)	4·0
Kitchen	2·0
Bedroom (general)	1·0
Dressing table	4·0
Restaurant	3·0
Rink (skating)	3·0
School—	
Class-room	3·0
Corridor	0·5
Sewing	6·0
Shop window—	
Light goods	8·0
Medium goods	16·0
Dark goods	20·0
Shops (interior)—	
Light goods	5·0
Dark goods	10·0
Station (railway)	2·0
Street—	
Business (not including light from shop windows, &c.)	0·5
Residence	0·1
Country roads	0·05
Studio	4·0
Theatre—	
Lobby	3·0
Auditorium	2·0
Train shed	1·0
Type-setting	8·0
Warehouse	1·5
Wharf	1·0

The minimum illumination at any point should not be less than half the values stated above. To calculate the foot-candle illumination one must have full particulars as to the polar distribution of the light source he is going to use, also the actual candle-power emitted by the source in the different zones. With the advent of different forms of filament winding and different efficiencies of lamps, the present rating is becoming insufficient. The most ideal method seems to be the rating of lamps in quantity of light emitted, *i.e.*, lumens—a lumen being equal to 0·0796 spherical candles; but the most understandable rating would be in mean spherical candle-power. The mean spherical candle-power may then be considered as a measure of the total flux of light, M.S.C.P. × 4 = total lumens emitted, and thus one source would be directly comparable with another. The source rarely gives exactly the distribution of light required for a specific problem, and it is almost always necessary to use it with a suitable reflector. [The lecturer showed polar curves which indicated how the bare lamp distribution could be altered, and how great were the advantages to be derived by using a suitable reflector.] With white glass one can only obtain a general distribution; with mirrored reflectors only concentrated distribution, and with prismatic reflectors, properly designed, any distribution from extremely concentrating to extensive can be obtained. With enclosing glassware one has a very similar set of conditions. A frosted globe, which has only diffracting properties, leaves the distribution curve of the illuminant essentially unchanged, and merely smoothes it out by averaging the light flux over a narrow range of angles. An opal or white glass globe, which is an excellent diffuser, entirely changes the distribution curve by substituting the diffusing globe as secondary radiator, and retains only for a small portion of the light the original distribution. A lamp in an opal globe, not too dense, is, therefore, clearly but faintly visible, surrounded by a brightly luminous globe. In the case of a frosted globe the lamp appears as a bright ball of light, while its outline is not visible; the globe being non-luminous or but faintly luminous. With prismatic globes it is possible to obtain both good diffusion and redirection of the light rays. Clear glass with correctly designed prisms affords a means of controlling light to the greatest extent and redirecting it more efficiently than any other known material.

[The lecturer then showed a curve obtained from an enclosed prismatic unit in conjunction with a 400-c.p. half-watt lamp.] The unit is specially designed for street lighting and gives the maximum illumination—two and a-half times the rated candle-power of the lamp—at an angle of 15° from the horizontal, which is considered ideal for the purpose. The particular unit from which the curve was obtained is made up of two pieces of prismatic glassware, one fixed inside the other. The internal piece has a smooth interior and horizontal prisms on the exterior, and the external piece has a smooth exterior and vertical ribbings on the interior. This, when fixed together, offers both a smooth interior and exterior, which does away with the objection as a dirt collector of prismatic glassware when used in the open.

The following simple rules for good lighting should be observed:—Don't work in a flickering light: don't expose the eyes to unshaded lights in the direct range of vision; don't judge illumination by the brightness of the lamps; avoid excessive contrasts; use the right type of globe, shade or reflector; make sure that the illumination is sufficient; keep lamps, globes and reflectors clean; and make sure that the lamps are in the right positions.

Discussion.

Mr. Wilson Hartnell said that in a theatre or ballroom overhead lighting was required, in order that people could see what was going on around them, whereas in dining-rooms and drawing offices persons did not want to look around them, but desired to have the light directed on to what they were doing. In a drawing-room also subdued light was very pleasant, especially if persons met simply for conversational purposes. They should always ask themselves when putting in a lighting installation: "What result do you wish to obtain?" and then act accordingly.

Mr. Brown said that several times he had tried to demonstrate to people that Holophane shades were the best for their purposes, but the cost of the shades killed any arguments that could be put forward in their favour. When they came to put the thing into actual practice it was not quite so easy as it appeared on paper or on a diagram—a great many of the apparent advantages would have to be discounted when one was trying to convert people in regard to lighting.

Mr. Moss said he had had similar experience to Mr. Brown. He had gone to considerable expense and trouble at times in demonstrating Holophane lighting in mills as compared with lighting by ordinary shades, and he had always run up against the one difficulty—cost. At the same time, he thought it was quite possible to get very satisfactory results with a good glass or white opal shade. Shops to-day had to be attractive, and there was no doubt that lighting was one of the principal things a shopkeeper had to consider.

Prof. G F. Charnock said his experience of lighting in the drawing office or classroom was in favour of indirect lighting. He had laid down a sort of standard some time ago, that from the lighting in a drawing office one should be able to read one-hundredth of an inch on a steel rule. Unless the light was very good indeed he did not think many would be able to do that, but he found with indirect lighting that it was perfectly easy, although when they entered the room they would not be impressed with the abundance of light. Well diffused lighting was wanted in a drawing office. If they used the desk-light standards they ran the risk of injuring the eyes, because one occasionally found it necessary to turn round for some reason or other, and the very great change from the bright light to the dark corners of the room was likely to prove objectionable. With regard to Holophane shades, if properly arranged they were well worth the extra cost. With some modern theories with regard to lighting buildings there was a tendency to run in the direction of too great economy, and rooms of buildings, halls and churches which were reputedly well lighted according to modern notions were, when one came to examine them closely, somewhat disappointing. If a man could not read his hymn book in church the lighting was not sufficient, and all the very beautiful effects on the ceiling and on the arches, and on the carving, and so on, were really of secondary importance. He would like to caution those present against taking too much notice of photographs, because, as an amateur photographer, he could assure them that with a little trickery in exposure and development they could get any result they desired. He did not regard the photographs which the lecturer had shown as satisfactory proof in regard to the installations concerned, and he thought it well to throw out a word of caution.

Mr. Wright said the lecturer had told them nothing about overlighting. He knew an arcade—lighted by gas he believed—into which it was positively injurious to the eyes for a person to enter. Proper shading ought to be adopted to diffuse the lighting. He agreed with Prof. Charnock with regard to the lighting of drawing offices. He was sure that his eyesight had suffered in his drawing-office days through the necessity of using a strong and concentrated light.

Mr. Collinson said that the diagrams which they had seen with regard to the metal-filament lamps largely went to show that the present shape of lamp was not altogether satisfactory, and it would rather appear that in the next year or two that type of lamp would be gradually eliminated, and another lamp put on the market which would give a better downward distribution of light. He understood the lecturer to hold the opinion that prismatic glass was the thing to use in connection with electric lighting. His own experience of prismatic glass was that when it was new and clean it was very good, but after it had been installed for a while and was covered with dust it seemed to lose a good deal of its efficiency. Dirty shades were ineffective, and although they could put on a good shade, unless they kept it clean they would not get the effects they should have.

The Chairman (Mr. T. Roles) said that personally he thought for dwelling houses shades of alabaster or special glass were much more pleasing in appearance than Holophane shades, whereas for business premises Holophane shades were, as a rule, found to be excellent. He agreed with Prof. Charnock with regard to the injurious effect of strong light on the eyes of draughtsmen, clerks and others who worked at desks, and thought that in every room it was necessary that there should be a scheme of general illumination so that one would not look from the strong light to practically no light at all. In the Bradford Town Hall it had been suggested, and, he believed, carried out in the majority of the offices, that the lighting should be immediately over the desks. In the electricity offices, however, he strongly opposed this form of illumination, and the draughtsmen and clerks supported him—they much preferred a diffused light which was practically shadowless. In regard to street lighting, and indeed, lighting generally, he believed it would take a number of years before they could convince the public that good lighting lay in good distribution rather than in having great flares of light in different parts.

The lecturer briefly replied to the points raised in the discussion.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electrically-Operated Carriage-Drive Gates.

The ornamental value of handsome gates at the entrance to a carriage drive is often lost upon those who have occasion to pass through them, owing to the necessity for descending from the vehicle to open or close the gates in the absence of the lodge-keeper. The electrical way of surmounting this difficulty is exemplified at a country house in the North of England, where a fine pair of gates, with imposing pillar supports gracing the approach to the hall, is electrically operated. The operating gear consists of a ½-H.P. Witton motor, geared through a clutch to a mechanism for opening and closing the gates. The electric motor and mechanism are housed in a small tunnel underneath the gates, a small manhole situated on one side giving access to them. Power is supplied from the house installation. The controlling switch, which is located in the garage, is of the reversing type, so that putting the switch in one position closes the gates, and putting it in another position opens them. On completing the circuit the motor is started up, and a solenoid circuit energised, connecting the motor to the gate-opening mechanism through the clutch. The presence of this clutch, which is open when the motor is not at work, enables the gates to be opened or closed by hand when desired. Before leaving the garage the chauffeur opens the gates, and after driving through, he signals by means of the horn to anyone who happens to be in the garage, should he desire the gates to be closed immediately. On the other hand, when the gates are found closed on the return journey the sound of the horn gives the signal for the switch to be put to the opening position. It is estimated that the gates can be opened over 500 times at a cost of 1d. for energy. The scheme could be arranged so that by means of a time switch the gates were closed some few minutes after the departure of the car from the garage; moreover, they could be controlled by means of a push button in the hall of the house, or by a mechanism completing the electrical circuit due to the weight of the car pressing on it as the car reached the gates.

The gates were constructed by Messrs. Lockerbie & Wilkinson, Tipton, Staffs., and the operating mechanism by the Witton-Kramer Electric Tool and Hoist Co., Witton, Birmingham, for whom the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., are the sole selling agents.

Electrically-Driven Cloth Printing Machine.

An interesting example of the electric drive as applied to the printing industry is shown in the accompanying illustration. The machine is a six-colour cloth printing machine arranged to print squares or rectangles, with side and cross borders in any length from 1 yard to 10 yards, increasing by 1 in., and using rollers 18 in. in circumference. The machine is driven by a 25 H.P. three-phase Witton motor, the controller resistance being mounted on the bedplate of the machine. As will be observed, the motor is completely out of the way, and the illustration gives a good idea of the compactness of the electric drive. The electrical equipment was supplied by the General Electric Co., Ltd., of Witton, Birmingham, and 67, Queen Victoria Street, London, E.C.

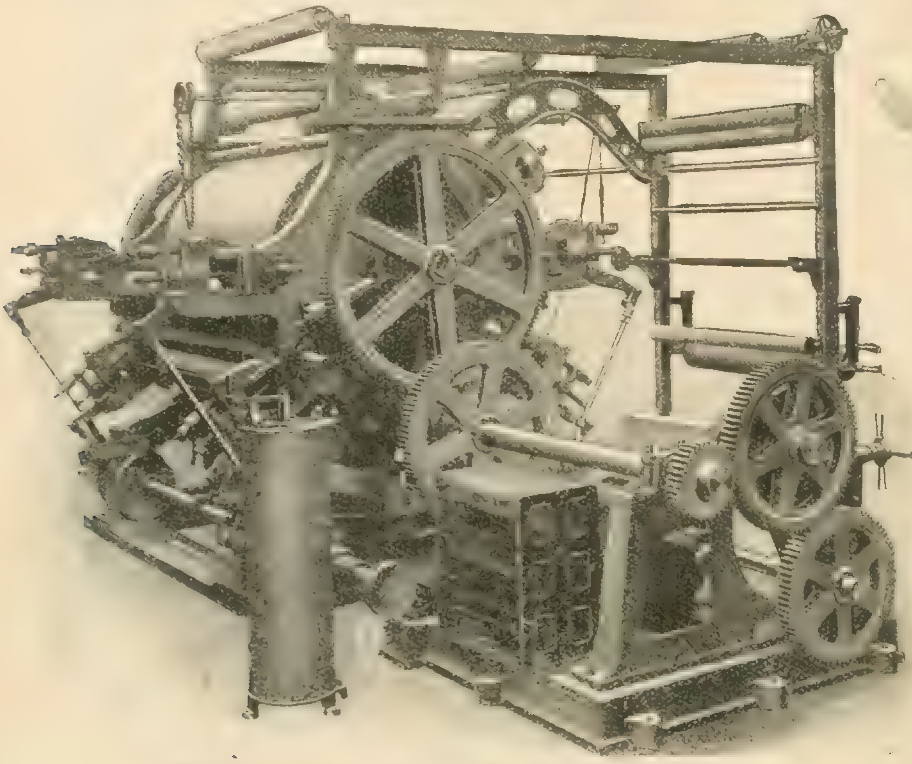

Fig. 1. Six colour Cloth Printing Machine Driven by a Witton Motor.

The Naylorgraph.

Last week a demonstration was held in London of a new type of electric sign, known as the "Naylorgraph," which is being constructed by Messrs. Naylorgraph, Ltd., of 240, High Holborn, London, under patents granted to Mr. J. P. Naylor.

This sign differs from the numerous types of signs displaying words and set phrases, with which our readers are familiar, in that within its letter capacity it can be made to display any desired message, practically on the spur of the moment; moreover, its construction is such that the legend is visible by day or night.

The High Holborn sign, fig. 4, which is situated in a position commanding a considerable length of this thoroughfare, has an area of 400 sq. ft., measuring 33 ft. long by 12 ft. high; it consists of 52 monograms in four lines of 13; each monogram has 23 elements or units which can be grouped to form a letter.

The elements are of special design, consisting of a white disk-like member provided with two black metallic covers or eyelids, which are rotated by electro-magnetic means to uncover the disk; behind each disk is a lamp for night illumination, also controlled in a similar manner. The 1,196 elements comprising the sign are coupled up to a single keyboard, which is selectively placed in relation with each monogram so as to cause the display of any letter upon any panel, an auxiliary board being provided to delete or cause non-display of any desired monogram. This keyboard was primarily designed for the display of news, and by its means an average of one change a minute can be obtained on the sign.

The control devices are connected and operated in series, so that they can be connected directly to a 200-volt D.C. supply. It may be pointed out that the elements are self-contained units provided with a short flexible and plug, which are easily replaceable.

The sign was utilised for recruiting purposes during the week, with considerable success, and its versatility undoubtedly formed an attractive feature.

Messrs. Naylorgraph have been granted patents in over thirty countries, and their letter design and monogram are registered; we understand that they are prepared to negotiate for the exploitation of their foreign patents.

B.T.H. Electric Fans.

A recent list (No. 7,100-B) issued by the British Thomson-Houston Co., Ltd., of Rugby, gives particulars of a number of types of electric fans and fan motors made by the firm. Particular stress is laid on the desk and bracket types of fan, which are built for either direct or alternating-current working, with 12-in. or 16-in. diameter fans, and are built in oscillating and non-oscillating designs, both having swivel and trunnion mounting, which permits the movement of the fan horizontally or vertically through a wide angle. The ease of conversion from bracket to desk type is an attractive feature.

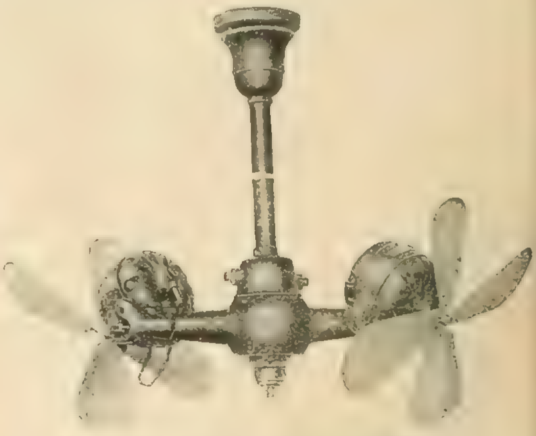

Fig. 2.—B.T.H. Twin Blower.

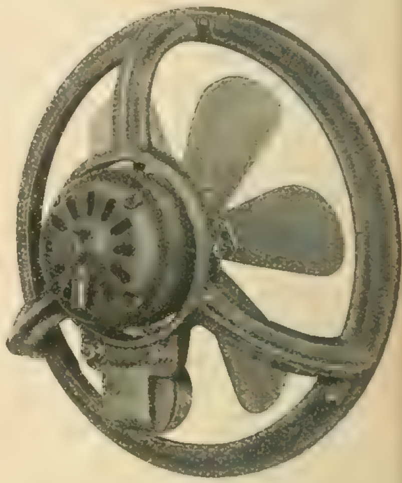

Fig. 3.—B.T.H. Exhaust Fan.

The oscillatory movement is provided by positive mechanism, and does not depend on air reaction.

The motor and fan can be made to oscillate through a predetermined angle. The list also shows ceiling type fans, one of which, a twin blower, we illustrate in fig. 2; we also illustrate an exhaust fan, fig. 3, these being built in 12-in. and 16-in. sizes for either direct or alternating-current working, and provided with a separate speed regulator.

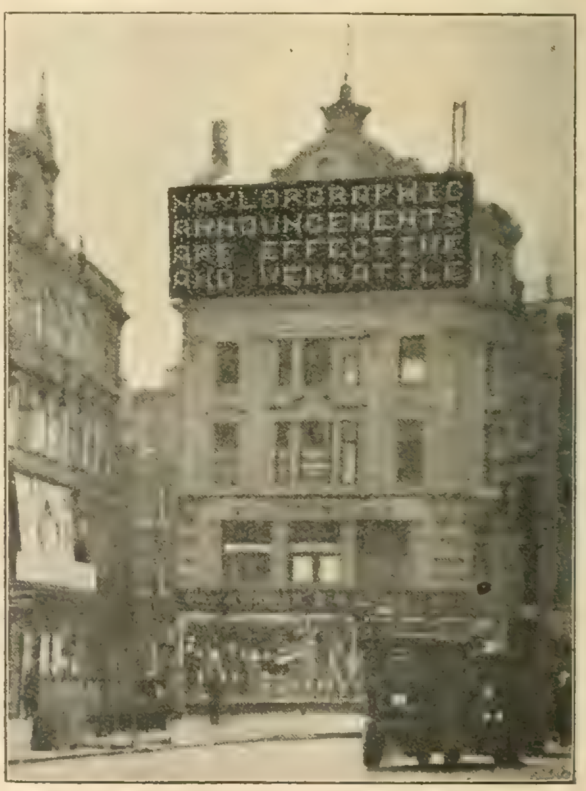

Fig. 4.—The Naylorgraph Day and Night Sign.

Electric Lighting of Ambulance Trains in France.

The electric lighting of ambulance trains for use on the Continent has presented some features of special interest, the running conditions being particularly exacting. Trains consisting of pharmacy and ward coaches have been built in this country by the Great Eastern Railway, the Great Western Railway, the London and North-Western Railway, and the London, Brighton & South Coast Railway, while several coaches have, at the order of the Red Cross Society, been supplied by the Birmingham Railway Carriage and Wagon Co.

These various units have been equipped throughout with Stone's system of electric train lighting, which has been adapted for service on coaches working to no fixed time-table and subject to long periods of standing and slow running. To meet the exceptional requirements of the case, use has been made of special dynamos, which are capable of doing the requisite current generation at a speed of but little more than 10 miles an hour. These machines are of the latest type, and are fitted with ball bearings. The supply is at 24 volts.

The lamp circuits are divided into two sections, so that either half lights or full lights can be used at will; moreover, individual control is provided on most of the lamps. Wall sockets also are fitted in several coaches, to facilitate the employment of portable lights.

The accumulators installed consist of double batteries of Stone's standard "Tonum" cells, and these give a "full lights" capacity of over 48 hours. It is unlikely, however, that all the lamps will be used at one time, hence the available storage is very great. With batteries of so large a rating and dynamos generating current at so low a speed, the installations are capable of satisfactory working, even under the most trying conditions.

The whole of the apparatus is of British manufacture, being supplied by MESSRS. J. STONE & CO., LTD., of Deptford, London, S.E.

LEGAL.

UNDERWOOD v. BRITISH URALITE CO.

THIS case was, on Thursday, April 22nd, the subject of an appeal by the defendants to the Divisional Court of King's Bench, before Justices Bailhache and Shearman, from a verdict and judgment in the action of Underwood *v.* The British Uralite Co., heard in January last by Judge Rentoul, in the City of London Court, when a jury awarded the plaintiff £71 damages for breach of contract. The matter was fully reported in our issue of February 5th, page 174.

COUNSEL for the appellants argued that the defendants had not entered into any contract with the plaintiff by which they were precluded from selling to Messrs. Kynock, and that there was no custom with regard to dealers which prevented them from dealing direct after the plaintiff had failed to purchase within the period of the option, there being no concluded contract of sale between plaintiff and Martin or between Martin and Kynocks.

MR. JUSTICE BAILHACHE, after hearing lengthy arguments on both sides, said he was of opinion that the work done by plaintiff was not for the defendants, but in order that he himself might effect a sale. There was no implied contract to pay for services so rendered. What was done was done by the plaintiff because he was a person who had an option of purchase and was trying to find a purchaser from himself. He did not think the circumstances of the case supported the arguments of the plaintiff. If it were so, the defendants could not dispose of their machinery without a liability to pay the dealer for services rendered. The Judge in the Court below had wrongly directed the jury on that point. The other point put to the jury was that there was a custom that where a person had machinery to sell, and he went to a dealer and offered it to him for sale, and that dealer brought people to see it, the owner might not afterwards deal with the person whom the dealer had so brought. He did not agree with such a contention, and the evidence was not sufficient to support it or to establish the existence of a custom. The appeal must, therefore, be allowed.

MR. JUSTICE SHEARMAN gave judgment to a similar effect, observing that Messrs. Kynock had not gone behind the dealer to make their purchase, and there were no circumstances put before the jury to show that there was any liability to pay plaintiff for services rendered.

The appeal was allowed, and judgment entered for the defendants, with costs.

On the application of Mr. Doughty, appearing for the plaintiff, a stay of execution was granted with a view to appeal.

OSRAM LAMP WORKS, LTD., v. SCEANDO LAMP CO., LTD.

MR. WALTER, K.C., mentioned, on April 23rd, to Mr. Justice Younger in the Chancery Division, a motion in this action for an interim injunction to restrain, until the trial, an alleged passing-off by the defendants.

Evidence, he said, had been filed on both sides, and the conflict was such that he could not usefully ask his Lordship to deal with the matter upon affidavit evidence. He had agreed with the other side therefore that there should be no order on the motion except that the costs should be costs in the action.

His LORDSHIP assented to that course being adopted.

ALLEGED INFRINGEMENT OF A PATENT VACUUM CLEANER.

IN the House of Lords on April 19th, 23rd and 26th, arguments were heard in an appeal by the British Vacuum Cleaner Co., Ltd., against an order of the Court of Appeal in favour of the respondents, James Robertshaw & Sons, Ltd.

The House consisted of the Lord Chancellor and Lords Strathclyde, Parker, Sumner, Parmoor and Wrenbury.

The action was brought by the appellants to obtain an injunction to restrain the respondents from infringing the appellants' letters patent No. 17,433 of 1901, granted to Hubert Cecil Booth for an invention entitled "Improvements relating to the extraction of dust from carpets and other materials," and for an inquiry as to damages and other relief. The specification stated that it was essential for practical success to drive by power the pump employed for producing a vacuum, and to maintain a vacuum of at least 5 lb. per sq. in. in the filter on the side of the filtering medium where the air and dust entered, when the apparatus was at work, and that it was only to extractors working with a considerable vacuum that the claims related. The first claim was for the combination of an extracting implement connected with a power-driven suction pump and dust-collecting means interposed between the said implement and pump, substantially as and for the purpose specified. The patent had been held by the House of Lords in a previous action to have subject matter and to be valid. The plaintiffs complained of threats and of actual infringement by the defendants' machines, which had suction bellows instead of a cylinder pump. The defendants pleaded that the patent was invalid on the ground of the publication of two specifications of Harvey, Nos. 516 of 1893, and 4,545 of 1894, and the prior user of machines made under Harvey's patent, and they denied infringement on the grounds—(1) that the patent sued on did not cover suction bellows although worked by motor, and (2) that the machine complained of did not work at substantially 5 lb. vacuum. Mr. Justice Sargant decided in favour of the plaintiffs, but the Court of Appeal by a majority (the Master of the Rolls and Lord Justice Swinfen Eady—Lord Justice Phillimore dissenting) considered that the term "a power-driven pump" could not be applied to a power-driven bellows, and that the defendants had done no more than apply power to the old Harvey machine. Lord Justice Phillimore considered that the essence of the plaintiffs' invention, as regarded the power-driven pump, was "the production by mechanical power of a suction such as will produce a considerable vacuum sufficient to extract the dust from and through the carpet, the extractor being a close fit." Accordingly, by the majority judgment of the Court of Appeal, it was held, notwithstanding the prior user of the machine of Harvey, that the patent was, on the construction placed on the specification by the House of Lords, valid; but that the defendants had not infringed, and the appeal was allowed. The plaintiffs now appealed against that judgment.

Mr. Thomas Terrell, K.C., Mr. Colefax, K.C., and Mr. Courtney Terrell appeared in support of the appeal; Mr. Walter, K.C., and Mr. Gray for the respondents.

On the hearing of the appeal the respondents were not heard, and judgment was reserved.

ARMORDUCT MANUFACTURING CO., LTD., v. ARMITAGE.

IN the City of London Court, on Monday, before his Honour Judge Rentoul, K.C., an action was brought by the plaintiffs against Mr. T. Armitage, electrical goods dealer, John Street, Huddersfield, for £21 balance of account for Sunbeam electric lamps supplied. Mr. F. Hinde appeared for the plaintiffs, and Mr. F. H. Bodvano for the defendant.

MR. HINDE said that the defendant admitted owing £8 15s., for which plaintiffs had obtained judgment. As to the balance, £12 5s., there was no dispute about the receipt or acceptance of the lamps.

The matter was gone into in considerable detail, after which judgment was given for the plaintiffs for the amount claimed, with costs.

New Zealand.—The New Zealand Customs authorities have recently given a decision to the effect that "Igniters, electric (for gas or oil engines), are to be classified under No. 385 of the Tariff, a duty of 20 per cent. being imposed on foreign manufactures, while British goods are to be admitted free of duty."

A Wellington firm of importers is inquiring for the names of British makers of metal-filament lamps. Application may be made to the Board of Trade C.I. Branch in London.

Women's Work Exhibition.—At a "Women and Their Work" Exhibition, which is being organised by the *Daily Express*, and which opens to-morrow at the Royal Horticultural Hall, Westminster, for a period of one week, there will be daily demonstrations of electric cooking. On May 4th, at 3.30 p.m., Miss Maud Lancaster will lecture on "Electricity in the Service of the Home."

PARLIAMENTARY.

Halifax Corporation Bill.

Lord Newton's Select Committee of the House of Lords commenced the consideration of the Bill promoted by the Halifax Corporation on April 22nd. Under the Bill the Corporation sought powers to construct certain tramways and to provide and run trolley vehicles and motor omnibuses.

Mr. Lloyd, K.C., for the Corporation, explained that the principal tramway project was an extension to Elland, a mile and a half long, and this was opposed by the Huddersfield Corporation and the West Riding County Council. A second project was an extension of the tramway from West Vale to Stainland, and this also was opposed by the County Council. The promoters also wanted power to run motor 'buses along any street in the borough, along two specified routes outside the borough, and on any route which the Board of Trade and the road authority might eventually agree to. They were agreeable to contributing ⅜d. per 'bus mile to the expense of maintenance of the roads, which was the sum generally fixed in other cases. Under the Bill they asked for borrowing powers of £110,000 for construction of tramways, £14,000 for tramway rolling stock, £5,100 for trolley vehicles, £26,300 for electrical equipment, £6,000 for an extension of the tramway depôt, and £3,600 for motor omnibuses.

Having heard the evidence the Committee rejected the proposal for the tramway to Elland, and also modified the clause which would have allowed the Corporation to make agreements postponing purchase by outside authorities. Clauses were also inserted to protect Huddersfield and Brighouse against competitive omnibus services from Halifax.

South Shields Corporation Bill.

A Select Committee of the House of Lords, presided over by Lord Hylton, after consideration of the South Shields Corporation Bill, has ordered it to be reported for third reading in a modified form. Amongst the proposals contained in the Bill were those for tramway extensions in the Mile End and Sunderland Roads, and for the running of motor 'buses to Boldon Collieries.

In the evidence it was stated that the Corporation had made an agreement with the Rural District Council with regard to the motor 'bus service and would contribute to the cost of the maintenance of the roads.

No opposition was offered to the tramway proposals, and the only opposition to the motor 'bus service was in respect of the wear of the roads and bridges.

The Committee rejected the motor 'bus proposal and allowed the tramway clauses.

WAR ITEMS.

Board of Trade Assistance.—The Board of Trade Commercial Intelligence Branch has issued list No. 17 of inquiries for sources of supply of goods, for the week ended April 17th.

Manchester Car Collections.—More than £10,000 has been collected for various war relief funds by means of the collecting boxes which have been on all the Manchester tramcars since the commencement of the war.

Glasgow University Engineers' Offer.—At the meeting of the Court of the University of Glasgow, on April 23rd, Principal Sir Donald MacAlister intimated that the whole staff of the engineering department—lecturers, assistants, demonstrators, and workmen in the laboratory—had offered themselves in a body to the military authorities in case their services might be of use in connection with the provision of munitions of war. He had had a letter from the Major-General of the Ordnance Department cordially acknowledging the value of the offer, and stating that in a very short time they would be able to indicate how the services of the staff might be best utilised. In the meantime the Admiralty had asked the University to do a service which they could do in connection with the actual work of providing munitions of war in Glasgow—namely, that they should put their workmen and their testing machines at the disposal of the Admiralty for the purpose of testing specimens of steel used in shell-making in the district. He was quite sure that Professor Cormack would undertake the supervision of this matter so far as providing facilities for the Government was concerned, and he was sure that the Court would cordially accede to the request.

Once Bit, Twice Shy.—Our contemporary "La Lumière Electrique" reproduces a letter which is being circulated by the Syndicate of Engineers, Boilermakers, and Foundrymen of France to all firms engaged in the trades named. After offering official statements on the war in six languages for circulation to foreign clients and agents, the letter points out that the Germans and Austro-Hungarians who were resident in France before the war, whilst ostensibly earning their living, were at the same time assiduously preparing for war, and urges its readers to guard against similar tactics in the future. To this end, all French concerns are adjured never more to employ Germans or Austrians in any capacity whatever; never to accept the gratuitous services of young Germans or Austrians who may present themselves as "volunteers"; and not to renew agencies for enemy firms after the war, but to deal in or purchase only apparatus, etc., of French manufacture, or, if not made in France, of Allied or neutral origin, the principle being to abstain rigidly, in view of the mentality that has been unmasked, from commercial transactions with the Germans. The Syndicate places its services at the disposal of readers, to furnish them with the names and addresses of French, British, American or other firms that make apparatus such as they have been accustomed to procure from Germany, or, in the case of items hitherto manufactured only in Germany or Austria-Hungary, to assist in the establishment of such manufactures in France. No doubt a similar feeling will be cherished by the majority of our readers. We wonder how many British firms that accepted the services of young Germans "desirous of learning the language" at a nominal price have paid for their seeming economy with the loss of customers worth tens of thousands a year to them, on the return of their artless pupils to the Fatherland, loaded with detailed information regarding their trade and clientèle. Nevermore!

German Capital in Russia.—Reuter's agent at Petrograd states that the Department of the Ministry of the Interior, which is in charge of rural and municipal economic affairs, has opened an inquiry into the question as to how far municipal economy in Russian towns is dependent upon German markets and German capital.

Electricity Works Employés.—It having been represented that men, some married with families, had enlisted from the various Stoke Corporation electricity works, and that their places had been filled by single men of military age, Colonel Blizzard asked Mr. Yeaman, the electrical engineer, to make inquiries. The subject was brought before the Electricity Committee, and Mr. Yeaman was instructed to reply that the Electricity Department had sent a larger percentage of men than any other department of the Corporation—30 per cent. of its employés having enlisted, and 44 per cent. from the office staff. The general allegation of taking on single men of military age was disputed, but it was stated that the greatest difficulty had been found in obtaining men, and that a few more who would enlist were unable to do so because they could not be spared, particularly as the War Office, the Local Government Board, and local firms insisted upon an adequate supply of electricity being maintained for the production of munitions, etc. Mr. Yeaman concludes:—"I think you will agree that everything possible has been done by my committee to forward the interests which we fully recognize are national and not local, reserving merely the irreducible minimum for our own pressing local needs."—"Stafford Advertiser."

German Electrical Machinery Confiscated at Sydney.—An Australian newspaper just to hand states that application was made to Sir William Cullen, President of the Prize Court, for the confiscation of seven cases of machinery seized on board the steamer "Annam" by the Commonwealth Government. The application was made by Mr. H. E. Manning, who was instructed by the Commonwealth Crown Solicitor; Dr. Brissenden appeared for the Australian Metal Co., Ltd.; and Mr. P. Halse Rogers, for the Municipal Council of Sydney. Mr. Manning explained that in 1913 a contract was entered into between the Australian Metal Co., Ltd., and a German firm for the supply of certain electrical machinery, to be ultimately used by the City Council. The original machinery was supplied and set up, but it was afterwards discovered that certain parts were defective. The Australian Metal Co. undertook to replace the defective parts, and in order to do that it was necessary to send to Germany. This was done in June, 1914, but it was not until September 29th, 1914, that the goods were shipped by the German firm, via Copenhagen. The vessel arrived at Sydney long after the outbreak of war, the cargo was discharged, and the goods in question were seized by the Customs authorities. The Australian Metal Co. had no communication with the German firm after the outbreak of war. The object of the present application was to obtain an order from the Court confiscating the goods, which would be ultimately handed over to the City Council. The President said it was proved that the goods were ordered prior to the outbreak of hostilities, and the Australian Metal Co., who were merely carrying out the Council's order, were exempted entirely from any suggestion that they were trading with the enemy. The goods, however, having been dispatched from an enemy's country after a state of war existed, must be confiscated, and he made an order accordingly; no order as to costs.

Trading with the Enemy.—The "Australian Mining Standard" states that Colin Leigh Remington, trading in Elizabeth Street, Melbourne, under the name of McLean & Co., electrical engineers, was arrested in March and charged that "during the continuance of the present state of war, on September 3rd, 1914, at Melbourne, he did unlawfully attempt and unlawfully endeavour to trade with the enemy, to wit—C. & F. Schlothaner, Ruhla, Germany; M. Reiner & Co., Hamburg, Germany; Schumanns Elektrizitatswerk, Leipsig, Plagwitz, Germany." Having been released on £500 bail, he came before Mr. Goldsmith, P.M., at the

Melbourne City Court on March 12th, to answer the charge. Mr. H. I. Cohen, who prosecuted, explained that accused was arrested because it was known that he was booked to leave for America on March 13th. Several letters to firms mentioned in the charge having been read, and Mr. Bryant having, in defence, argued that even after the proclamation prohibiting trading with the enemy, it was perfectly justifiable for a person in Australia or England to buy German manufactures from persons in neutral countries, provided the money in payment did not go to Germany, and the accused having stated that whatever he had done against the law had been done in ignorance, the Police Magistrate stated that he had no doubt that defendant had offended against the law. He could not understand how a business man could, within a few days of each other, have written such contradictory letters as two which had been read. If it was not attempting to trade with the enemy he did not know what was. He should say it was non-controversial. It was the sort of thing that could not go on. The thing that appeared to mitigate the offence was that it occurred on September 3rd. He (Mr. Goldsmith) did not regard the case as so grave as the matter that was before him some weeks ago, where an endeavour was made not only to obtain goods through a neutral country, but to have them branded as of other than German manufacture. In view of the circumstances, and the fact that the defendant had abstained later on from giving directions, the fine would be £200, with £6 6s. costs. Mr. Goldsmith added that in charges of this nature which might in future come before him, unless there were markedly mitigating circumstances in such cases, even though they were committed anterior to the first case he had heard, he would order imprisonment. Those who traded with the enemy supplied them with munitions of war to destroy our soldiers.

Reuter's agent at Melbourne telegraphs, according to the "Financial Times," that Theodore Zwicker, an importer, has been fined the maximum penalty of £500 for attempting to trade with the enemy.

The German Cable Makers' Syndicate.—Shortly after the outbreak of war the agreement of the Syndicate of German Cable Makers, which was on the point of expiration, was provisionally prolonged until the end of March, 1915. This temporary arrangement has now been extended to the close of the year. It is proposed to protract the combination definitely for a number of years after the conclusion of peace. The chairman of the Syndicate is Herr Berliner, general director of the Bergmann Electricity Works Co.

Anglo-Russian Trade Relations.—One of the features of the Anglo-Russian commercial entente, initiated some eight or nine years ago, was the establishment, contemporaneously, in London and Petrograd, of the Russian Section of the London Chamber of Commerce and the Russo-British Chamber, respectively. The latter has now branches in Warsaw, Odessa, and other leading Russian cities; the former includes in its membership practically all corporations and firms, financial and commercial, of any standing and importance in London, whether British or Russian, who are interested in trade between the two countries. The work that has been accomplished in the intervening years has placed the organisations in question in a position to meet the new situation brought about by the war in a manner that would obviously have been impossible without a lengthy period of preparation. The Russian Section of the London Chamber of Commerce has at its disposal not only the large resources of that institution but the services of the special Statistical and Information Department of the Chamber, with its extensive commercial library. This department has been putting Russian buyers and English sellers, or vice versa, into business relations for some years now, but naturally since the outbreak of war this work has been very greatly extended. The department affords full information as to the products obtainable in each country and the manufacturers and merchants dealing in the various articles; the statistical and other information, as well as the experience gained in the past, is now of great benefit. At the present moment the Chamber is busily engaged in applying its resources with the object of meeting the present demands arising both here and in Russia, and, no doubt, the coming of summer and the re-opening of the trade routes connecting the two countries will again increase the work. The work of the Section is not, however, confined to introducing buyer and seller; many other subjects are handled. For example, at the meeting held on 23rd instant, a special committee was appointed to carry on the work initiated by an emergency committee nominated immediately after the outbreak of war, which will watch, in the interests of Anglo-Russian trade, negotiations for commercial treaties which may be concluded by Russia with various countries when the war is over. The committee, in addition, will consider all questions bearing on the general subject of the extension of trade between Great Britain and Russia which may arise in the interim. Particulars of the new Russian Customs Tariff which, broadly speaking, increases the duties on British goods by 10 per cent., and on those from Germany, Austria-Hungary, and Turkey by 100 per cent., were announced. The result of correspondence with the Censor on the subject of transmitting telegrams in the Russian language was also communicated, whilst among other subjects which were discussed with a view to action was the effect of Clause 5 of the Finance Act, 1914, upon Russian shareholders in British companies operating in Russia, etc. A proposal for an exhibition of British goods in Russia was also discussed and deferred for further details.

Belgium's Hour of Need: An Appeal.—In common with the editors of other publications, we have this week received an appeal on behalf of the millions of people who are on the verge of starvation in Belgium. We wish that we had room to print it. It is eloquent, convincing, and heart-searching—we cannot attempt to summarise its arguments in a few words. True, great things have been done to enable those seven millions who remained behind in Belgium to keep body and soul together, but it is too horrible to contemplate the suffering, mental and physical, and the pangs of hunger, that we are authoritatively informed these brave people have undergone, and which they must yet experience while in the German grip unless more generous help is sent. The German army of occupation refuses to feed them, and "unless we get more assistance hundreds of thousands will actually starve." We have opened our columns in these terrible war-days to many appeals not purely electrical, but we are sure that there is none that can with greater justice lay claim to our assistance. The appeal of the National Committee for Relief in Belgium is signed by representatives of varied interests, and the committee has among its members men and women from almost every conceivable walk in British life, and we have no hesitation in urging our readers—all of whom recognize the vast debt we owe to Belgium—to do their utmost for these millions who suffer because of the immortal bravery of our Ally in defending its own honour and obstructing the way to Paris, to Calais, and, perhaps—to London. Donations may be sent to Mr. A. Shirley Benn, the Hon. Treasurer, Trafalgar Buildings, Trafalgar Square, London, W.C

Engineer Volunteer Training Corps.—The replies received to the circular recently issued by the Institution of Electrical Engineers to the members residing in the London district have been communicated to the Central Association of Volunteer Training Corps, whose Engineering Adviser is of opinion that the response received is sufficient for the matter to be proceeded with, and enrolment forms have accordingly been sent to all those who have expressed willingness (conditional or unconditional) to join the proposed Corps. Further enrolment forms for members whose residence or occupation is in the London district can be obtained at the Institution of Electrical Engineers, Victoria Embankment, W.C.

German-Russian Electric Finance cum Force Majeure.—According to the "Utro Rossi," Moscow circles are credibly informed that a lively business is being done in Brussels in the transfer of German concerns in Russia to Belgian share companies which have been established for the purpose. The acts of sale take place with the observance of all legal formalities, and are registered at the Spanish Consulate, scrupulously fulfilling the obligations of the Russian Consulate. All this is done in the expectation of using the Belgian firms and preserving in German hands the power to control the concerns in Russia which according to the existing law they should lose. The Belgian Government has accurate information showing that up to now 38 such transactions have been registered, of which seven are related to the General Electricity Company-trust, which was interested before the war in electrical undertakings in Riga, Keiff, Bielostok, Radom, Chenstochoff, and Simferpol. Nearly all the shares in the Kieff Lighting Company have now been transferred, of course, fictitiously, to it. In exchange for them German shareholders will receive shares in the Belgian trust. Our Allies, continues the Russian journal, are obliged to execute the operations under German compulsion. After the war they will explain them, and they will be cancelled. But for the edification of the presumptuous Germans, it would do no harm to put existing law into force on the liquidation of German businesses in Russia, with a clear intimation that the transfer of such businesses, effected no matter how, abroad, will be treated as null and void in Russia.

Personal.—The following announcements appeared in the "London Gazette" on April 27th:—Territorial Force: Hampshire (Fortress) Engineers. The undermentioned to be Second Lieutenants. March 25th.—No. 4 Electric Lights Company—Sapper Harold Tom White. No. 6 Electric Lights Company—Norman Mansfield R[illegible].

London Electrical Engineers. The undermentioned to be Second Lieutenants. Dated April 28th, 1915:—Corporal Thomas Hepburn Gatch, Lance-Corporal Gerald Fergus Wood, Private Alfred Blacker, from the 28th (County of London) Battalion, The London Regiment (Artists Rifles).

Mr. A. R. Farrow, who has been gazetted Second-Lieutenant in the R.F.A. (2nd Home Counties' Brigade), is the son of Mr. A. E. Farrow, manager of the Windsor Electric Light Works, and was a pupil in the Diesel Engineering Works at Manchester.

Roll of Honour.—Private John Hoose, of Frodsham, who was employed at the Helsby Cable Works before the war, has been killed in action. He was serving with the 2nd Welsh Regiment, and was shot in the head. Deceased, who had previously been wounded and had returned to the front, has left a widow and two children.

Lance-Corporal Walter Hewett and Private Charles Webber, who were arc lamp attendants in the employ of the Stepney B.C. electricity department, have been killed in action.

BUSINESS NOTES.

Consular Notes.—GERMANY.—The American Consul at Berlin reports that the merchants of the city of Berlin have taken preliminary steps to quote hereafter, when normal times have arrived, independent prices for zinc, lead, aluminium, and antimony. This measure involves the further extension of the activities of the Berlin Metal Exchange, and its prime object is to create independence for the German metal trade from the quotations in London. The American Consul is of opinion that this proceeding is justified in view of actual conditions in the relative production and consumption of metals in the various European countries. He considers it an anomaly in the metal trades that the price of zinc, for instance, of which Germany is one of the foremost producers and consumers, is fixed in London.

INDIA.—The American Consul at Bombay reports that the Railway Board of India has issued instructions to install electric lighting in all carriages on State worked railway systems. The change will of necessity take time to carry out, but the general adoption of electric lighting has now been decided on and will gradually be brought about as funds and time permit.

Stoker Contracts.—The following is a list of recent sales of stokers by the UNDERFEED STOKER CO., LTD., to electrical undertakings:—

Borough of Leigh Electricity Department	2 E.
Lisbon Electric Tramways	1 E.
Derbyshire & Nottinghamshire Electric Power Co. ..	6 B.5
Blackpool Corporation Electricity Department.. ..	2 E.

Other orders executed include those for Priestman Collieries, Newcastle-on-Tyne; Davidson & Co., Belfast; Edward Sassoon Mills, Bombay; National Steam Car Co., Chelmsford; and the Delagoa Bay Development Corporation.

Catalogues and Lists.—WESTMINSTER TOOL AND ELECTRIC CO., Suffolk House, Laurence Pountney Hill, London, E.C.—Small illustrated and priced leaflets of lifting magnets, electric drills, and electric blowers. The company's telegraphic address has been changed from "Aphasitic-Cannon-London," to "Westolelco-Cannon-London."

THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponders End.—Leaflet No. H 3,097 gives prices and particulars of domestic fans for the coming summer season. Customers can have these overprinted in quantities of 250 up. Leaflet No. A 3,096 (8 pages), gives details and reduced prices of "Ediswan" foolproof, quick-make and quick-break ironclad switches and switch fuses (250 and 600 volts)

MR. G. BRAULIK, 8, Lambeth Hill, London, E.C.—Twelve-page illustrated catalogue giving fully tabulated details and prices of "Therma" electric cooking and heating apparatus—boilers, cooking plates, ranges, baking and roasting ovens, &c.

CONTRAFLO CONDENSER AND KINETIC AIR PUMP CO, LTD, 3, Central Buildings, Westminster, London, S.W.—Thirty-two-page illustrated pamphlet, containing a very full description of the Contraflo-Kinetic system. The pictures show these condensing and air-pump equipments applied to power station plants in Buenos Aires, Japan, China, Rochdale, Lots Road, Dunston, Bolton, &c. A tabular list gives particulars of Kinetic plants supplied or on order, ranging from 500 to 25,000 KW.

MESSRS. GEO. SCHULTZ & CO., LTD., 10, Bush Lane, London, E.C.—New catalogue (24 pp.) giving particulars and prices of various electrical insulation materials which they are now manufacturing at Manchester. They have recently acquired additional premises, increasing their output facilities, and considerable stocks are carried of these and other manufactures, including enamel insulated wire.

THE GENERAL ACCESSORIES CO, LTD., 70, Worship Street, London, E.C.—Eighty-six-page catalogue containing illustrations and prices of electrical accessories of British manufacture—lampholders, switches, bells and bell-pushes, fuse and distribution-boards, and so forth.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—Illustrated priced leaflets relating to carbon-filament lamps and Barwick motor-starters.

MESSRS. A. P. LUNDBERG & SONS, 477 to 489, Liverpool Road, London, N.—Twelve-page illustrated list (S. 38) giving full particulars, with diagrams, prices, &c., of their "Pivot" single-way and two-way tumbler switches.

MESSRS. HERBERT MORRIS, LTD., Empress Works, Loughborough.—Illustrated and priced pamphlet, No. 62, relating to their standard pulley-block, crane, runway and other manufactures.

MESSRS. ROSE BROS., 38 and 39, Beech Street, London, E.C.—Eight-page illustrated catalogue of electrical instruments made by the Compagnie F A.C. Da and Dutilh, of Paris, for whom the firm are sole British agents. Pocket, switchboard, and motor-car and lamp-testing instruments are shown and priced, also accumulator charging boards.

GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Illustrated and descriptive price leaflet of the "No-Cell" dynamo outfit for motor-cars, giving head-light illumination without accumulators.

BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—List No. 2,255 (8 pp.), giving full description and tabulated dimensions of their new type D.Q. continuous-current motors, ranging from 0·15 to 10 H.P.

THE WESTINGHOUSE COOPER HEWITT CO., LTD, 80, York Road, King's Cross, N.—New list of mercury vapour converters for transforming alternating to direct current, which are made up to 80 amperes at 250 volts, single and three-phase, and are guaranteed for stated periods.

THE ELECTRIC AND GENERAL WORKS, LTD., 15, Victoria Street, London, S.W.—Illustrated leaflet showing switches, circuit-breakers, motor control boxes, protective apparatus fuses, and other apparatus, of which they have a collection of samples on view at the above address.

ELECTRICAL SUPPLIES CO., 53, Victoria Street, London, S.W.—Folder giving prices of electric bells, which are made in a London factory.

MESSRS. ALFRED HERBERT, LTD., Coventry.—The firm's *Monthly Review* of modern machine shop practice for April contains a good deal of useful information, and includes an article on electrical machinery, written from the standpoint of the man who has charge of such plant.

Gears and Pinions.—MESSRS. SCHOLEY & CO., LTD., have received a contract for tool steel gears and pinions from the Croydon Corporation Tramways Department. They have also recently received large orders from the following:—

The Oerlikon Co. (L. & N.W. Railway electrification).
L.B. & S.C Railway.
East Ham Corporation Tramways.
Pretoria Municipality.
Colombo Electric Tramways & Lighting Co.
Johannesburg Municipality.
Auckland Electric Tramways Co.

Private Arrangements.—HARRY J. BOOKER, electrical engineer, 51, Tothill Street, Westminster, London, S.W.—A meeting of the creditors of the above was held on Monday at the offices of Mr. James Mortimer, accountant and auditor, 3, Pancras Lane, Cheapside, E C. Mr. P. Houstoun, who represented several of the creditors, was elected to the chair. The statement of affairs presented by Mr. Mortimer showed liabilities of £1,043. The indebtedness to the trade was £923, and the balance of £120 was due to Mr. J. Grevener for cash advanced. The assets consisted of cash at bank, £55; stock-in-trade £19, expected to produce £10; book debts £611, estimated to realise £580; and motor-car, £100. The assets therefore totalled £746, or a deficiency of £298. Mr. Mortimer stated that the debtor was seriously ill, and was at present at Yarmouth. Up to a recent date he had been in a Sanatorium, and had been in ill-health for some months. Owing to pressure by a creditor he consulted his solicitor, and it was then decided that an investigation should be made. The debtor gave instructions for the investigation, and said that if it was thought necessary the creditors should be called together. The debtor only started business in March of last year, and he then had a small capital, but he owed money to Mr. Grevener, and he probably only had an excess of assets over liabilities of about £15. The books had not been properly kept, but as far as could be seen the purchases had amounted to £2,245, while the sales had been £2,590. In answer to questions, Mr. Mortimer said that the debtor would not make any offer. But for the war the present position would not have arisen. The debtor dealt chiefly with German manufacturers, and he had not been able to get his supplies. Nevertheless, had it not been for his illness, the debtor would probably have made the business a success. After a short discussion it was unanimously decided that the estate should be dealt with under a deed of assignment, with Mr. G. E. Corfield, of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C., as trustee. The following are creditors:—

Adnil Electric Co.	£200	Barnes, F. J.	£85
Electric Power Eng. Co., Stechford	26	British Westinghouse Co. ..	80
Falk, Stadelmann & Co	24	Medway's Safety Lift Co. ..	10
General Cable Mfg. Co... ..	30	Midland Electric Co.	14
Hogan & Wardrop ..	40	Morris, P. D.	42
Imperial United Lamp Co. ..	137	Northern Electric Wire Co. ..	164
		Watlington & Co. . ..	11

FARDON & CARPENTER, LTD., electrical engineers, 4, Maidenhead Court, London, E.C.—A meeting of the creditors of the above was held last Friday at the offices of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C. Mr. G. E. Corfield, the liquidator of the company, presented a statement of affairs which showed liabilities of £621, of which £389 was due to the trade and £232 to "other creditors." The assets consisted of cash in hand £291, and book debts £105, estimated to realise £65. The assets thus totalled £356, or a deficiency as regarded the creditors of £265. It was reported that the company was registered on December 31st, 1913, with a nominal capital of £2,002, and that it took over the business of the Emerson Works. The company had issued debentures for about £300. Last October the debenture-holder appointed Mr. Carpenter as receiver and manager. He had since sold all the assets, paid off the debenture, and after deducting the costs and expenses there was a balance remaining of £291, which he had handed over to the liquidator. The "other creditors" referred to in the statement of affairs were principally in respect of claims by the directors under agreements with the company. The creditors decided to confirm the voluntary liquidation of the company, with Mr. Corfield as liquidator. The latter stated that it was a simple liquidation, and that as soon as the book debts had been collected a dividend would be paid.

Australia.—A Brisbane firm desires to secure agencies of British makers of engineering specialities, electric cranes, and other machinery requiring expert handling. Application should be made to the Board of Trade Commercial Intelligence Branch, in London.

Book Notices.—*First Principles of Production.* By J. T. Peddie. London: Longmans, Green & Co. Price 5s. net.—Herein the author essays a study of the first principles of production and the relation of science to industry and to evolve a basis for a new Imperialism—truly a formidable task, but one which he performs with a considerable measure of success. We take issue, however, with the very first sentence of his introduction, and much regret that such an unfortunate sentiment should be given such prominence. "At the conclusion of the great war," writes Mr. Peddie, "it will be necessary for the leaders of British industry and science to take stock of their positions." At the conclusion of the war it will be too late to do any such thing. The primary needs of the moment are well known, and they must not be neglected in the least degree, but amid all the stress and strain of turning out munitions of war on an unprecedented scale, our leaders of industry and science must find time to mend their ways of peace and see that our new industrial and commercial policies are in full working order on the first day of peace, wherever the war prevents their earlier application. The first day of peace will be the first day of an industrial war for which we must be prepared—for which we must now prepare—and the outstanding omission from Mr. Peddie's book is neglect to insist sufficiently on the need for instant action by every industrial leader and manufacturer, each in his own field. With Mr. Peddie's estimate of the evil effects on us of the reduced standard of wages and living in Germany after the war, we are in entire agreement. We suggest only that he over-estimates the advantage we have in the "breathing space now afforded us." In point of fact, we must rely on no period of grace.

Matters in which it is easy to agree with the author are the necessity for giving greater pecuniary support and recognition to science and scientists; the rank folly of splitting our industrial barque on the reefs of political interest and dogma; and the desirability of improving our technical education facilities, particularly in respect of really efficient commercial training. The short paper which gives its title to this volume represents a sound, general survey of the classes of our community and the factors going to make up cost of production; it is followed by a yet shorter paper (about 1,700 words) on "The State and Opportunity in Industry." An essay on Tariffs, Free Trade and Industry insists upon the indivisibility of tariff and free trade problems, and presents several fresh arguments on this hoary subject. In discussing the "Influence of Science on Political Economy," the author's chief point is that political economy must be adapted to and judged by the period to which it applies. We are given an interesting review of the past effects of invention, scientific developments and tariff changes on industrial expansion, but we seek in vain for any definite practical suggestions for present action. A paper on "Finance and Industry" points out the advantages, limitations and dangers of German banking policy, and we agree that industry must show that it is prepared to operate on efficient and truly scientific bases before it can receive satisfactory support from banks. This essay is followed by a brief compilation, laying emphasis on the importance of science in industry and presenting several striking instances of German methods and achievements. The remainder of the volume is chiefly devoted to reprints. The work is not indexed, and, though well worth reading, it does not unfold any organised, continuous policy for immediate application. Though much may be done by co-operation and State action in the near future, the immediate necessity is for reform along well-known lines by individual firms in details and ramifications of their methods and activities, which are known only to themselves, and can be set in order only by effort from within.

"*Bulletin* No. 77. Bureau of Mines." "The Electric Furnace in Metallurgical Work." "Fourth annual report of the Director of the Bureau of Mines," for the year ended June 30th, 1914. Washington: Government Printing Office.

"Wiring of Finished Buildings." By T. Croft. London: Hill Publishing Co. Price 8s. 4d. net.

"Business Methods and the War." By L. R. Dicksee. London: Cambridge University Press. Price 2s. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV. No. 4. April, 1915. New York: The Institute. Price $1.

"*Proceedings* of the Physical Society of London." Part XXVII. Part 3. April 15th, 1915. London: The *Electrician* Printing and Publishing Co. Price 4s. net.

"Science Abstracts." Sections A and B. Vol. XVIII, Part 4. April 26th, 1915. London: E. & F. N. Spon. Price 1s. 6d. each net.

The Truth about the Sino-Japanese "Conversations." London: The Chinese Students' Union

Dissolutions and Liquidations.—MESSRS. COOPER AND ROBERTS, electrical and engineering merchants, 8, Paul's Bakehouse Court, Godliman Street, London, E.C.—Messrs. J. N. Cooper and E. Roberts have dissolved partnership, the latter having joined the Army. Mr. Cooper is continuing the business under the same style, and will attend to all debts.

HOVE ELECTRIC LIGHTING CO., LTD.—A meeting will be held at Salisbury House, London Wall, E.C., on June 2nd, to hear an account of the winding up from the liquidator, Mr. F. R. Reeves.

COLNE AND TRAWDEN LIGHT RAILWAYS CO.—A meeting will be held on May 24th, at Albion Works, Armley Road, Leeds, to hear an account of the winding up from the liquidator, Mr. G. G. Davies.

THE ELECTROMOBILE CO., LTD.—A meeting will be held on May 31st, at Sardinia House, Kingsway, W.C., to hear an account of the winding up from the liquidator, Mr. S. Cole.

An Italian View of the Russian Market.—The Italian Consul General at Moscow reports as under on the mode of cultivating the Russian market:—"If there is a desire in Italy to successfully prosecute Russian trade from Moscow it behoves our manufacturers to set about the business seriously. Under the special circumstances ruling here it is needful that the representative in Moscow should possess the following qualifications:—(*a*) At least an approximate knowledge of Russian; a foreign tongue, even if it were French, would immediately be met with diffidence. Little sympathy is extended to a foreign tongue and its use can only eventuate in prejudicing a dealing. (*b*) The possession of ample funds for advertising and other expenses. (*a*) The possession not only of catalogues, but of a full range of samples, for the Muscovite merchant is averse to buying without the sight of samples. There are at Moscow a number of Italians and other foreigners who are in a position to take up such representation. It would be an illusion to consider that the conquest of this market is an easy matter, for Japan, on one hand, and England on the other, have already been very active, with the same object, since the outbreak of the war; and, moreover, are able to offer the following advantages:—(*a*) More easy and more direct transport: (*b*) greater credit facilities, for English and Japanese manufacturers and exporters are in the habit, in this extraordinary period, of granting facilities for payment, whereas Italian merchants are always obdurate and diffident; it should, however, be borne in mind that it is needful to risk something in the first transactions. Italian merchants should quote lower prices for orders from Russia than from other countries, as do both England and Japan. Italian manufacturers are certainly right in selling their products to the highest bidder, but the Muscovite is also right in refusing to buy from Italy an article at 10, which he can obtain from Japan and England at 9. While, therefore, continuing to sell to other countries at 10, our manufacturers should examine the question, and see if it is not worth while selling at Moscow at 9, bearing in mind that the Muscovite market, with its infinite and insatiable hinterland in Europe and in Asia, and a yearly trade movement of 5 milliards of francs, will always continue to buy, even when the war is ended. This certainty is a subject worthy of our greatest attention."

Bankruptcy Proceedings. — JAMES PROCTOR KYD CLARK, lately trading as an electrical and mechanical engineer, at Hythe Road, Willesden Junction, N.W., under the style of George Driver & Son.—The public examination was held last week before Mr. Registrar Hood, at the London Bankruptcy Court. The debtor applied to pass upon accounts showing total liabilities £2,167 (unsecured £222), and assets *nil*. Replying to Mr. Daniel Williams, Official Receiver, the debtor stated that having previously been in employment, he, in 1895, became a partner with two other persons in the business of electrical and mechanical engineers carried on at Euston Road by Mr. G. H. Driver, an inventor. Witness put in £500 capital upon being admitted a partner. During 1900 Mr. Fladgate, one of the partners, retired from the business, upon an undertaking that the remaining partners should pay him 5 per cent. interest on £1,500 capital which he had left in the firm. In the previous year the business had been removed to Willesden Junction. It was part of the arrangement with Mr. Fladgate that in the event of the interest falling three months in arrear the principal amount was to become recoverable, and that in the event of Mr. Fladgate's death the interest should be paid to his sister during her lifetime. Mr. Driver, the other partner, died in November, 1903, his capital being then agreed at £1,600, which witness paid to the representatives of the deceased, giving them at the same time a release from any possible claim in respect of the Fladgate liability. Witness further arranged with the latter gentleman to pay off one-half of the said £1,500 by instalments, and to continue the payment of interest on the other half. He had only paid, however, £250 off the principal amount, but continued the business alone until November, 1914, when, owing to lack of capital and pressure by creditors, he transferred it, as from September 30th, 1914, to his manager. Generally speaking, it had been a successful business, and the balance-sheet for the year ended March, 1914, showed a profit of £1,400. It, however, suffered by the lapse of patents and heavy competition. The debtor was examined at considerable length with reference to the disposal of his business, and was asked whether he did not get rid of it in order to defeat a judgment creditor. He asserted that his chief reason was that he was anxious to get into the motor-boat service and go to sea, but he frankly admitted that the result of the transaction was to leave the judgment creditor entirely out in the cold. The examination was concluded.

The Prentice "Lightning" Cooker.—THE ARMORDUCT MANUFACTURING CO., LTD., ask us to state that owing to certain rearrangements which are being made at their Witton Works, they have decided to relinquish the manufacture of Mr. Napier Prentice's "Lightning" cooker, for which they held the sole licence. They state that other engagements prevent them from doing justice to Mr. Prentice's interests in the development of the cooker at present, and they understand that Mr. Prentice will be making arrangements for the manufacture of the cooker by some other firm.

Denmark.—A Copenhagen merchant wants agencies for British makers of electrical fittings and accessories, insulators, meters, dynamos, small motors, fans, pumps, &c. Application should be made to the Board of Trade C.I. Branch in London.

Trade Announcements.—The British Electric Transformer Co., Ltd., have now closed their offices and showrooms at Charing Cross House, 29a, Charing Cross Road, London, W.C., and all further communications should be sent to them direct at Hayes, Middlesex. Telegraphic address: Transfundo, Hayes, Middlesex. Telephones 226 Ealing, 101 Southall; 12 Hayes (local calls).

The Century Electric Co., of St. Louis, U.S.A., informs us that it has increased its capital stock (fully paid) to £200,000, to enable it to more readily care for the rapidly increasing demand for its products.

The Equipment and Engineering Co., of Westinghouse Building, Norfolk Street, Strand, W.C., announce that their new telephone number is "City 1088" (two lines).

The Kingolite Co., Ltd., of Pyke House, Oxford Street, and Soho Square, W. (of which Mr. William J. Owen is managing director), have disposed of their business in electrical accessories and silk shades to the Edison & Swan United Electric Light Co., Ltd. The Kingolite Co.'s Works, together with practically the whole staff, have been transferred to Ponder's End, while Mr. Owen, having accepted a position with the Edison & Swan Co., continues to superintend the business he has been instrumental in establishing.

Messrs. Garnish, Lemon & Co., Ltd., of 12, Pilton Street, Barnstaple, have taken over the business of Mr. C. W. Cockram, electrical engineer, 112, Bontport Street, Barnstaple, and have appointed Mr. Cockram as manager.

The B.E.A.M.A.—The following firms have recently been elected members of the B.E.A.M.A.:—The Mirrlees Watson Co., Ltd.; John Musgrave & Sons (1913), Ltd.; Newton Bros., Derby; Isaac Storey & Sons, Ltd., Branch of United Brassfounders and Engineers, Ltd.

LIGHTING and POWER NOTES.

Aldershot.—Proposed Loans.—The L.G.B. having intimated to the U.D.C., which had applied for a loan of £8,500 for electricity purposes, that no loans were being granted except in cases of pressing necessity, the Council has decided to point out that the work needed is pressing, as current is being supplied to firms engaged on army contracts. Tenders received for additional plant have been referred to the Lighting Committee.

Argentina.—The Compania Italo-Argentina de Electricidad recently inaugurated its No. 2 power house, situated in Calle Tres Sargentos. The new station now serves the important area comprised between Callao, Avenida de Mayo and Paseo de Julio. The Tres Sargentos power station is the largest of the numerous minor stations. It has a capacity of 8,000 to 10,000 h.p. The third station, situated at Calle Balcarce 547, will be opened to public service in a few weeks. These three stations, in conjunction with three others in construction and with the large central power station in the Boca, will enable this company to meet all demands in the central part of the city.—*Review of River Plate.*

Blackpool.—Year's Working.—The total income of the electricity department for the year just ended was £47,326, an increase of £2,330; and working expenses amounted to £24,066, while interest and sinking fund charges came to £14,761. The profit was £8,499, or over £1,000 more than a year ago. During the coming year it is expected to make a profit of about £5,000. There are 2,870 consumers, the new customers during the year numbering 409.

Bolton.—L.G.B. Inquiry.—An inquiry was held on April 22nd into an application to borrow £45,032 for the electricity undertaking. The first part of the inquiry related to £23,032 for converter and other plant, necessary in order that full benefit might be obtained from the new works at Back-o'-th'-Bank. It was explained that there were four systems of supply at Spa Road works, requiring different plant for each, and the cost of generating would be substantially reduced if the whole supply could be generated by one plant. The Committee proposed, therefore, to transfer generation from Spa Road to Back-o'-th'-Bank, and by altering the system of distribution the department would be saved £8,714 per annum. The Town Clerk intimated that the Corporation had suspended other works on capital and revenue account to the extent of something like £275,000, in order to comply with the requirements of the Board and the Treasury.

The other part of the inquiry related to £5,000 for the equipment of sub-stations on consumers' premises, and £17,000 for mains. There was no opposition.

Buckhurst Hill.—Prov. Order.—The County of London Electric Supply Co. has informed the local authority that it has decided not to proceed with the application for a prov. order for E.L. at Buckhurst Hill, Woodford, Wanstead and Chigwell.

Bury.—The Corporation Electricity Committee was informed last week that while excavations were being made for the foundation of the retaining wall in connection with the Chamber Hall electricity works extensions, a seam of coal had been discovered, and that some tons of coal had been obtained and used at the works.

Cahirciveen.—E.L. Scheme.—In connection with the electric lighting scheme, Mr. W. J. U. Sowter, of Bray, has been instructed to report on the plans and specifications submitted by the Ampere Electric Lighting Co. Application has been made to the Irish Congested District Board for permission to build the power house and works; as soon as this is granted and the plans approved the work will be proceeded with.

Castlewellan.—Street Lighting.—The *Belfast News Letter* of April 23rd states that at a meeting held on April 22nd it was decided to accept the proposal of the Irish Town Lighting Co. to generate and supply electricity for 40 street lamps, at £40 per annum.

Chile.—The electric light company of Santiago recently informed the municipality that unless its debt of $1,500,000 for electric light was paid, the contract will be annulled.—*Review of the River Plate.*

Clacton-on-Sea.—L.G.B. Inquiry.—An inquiry was held last week into the application of the U.D.C. for a loan of £1,300 for a new battery at the electricity works. The engineer reported that to keep the old battery in its present condition would cost from £100 to £150 a year. The Council, it was stated, had contracted with the D.P. Battery Co. for a new battery at a cost of £1,690, with an estimated allowance of £429 for old material, and the work had been commenced in anticipation of a loan being sanctioned. There was no opposition.

Continental.—Russia.—The Russian journal *La Cause Municipale* has recently made an inquiry into the electric installation schemes projected in the various Russian towns and cities. It appears that electric lighting installations are contemplated in the following municipal areas:—Armiansk, Atcbinsk, Bobronysk, Borovitchi, Borzna, Chadrinsk, Gorodok, Jakobstad, Jamburg, Jaransk, Jenisseysk, Kamychlov, Kinechma (concession), Krasnokoutsk, Kobelaki, Kolomna, Korotcha, Koustanai (concession), Lenkoran, Neavige; Novgorod, Novo-Alexandrovsk Ossa, Ostrov, Penza, Poltava (new station), Pronsk, Soroki, Starobelsk, Sheslitamak, Svüajsk, Taganrog, Toipsé, Zadonsk and Zolsnocha. Enlargement of central stations are contemplated in the following:—Balaclava, Lipetzk, Oskol, Sorimy, Tchernigov, Tiflis, Ariev (Government of Lifland), Viatka and Vologdu.

Electric tramway installations are projected in the following places:—Bacou, Jalta, Congansk (concession), Kontais, Osmsk, Orenburg, Ouman, Penza, Poltava, Samarkand (concession), Tambov, Tomsk and Varonege. Lastly, extensions of electric tramway networks are under way at Odessa, Rostov on the Don, and Vladivostok. The redemption of an electric tramway and lighting installation in Smolensk has been decided upon, to be given effect to in the course of the current year. The redemption of the tramway alone is contemplated at Tiflis. At Ivanovo-Voznessensk the building of a generating station has been begun.

The *Pyatigorsk Echo* says that the Lighting Committee of the town has signed a contract for the construction of an electric station, the work to begin this spring.

The District Government of Vladikavkaz has asked for a portion of land to be set apart for the purpose of constructing an electric station.

Coventry.—Plant Extensions.—The Electricity Committee recommends that a spare stator and spare motor be obtained for use in connection with the turbo-alternators at the electricity works, at an estimated cost of £1,658, and that certain property in Stoneleigh Terrace be purchased for the purposes of a substation, at a cost of £200. Both amounts are to be paid out of revenue.—*Midland Daily Telegraph.*

Dalkey.—Proposed E.L.—The Urban Council has, says the *Freeman's Journal*, been informed that the Kingstown Council, under its Electric Lighting Order, would be in a position to supply electric light to the township, and has referred the matter to a Committee for report.

Dover.—New Plant.—The town clerk has reported to the Electricity Committee that he believed that the L.G.B. was satisfied with the Corporation's application for a loan of £6,000 for new plant, and the engineer was instructed to obtain tenders as soon as the sanction was received. The estimated value (£1,000) of the sets to be superseded will have to be paid out of revenue, spread over three years. "Public service" badges are to be provided for the staff at the works.

Dublin.—The Electricity Supply Committee has purchased 20,000 pairs of carbons for the old type of city arc lamps, also supplies of various carbons for the flame arc lamps, which will keep the city lighting adequately maintained until the end of October next.

East Grinstead.—Prov. Order.—It is understood that the B. of T. will grant the application of the U.D.C. for a prov. order for E.L., but only for a date to be fixed at the end of the war.

Falkirk.—On account of the extra expenditure on coal, &c., the Corporation has increased the charges for electric current by about 30 per cent. Reference was made at a meeting of the T.C. to the fine spirit shown by firms who had contracts with the electricity department, and who had agreed without demur to pay the increased charges when they might have interpreted the contracts in the strictest sense.

Heywood.—Year's Working.—On the past year's working of the electricity undertaking there was a loss of £927, against £4,610 in the previous year. To cover this, and a loss of £1,042 on the tramways, the department has decided to ask for a sum equal to a rate of 6d. in the £.

Huddersfield.—Wages.—At a meeting of the Electricity Committee consideration was given to an application by the Municipal Employes' Association for an increase in wages of 2s. per week, and it was resolved that the Association be informed that a rise of 2s. was given to employés in January last, and that the wages of the enginemen and firers be increased ½d. per hour as from the date of the meeting. The Committee, after consideration of the electrical engineer's report as to minimum charges for energy, decided that the minimum charge for energy supplied, including meter rent, should be 10s. per half year. The Committee also resolved that for the present no alteration should be made in the charges for arc lamps.

Hull.—Loan Sanction.—The T.C. has received the sanction of the L.G.B. to a loan of £27,300 for the purchase of new generating plant already installed. The Electricity Committee, owing to the stopping of capital expenditure, has decided to temporarily stop the hiring out of motors, but new services will still be connected, and the cost met out of revenue.

India.—According to the *Indian Textile Journal*, the equipment of the Karachi Electric Supply Corporation's station, which was recently opened, consists of a 100-h.p. and two 240-h.p. Mirrlees Diesel engines, coupled to Crompton dynamos, and working in conjunction with a 276-cell Tudor battery, and Crompton boosters. For balancing, two C.M.B. balancers are installed. The supply is on the three-wire system at 440-220 volts, and is given by overhead mains of stranded copper carried on steel poles. The mains work was carried out by Messrs. Henley.

Keighley.—The Morton P.C. has passed a resolution deploring the action of the Keighley R.D.C. in granting the Keighley Corporation the privilege of supplying electricity to the Morton Banks portion of the rural district, believing that such action would result in Morton Banks being absorbed into the borough. It was stated that at Morton Banks 214 of the 310 ratepayers, and in Morton 250 out of 330 ratepayers had signed a petition against the supply of electricity by the Corporation.

Kingstown.—The U.D.C. has received a report from its law agent to the effect that a deed of transfer had been executed of the Dublin and Southern District Electric Supply Co.'s rights and property in a prov. order for electric lighting, to the Kingstown U.D.C. The report stated that the company had received all moneys payable in connection therewith, except the amount claimed as arbitration costs, which would be paid when taxed.—*Freeman's Journal.*

Leeds.—Restricted Lighting.—Further restrictions of lighting have been put into operation by the authorities. Both gas and electric lighting in the streets are to be extinguished each night at 11.30, with the exception of Saturday, when the lights will be allowed to remain on until midnight. Should any hostile airships be reported as approaching the city, all lighting will be cut off, no matter what the hour may be.

London.—L.C.C.—The Finance Committee reports that from information supplied by the Woolwich B.C. with its application for sanction to the borrowing of £48,000 for its electricity undertaking, it transpires that the 650-kw. plant at the Plumstead station, of which the B.C. entered into an agreement to expedite the repayment of the outstanding debt, will be retained for use as stand-by plant. The general position appears to be that none of the older plant at the Woolwich and Plumstead stations can at present be regarded as obsolete, as the B.C. is now making use of all its plant, except certain plant at Plumstead, to the amount of 450 kw., for which the boiler power is not available, and that all the older plant, both at Plumstead and Globe Lane, will more or less be "stand-by" plant when all the new plant is in working order. This being so, the Committee recommends that the acceleration of payments shall be annulled, and the original terms of repayment revived on the understanding that the outstanding debt on the plant in question shall be repaid as soon as the plant becomes obsolete.

The Highways Committee has approved agreements proposed to be entered into for a reciprocal supply of electricity between the Woolwich B.C., the South Metropolitan Electric Light and Power Co., Ltd., and the West Kent Electric Co., Ltd.

The number of electric pressure stations required by the Council to be established by supply authorities is 154, and 114 are actually established. The whole of the County Council areas of supply, except the areas of the Chelsea Co. and St. Pancras B.C., where the Council's inspectors have no jurisdiction, have been dealt with.

Lewisham.—Subject to legal approval of an agreement, the B. of G. has decided to allow the South Metropolitan E.L. and P. Co. to increase its charge for current by 10 per cent. on grounds arising out of the war, this to be without prejudice to the present contract. With this increase the Board will pay less than 2¼d. per unit for current for lighting, and for power less than 1¼d.

Woolwich.—The B.C. has decided, owing to the increased cost of coal, temporarily to increase the price of energy by ½d. per unit.

Shoreditch.—The Electricity Committee reports having received an offer from a company, which is interested in the supply of oil for fuel purposes, to carry out experiments in the burning of oil fuel in one of the boilers at Whiston Street station, and to supply, free of charge, half the quantity of oil consumed, and also to supply the necessary apparatus. The Committee has accepted the offer.

Hornsey.—In view of the L.G.B.'s order curtailing the expenditure of local governing authorities, the T.C. has inquired of the contractors supplying machinery, cable, &c., whether it is possible to stop further progress on works contracted for, and to postpone completion of the contracts for the present.

Poplar.—The report of the Electricity Committee, referred to on p. 474, recommending a reduction of electric lighting charges, and proposing a profit-sharing scheme, has been adopted by the B.C., with one amendment relating to the transfer of money to the borough fund.

Manchester.—Year's Working.—The gross income of the electricity department from all sources during the year just closed was £543,305, compared with £513,589 in the previous year. The net surplus, after meeting abnormal expenses of £12,266, war allowances to 275 employés with the Colours £6,015, additional income-tax £3,287, and Parliamentary expenses *re* Local Act £2,964, was £35,850, against £36,006 in the previous year; £30,000 is to be contributed to rate relief. In the year just commenced it is estimated that sales will increase by about 9 million units. Last year nearly 10 million more units were sold, raising the total to nearly 128 million units. In view of various factors the question of a slight revision of charges is to be considered.

Mansfield.—Camp Lighting.—The L.G.B. has informed the T.C. with reference to the Council's application for sanction to a loan of £2,000 for the provision of transforming and converting plant in connection with the electricity undertaking, for the supply of energy to the Clipstone military camp, that, in the circumstances, it has no objection to orders for the necessary plant and cables being placed at once.

Portuguese West Africa.—The British electric supply company in Angola is completing a hydro-electric plant on the Catumbella River. A 23-mile 20,000-volt transmission line will connect the new plant with the three largest towns. For current supplied to private parties the company charges 50 cents per kw.-hour for light and 11 cents for power.—*Indian Textile Journal.*

Ripon.—Loan not Sanctioned.—The Treasury has declined to approve the proposed raising of a loan of £12,000 by the Ripon Corporation for electricity works.

Rochdale.—Year's Working.—The profit on the electricity undertaking for 1914 was £1,523, against a loss of £330 in the previous year. The total receipts amounted to £33,553, against £30,471, and the working expenses were £18,279, against £20,492, leaving a gross profit of £15,274. Interest and sinking fund charges amounted to £13,751, an increase of £3,441. Capital expenditure during the year was £50,749, bringing the capital account up to £208,951. The department is asked to contribute £1,500 for rate relief.

Mill Driving.—The new mills of the Tyre Yarns, Ltd., and Fabric Weavers, Ltd., are the first cotton mills in Rochdale in which electricity is used for motive power and light throughout. Electricity is obtained from the Corporation, two new mains having been laid to the mills. When fully working the mills will take about 2,000 h.p., though this may be increased. The electricity is received at 6,000 volts and transformed to 400 volts. There are 1,500 lamps in the mills. The electrical work has been carried out by Mr. G. L. Adamson, of Ohm Works, Rochdale.

Runcorn.—At a meeting of the R.D.C. last week, it was reported that a conference had taken place at the B. of T. offices in London respecting the proposed Warrington Electric Lighting Order. An official of the Board intimated that an extension must be made by Warrington towards the parish of Latchford Without, and, further, that the terms of supply in the area of the R.D.C. should be the same as for consumers in the borough.

Selby.—E.L. Scheme.—The U.D.C. has accepted the offer of the Electrical Distribution of Yorkshire, Ltd., to give an option to purchase as a going concern the proposed works in the urban district at the end of 21 years, or, failing this, at the end of 28 or 35 years.

Walthamstow.—Loan Sanction.—The U.D.C. has received sanction to borrow £6,986 for the installation of new plant at the electricity works.

Warwickshire.—In view of the increasing use of electricity in collieries, the Warwickshire Education Committee has instructed the Mining Lecturer to report as to the probable cost of suitable electrical equipment for instruction at the Mining School.

TRAMWAY and RAILWAY NOTES.

Belfast.—Year's Working.—The annual report on the financial working of the Council's tramway system shows that the total revenue up to March 31st last was £270,237, and the working expenses £153,378, leaving a profit of £116,858. The net profit was £52,033, as compared with £51,257 in the previous year. The declaration of war seriously affected the receipts, the loss being estimated at about £21,000 since August last. The amount which was paid to war dependents was £3,058, and the number of men who had volunteered for the war was 150.

Blackpool.—Year's Working.—The income of the Corporation tramways for the past year amounted to £76,105, against £84,797 for the previous year. The total working expenses were £44,850, against £43,487 in 1913-14. Thus the gross balance was £31,255, as against the previous year's £41,310. The balance for disposal amounts to £13,737, against the previous year's £24,552. Mr. Furness (the engineer) laid before his Committee figures showing the effect of the war upon municipal tramway undertakings in 18 towns. These showed Blackpool to have suffered more than any, the decrease in receipts being 13 per cent., compared with 8 per cent. at Accrington, 5½ per cent. at Salford, 4 per cent. at Blackburn, 3½ per cent. at Birkenhead, 3 per cent. at Wigan, 2¾ per cent. at Oldham and Hull, 2½ per cent. at Warrington, 2 per cent. at Bournemouth, ½ per cent. at Brighton. &c. Three places showed increases—Newcastle-on-Tyne 12¼ per cent., Birmingham 1¾ per cent., and Sheffield 3 per cent.

Bradford.—The Tramways Committee has drawn the attention of the Street, Drainage and Works Committee to the dusty state of the streets and roads used for the railless service, and to the fact that unless the conditions could be improved there would be a suspension of the service. The latter Committee has replied that the work of improving the state of the thoroughfares concerned would be proceeded with in the ordinary way. The question which now remains is as to whether the "ordinary way" of dealing with the streets and roads will satisfy the requirements of the Tramways Committee.

Bury.—Year's Working.—The tramways last year made a net profit of £8,472, to which should be added £897, paid in respect of men on active service. The same sum as last year—£5,000—will go to the relief of the borough rate. The profit on the Radcliffe section was £318.

Canary Islands.—The concession for the electric tramway in San Cristobel de la Laguna has been awarded to the Sociedad de Tranvias Electricos de Teneriffe.—*Board of Trade Journal.*

Cardiff.—Female Conductors.—Several women started work as conductors of tramcars on Thursday last week. In two days over 200 women offered to serve.

The tramway men, at a meeting on Sunday, passed resolutions protesting against the employment of females as conductors, declaring that plenty of males ineligible for military service were available.

Continental.—Switzerland.—The Swiss Federal Railways Administration has decided to construct a hydro-electric station at Massaboden, near Brigue, to supply current for the working of the Simplon line. The new station will replace the provisional station built at the northern entrance of the tunnel. The equipment will comprise two 5,500-H.P. Piccard and Picket turbines, running at 500 R.P.M., under a fall of 43 metres, with automatic regulators and other modern accessories.

East Ham.—The engineer and manager of the Corporation tramway department has drawn up a report on the rolling stock at his disposal, showing the necessity for modernising the equipment of the existing cars, in order to reduce the present excessive maintenance, and the purchase of additional cars in order to cope with traffic requirements. The Tramways Committee recommends that, as an experiment, one of the cars be fitted with a new type of equipment with 40-H.P. motors and new controllers, at a cost of £275. The question of the purchase of additional cars has been deferred.

Glasgow.—The special Sub-Committee of the Tramways on depreciation has had before it an abstract statement of the revenue and expenditure for the year to May 31st, 1914, showing a surplus of £53,892, with estimated figures for the year to May 31st, 1915, showing an estimated deficit of £31,017, and has agreed to recommend that allowances for depreciation be made in the accounts for the current financial year, as undernoted:—

	Year to May 31st, 1914.	Year to May 31st, 1915.
Permanent way	£440 per mile	£350 per mile
Elec. equipment of line ...	Av., 4·3 p.c.	Av., 2·9 p.c.
Buildings and fixtures ...	2½ „	2½ „
Power plant...	7·1 „	5 „
Workshop plant	7½ „	5 „
Cars	Av., 9½ „	Av., 8·2 „
Elec. equipment of cars ...	7½ „	6 „
Other rolling stock... ...	Av., 16·4 „	Av., 16·4 „
Misc. equipment	7½ „	5 „

The Sub-Committee on Finance has continued consideration of the report, as also a suggestion that a sum of £20,000 be taken from the reserve fund—which amounts to £38,069—and paid over to the common good fund of the city. The following information was also submitted:—Capital expenditure as at May 31st, 1914, £3,675,317 0s. 8d.; total amount at credit of renewals and depreciation as at May 31st, 1914, £2,158,738 18s. 6d.; amount set aside to meet renewals and depreciation for year to May 31st, 1914, £212,642 3s. 8d.; amount proposed for renewals and depreciation for year to May 31st, 1915, at suggested rates, £172,282 16s. 3d.; proposed reduction in renewals and depreciation for year to May 31st, 1915, £40,359 7s. 5d.

War Expenses.—A return, showing the extra expenditure incurred by the tramway department up to April 10th as a result of the war, has been prepared by the general manager. The total expenditure was £35,384, apportioned as follows:—Allowances to dependants, £30,360; car tokens to military and special constables, £4,308; special car, £241; pipe bands and drums for 15th Highland Light Infantry, £300; use of flare lamps, &c, £173. It is estimated that the total expenditure under the above headings to the end of the financial year on May 31st will amount to about £45,000.

The tramway system was brought to a complete stoppage for a short time on Thursday last week, through a workman having driven his pick into a high-tension cable near Parkston power station.

Huddersfield.—The T.C. has decided that the time is not now opportune for consideration of the extension of the tramway system to Lepton and Kirkheaton. The Committee has decided that a war bonus be paid in accordance with the resolution of the Council, based on the men's actual earnings per week as taken from the wage book, and that time and a quarter be paid to the spare men after 5 p.m. on Saturdays after they have worked eight hours.

Leeds.—War Bonuses.—The tramway men have considered the offer of the authorities in respect of the payment of a war bonus, and have written expressing the view that the concessions offered are insufficient. The men state that the grant only amounts, in the majority of cases, to 1s. a week.

London.—L.C.C. Tramway Receipts.—The total traffic receipts for the year ended March 31st, 1915, were £2,323,053 from lines worked by electric traction, and £10,261 from lines worked by horse traction, a total of £2,333,314. The receipts for the previous year under the same heads were £2,181,344, £21,146 and £2,202,490 respectively. The total car-miles run were 52,224,529, and the number of passengers carried 534,793,356. During the year ended December 31st, 1913, the number of fatal accidents caused by the working of the electric tramways was 37, while the number during 1914 was 25; during last year Sunday was the day on which most fatal accidents occurred, the number on this day was 6, or nearly 25 per cent. of the total.

The Highways Committee reports that the London Electric Supply Corporation has intimated that owing to the considerable increase in the price of coal and labour it will be compelled to raise its price for power supplied to the tramways. The Committee has agreed that as from March 3rd, 1915, the rate to be paid by the Council shall be ·4d. a unit plus £3 a KW. per year for power supplied, but if only a stand-by supply is required, the charge is to be at the rate of £2 a KW. a year.

Manchester.—A meeting of the tramway workers has passed a resolution calling on the Tramway Committee to grant increased wages to all employés receiving up to 40s. per week, instead of the present limit of under 30s. per week.

Newcastle-on-Tyne.—Extensions Deferred.—The Longbenton U D C. has consented to the postponement of construction of the tramway from the city boundary to Longbenton, authorised by the Corporation Act of 1914, as a result of representations by the B. of T.

With reference to the differences between the T.C. and tramwaymen in regard to wages, it is understood that the matter may be referred to arbitration.

Rawtenstall.—Halfpenny Fares.—As an experiment halfpenny fares are to be charged on the Water section of the tramway from Monday to Friday in each week. The experiment will be tried for three months.

Rochdale.—Year's Working.—The working of the Corporation tramways last year, resulted in a net surplus of £4,284, which is £4,205 less than a year ago and £3,939 less than two years ago. The fall is due mainly to extra repairs to permanent way and cars, increased wages, increased income-tax, current, and allowances to men on active service. Total traffic revenue amounted to £83,401, and working expenses to £46,891. The Committee has asked that the surplus of £4,284 should go to reserve and renewals account in view of the heavy commitments that face the department.

Salford.—The *Manchester Evening News* recently stated that, owing to the war, the Corporation tramway undertaking is being worked at a heavy loss, and that in order to increase the revenue it is proposed to abolish workmen's tickets and to withdraw concessions granted to the travelling public a year ago—concessions in the shape of extensions of stages.

South Africa.—Electric Vehicles.—The State Railway authorities have lately taken delivery of a fleet of nine electric motor-lorries, constructed by the General Vehicle Co., of New York; the vehicles are being used in the Cape Town district.

Southport.—The number of men from the tramway department who have enlisted is 34 out of 88. One clerk, nine conductors and one motorman left to join the army on Saturday.

Wigan.—War Bonuses.—By a majority of nearly two to one, Wigan tramway men have declined to accept the Coporation's war bonus offer of 2s. per head to men earning less than 35s. a week. The result of the ballot will be communicated to the Tramways Committee.

York.—The Special Committee that has been considering the works involving capital expenditure which could be held over till after the war, has decided that the Hull Road tramways extension and the extension of the electric mains to Strensall. Poppleton, and Naburn, and the provision of cooling-tanks at the electricity works, are essential, and their abandonment would involve the city in heavy financial loss.

TELEGRAPH and TELEPHONE NOTES.

Hong-Kong.—The American Consul reports that the expert from England who is to superintend the erection of the wireless installation arrived in Hong-Kong early this year. The proposed range has been increased to 500-700 miles by day and 1,300 miles or more by night under normal conditions, and the plant is expected to be in operation within five months. The inauguration of this service has some additional importance in view of the fact that the large wireless stations of the Chinese Government at Canton and Woosung, near Shanghai, are now working, and those at Foochow and Hankow will be completed by the time the Hong-Kong station is in working order. The service of the two Chinese stations now ready was commenced at the beginning of the year. They cover substantially the same radius as the Hong-Kong station, the plants thus being able to exchange messages with each other as well as with all ships in Chinese waters. A typhoon warning service was one of the first features adopted by the new system.

All these coast stations are of the same construction. The oscillating power in the antennæ is 5 kw. The stations are manned by a Chinese staff trained by foreign experts in the Peking College of Communications. The Woosung station has been opened for day and night service, and the Canton station is open from 8 a.m. to 10 p.m. The stations are supervised by managers with six to eight years' practical experience in wireless work. The charges are 5d. per word, with a minimum per telegram of 4s. 2d.

Illicit Wireless Apparatus. — William Thompson, described as a labourer, was charged with having in his possession wireless telegraph apparatus without the consent of the Postmaster-General at Blyth, on the 25th inst. A Post Office expert said that the apparatus could transmit messages over a radius of 5 miles under favourable circumstances. The defendant stated that he had made electrical experiments a hobby. He was not using the apparatus as a wireless telegraph instrument; the major part was used in developing the idea of steering ships at sea from the shore. He was experimenting on this subject with a model yacht on Ridley Park lake. A second charge of stealing 26 lb. of brass was also preferred against Thompson. The defendant had taken the brass to help him in his electrical experiments. The defendant was sent to prison for six months in the second division on the first charge and for one month on the second charge, also in the second division, the terms to run concurrently.—*Morning Post.*

Libya.—The American Consul at Tripoli reports that under the Ottoman *régime* land telegraphs were considerably developed in what is now the Italian Colony of Libya, 3,150 miles of wire being in existence at the end of 1910. During the war practically the entire telegraph system was destroyed, but there is now a permanent system, extending along the coast for more than 370 miles, and inland over a zone about 55 miles wide, with a total length of 870 miles of wire, with 24 telegraph and six telephone stations. Tripoli, the metropolis of the Colony, is still without telephonic communication for civil purposes. Some months ago several private firms applied to the Minister of the Colonies for a concession to install and operate a system, and on September 30th, 1914, a Commission appointed from Rome was charged with examining the question, but no pronouncement as to its findings has been made public. A system is maintained for Government needs. Before the Italian advent there was no wireless equipment in this district, but after they landed 12 installations were set up to replace the dismantled telegraphs. The instruments are Marconi, and the type most used is the 1·5-kw. musical spark station, which, designed for car transport, has been adapted for carriage by camel. Eventually all the telegraph lines destroyed will be rebuilt and others provided, but, being State owned and entirely constructed by State engineers, supplies will not be purchased locally but requisitioned through Rome. Firms interested in such articles who desire to enter this field should have agents in Italy in a position to interest officials charged with the purchase of telegraphic materials.

Russia.—Since the opening of the war the number of applicants for fresh telephones in Petrograd has fallen away by 50 per cent., and over 900 apparatus have been taken away from old subscribers.

Telephone Repeaters.—Writing to the *Electrical World*, the President of the De Forest Radio Telephone and Telegraph Co. states that the trans-Continental telephone system, New York—San Francisco, was made possible by the use of the De Forest "Audion" amplifier as a telephone relay. There are three audion repeater stations in the line.

The *Telegraph and Telephone Age* states that the De Forest Co. has recently developed an audion amplifier or audiphone, which is designed to relay or amplify minute pulsating or alternating electrical impulses from five times to 600 times their original intensity, without lag or distortion. It is stated that the wire telephone and telegraph rights have been acquired by the American Telephone and Telegraph Co.

The Telegraph Service.—At a special Conference of the Telegraphs Section of the Postal and Telegraph Clerks' Association, at Birmingham, on the 23rd inst., to consider the possible effects of the introduction of machine telegraphy, a resolution was adopted declaring that the introduction of typists and other telegraphically unskilled persons in any of the operations of telegraphic communication was an infringement of Trade Union principles. Another resolution was carried suggesting that it should be reported to the Parliamentary Committee of the Trade Union Congress that the Department was taking advantage of the war situation to employ typists at low wages on work hitherto done by telegraphists.

The Government has declined to grant a war bonus to postal employés with salaries below £210 per annum, having decided that the rise in the cost of living is not by itself a sufficient reason, at the present time, for increasing the wages of the employés.

United States.—New York.—The New York Telephone Co. has accepted an order of the Public Service Commission reducing the telephone tariff throughout the city; the new rates will come into force on July 1st, and are estimated to save the public $2 700,000 a year. The minimum charge for business and residence telephones will be 5 cents a call; and the cost of calls will depend upon the distance between the stations, the city being divided into 10 zones.

It is reported that the Telefunken wireless station at Sayville, Long Island, is being increased in power from 35 to 100 kw., so that communication can be continually maintained with Nauen in Germany.

San Francisco Exposition.—When President Wilson opened the Panama-Pacific Exposition by closing an electric circuit at the White House on February 20th, the signal was carried over a telegraph wire to the radio station at Tuckerton, N.J., which is operated by the United States Navy department. At Tuckerton the signal automatically operated a relay which set electric waves into action and the wireless signal was instantly received at the Tower of Jewels on the fair grounds at San Francisco, causing another relay to operate. The latter relay closed circuits throughout the grounds, and on receipt of the signal the main door of the Machinery Hall was opened, and the "Fountain of Energy" at once began to play. The wireless apparatus employed was that of the Federal Telegraph Co., of San Francisco, which uses the Poulsen system.—*Telegraph and Telephone Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot. — May 4th. Steam and other pipework; water-softening plant. See "Official Notices" March 26th.

Australia.—Melbourne.—May 18th. Four 250-k.v.a. three-phase transformers; 9,680 yards ·05 sq. in., three-core, lead-covered cable, for the City Council. See "Official Notices" to-day.

May 19th. Victorian Railways. Meters, coasting recorders or other energy-checking devices for train operation on the multiple-unit system, d.c., 1,500 v. See "Official Notices" to-day.

June 15th. City Council. Four mechanically-fired boilers, one turbine-driven boiler-feed pump, two fuel economisers, circulating water pumps. City Electrical Engineer. Specifications from Messrs. McIlwraith, McEacharn & Co., Ltd., London, E.C.

Sydney.—June 16th. Deputy P.M.G. 400 Morse sounders, American pony pattern. (Schedule No. 119.)

July 19th. Municipal Council. One or two 12,000-kw. turbo-alternators (Contract No. 363).* A copy of the specification can be obtained from the City Electrical Engineer, Sydney.

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Halifax.—May 7th. Coal for a year, for the Corporation Electricity Works (10,000 tons of pea slack or screenings, 5,000 tons of washed peas or washed smalls, 5,000 tons of small nuts). Mr. W. M. Rogerson, Borough Electrical Engineer (returnable deposit of £5).

Leigh (Lancs.).—May 21st. One vertical tube boiler, one 250-kw. rotary converter or motor converter, one switch panel, for the Borough Electricity Committee. See "Official Notices" to-day.

London.—May 12th. L.C.C. Installation, about 210 wiring and 250 lighting points, at Sebbon Street Elementary School, Islington, N. See "Official Notices" to-day.

South Africa.—Johannesburg.—June 1st. Municipal Council. 24 double-pole, automatic, oil-immersed circuit breakers of a continuous carrying capacity of 200 amperes (Contract No. 971). Specifications, &c., from the Controller of Stores, Municipal Offices, Plein Square Johannesburg. Tenders to Town Clerk.—*Board of Trade Journal.*

Spain.—The municipal authorities of Canizal (Province of Zamora) have lately invited tenders for the concession for the electric lighting of the town during a period of 10 years.

The time for submitting proposals for a railway, electrical or otherwise, from Madrid to Valencia has been extended to 18 months from February 21st.

Tasmania.—Launceston.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Winchester.—May 11th. Corporation. Twelve months' supply of steam coal, for the Electricity Department. See "Official Notices" to-day.

CLOSED.

Croydon.—The Council, on Monday, accepted the tender of Messrs. Green & Son (£831) for a new economiser for the electricity works, with 384 tubes and damper gear.

East Ham.—The tenders of Messrs. E. Broderick & Co., Ltd., Messrs. S. Pearl & Co. and the East Ham Rubber Co. have been accepted by the T.C. for a 12 months' supply of uniforms to the tramways department; as have also the tenders of Messrs. Farmer & Co., Pryke & Palmer, Engineering Supplies, Ltd., Middleton Bros., M. G. Davis & Co. and Docker Bros. for supplies of engineers' sundries to the electric lighting and tramways departments.

Glasgow.—Messrs. Woodward & Co. have secured the contract for the supply of six months' carbons to the Cleansing Committee of the T.C.

The T.C.'s Tramways Committee has accepted the offer of the British Thomson-Houston Co., Ltd., for switchgear for Kinning Park sub-station.

Huddersfield.—The Tramways Committee has accepted tenders for stores as follows:—

Brake blocks and castings.—France & Brook, Slaithwaite, and Melton and Co., Halifax.
Cables.—W. T. Glover & Co.
Steel tramcar tires.—J. Brown & Co.

London.—L.C.C.—The Stores and Contracts Committee has accepted the following tenders during the three months ended March 31st, 1915:—

Electric lamps, Schedule No. 17.—Ediswan & Swan U.E.L. Co. Items 8 to 27 (metallic-filament lamps, drawn wire).
Electric traction glow lamps for Tramways Department (Schedule No. 17a).—Siemens Bros. Dynamo Works, Ltd.—Item 1 (standard Dutch type).

The Highways Committee has received the following tenders for the supply of rails for the construction, reconstruction and maintenance of the Council's tramways:—

Track Rails and Fastenings.

Walter Scott, Ltd.	(accepted)	£28,340
Bolckow, Vaughan & Co., Ltd.		29,575
Chief Engineer's estimate		£26,580

Conductor Rails.

Frodingham Iron and Steel Co., Ltd.	(accepted)	£17,150
Chief Engineer's estimate		£15,650

The following tenders were received for the provision of two 8 000-kw. turbo-generators for the Greenwich generating station:—

Cole, Marchant & Morley, Ltd.	(incomplete)	£15,313
Brit. Thomson-Houston Co., Ltd.	(incomplete)	51,070
J. Howden & Co., Ltd.	(incomplete)	55 161
Do.	(alternative do.)	56,720
Maschinenfabrik Oerlikon		57,600
Fraser & Chalmers, Ltd.		58,012
Do.	(alternative)	59,709
Brit. Westinghouse Elec. & Mfg. Co., Ltd.	(accepted)	62,003
Fraser & Chalmers, Ltd.	(alternative)	63,816
Escher, Wyss & Co.		64,016
Willans & Robinson, Ltd.		64,620
Do.	(alternative)	65,619
Escher, Wyss & Co.	(alternative)	66,795
Brush Elec. Eng. Co., Ltd.		67,063
Do.	(alternative)	67,442
Dick, Kerr & Co., Ltd.		68,100
Estimate of Chief Officer of Tramways		£54.532

The Committee reports that the lowest complete tender was that submitted by Maschinenfabrik Oerlikon of Switzerland, but in view of the difficulties which would be likely to arise in the transport of raw materials and of the completed work, and in the inspection of the machinery during manufacture, it was decided to pass over this tender. With regard to the tenders submitted by Fraser & Chalmers, Ltd., the Committee was advised by Sir A. B. W. Kennedy, the electrical engineer, retained by the Council to advise on the tenders, that, although they were a firm of the highest standing, they had not constructed any turbines of a larger capacity than 3,000 kw. In view of the fact that the early delivery and smooth and speedy operation of these machines were of the utmost importance for the safe working of the undertaking, it was necessary to take into serious consideration the experience which the different firms tendering had had of machines of the type and size in question. The next lowest tender was that of the British Westinghouse Co., who had supplied three of the five turbo-generators at the generating station, and had since completed a further machine for the station, and acting on the advice of Sir A. Kennedy, the tender of the latter firm was accepted.

The following tenders have been received for the supply and laying of cables required in connection with an additional supply of power up to 3,500 kw., to be obtained from the London Electric Supply Corporation in connection with the working of the Council's tramways.

Western Electric Co., Ltd.	(accepted)	£6,214
British Insulated & Helsby Cables, Ltd.		6,298
W. T. Henley's Telegraph Works, Ltd.		6,408
Johnson & Phillips, Ltd.		6,636
W. T. Glover & Co., Ltd.		6,743
Siemens Bros. & Co., Ltd.		6,799
Callender's Cable and Construction Co., Ltd.		6 833
Estimate of Chief Officer of Tramways		6,214

The undermentioned tenders were received for 20,245 yards of trolley wire. The two lowest tenders were for goods made abroad, and in view of the transport difficulties were passed over.

Edward le Bas & Co.	£62 10	per ton
Fernand Espir	66 10	"
F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.) (accepted)	65 19 6	"
B.I. & Helsby Cables, Ltd.	68 5	"
Watlington & Co., Ltd.	68 0	"
T. Bolton & Sons, Ltd.	68 5	"

For 3,000 driving and 2,000 trailing wheel tires for the Council's tramcars, or, alternatively, 6,000 driving and 4,000 trailing wheel tires, the following tenders were received per tire:—

	3,000 driving wheel tires.	2,000 trailing wheel tires.	6,000 driving wheel tires.	4,000 trailing wheel tires.
John Brown & Co., Ltd. accepted	£1 6 6	£1 6 6	£1 6 0	£1 6 0
H. Bessemer & Co., Ltd.	1 10 6	1 5 0	1 10 6	1 5 0
Cammell, Laird & Co., Ltd.	1 13 0	1 11 0	—	—
Brown, Bayley's Steel Works, Ltd.	1 17 6	1 10 0	1 17 6	1 10 0
Steel, Peech & Tozer, Ltd.	1 18 7	1 11 11	—	—
Vickers, Ltd.	2 0 0	1 10 0	2 0 0	1 10 0
Patent Shaft and Axletree Co., Ltd.	1 18 0	1 15 0	1 18 0	1 15 0
Baldwin Locomotive Works, (Standard Steel Works Co.)	£12,134		£24,268	

(Plus cost of freightage from New York.

The Committee recommends that, in view of the conditions that arise owing to the war, the operation of Standing Order No. 295 be suspended, and that payment be made to Messrs. Dick, Kerr & Co., Ltd., the contractors for the supply of rotary converters for tramway sub-stations, at the rate of 50 per cent. of the value of the work executed and completed, whether such work had been delivered or not. Also that the operation of the Order be suspended, in order that payment on account of £8,000 may be authorised to the British Westinghouse Electric and Manufacturing Co., Ltd., in respect of further work completed by the company under its contract for the provision of two 8 000-kw. steam turbo-generators for the Greenwich generating station, but of which the Council is unable to accept delivery, the foundations not being ready.

The undermentioned tenders were received for rolled steel bar for magnetic brake shoes:—

		500 tons for 25a magnets. Per ton.	120 tons for 26a magnets. Per ton.
Lilleshall Co., Ltd.	(accepted)	£8 10 0	£8 10 0
Frodingham Iron and Steel Co., Ltd.		8 16 3	8 16 3
Earl of Dudley's Round Oak Works, Ltd.		8 17 6	9 10 0
H. Bessemer & Co., Ltd.		9 7 6	9 7 6
Goodwin & Co.		14 10 0	14 10 0

The Committee has accepted the offer of the London Electric Wire Co. and Smiths, Ltd., for 2 tons of triple cotton-covered copper wire, in excess of the amount contracted for, at the price of £79 a ton (£4 a ton below the contract price).

The undermentioned tenders for the supply, during 1915-16, of tramways equipment have been accepted:—

Electrical Equipment (Motor Generator) Spares.

British Westinghouse Co., items 1 to 17 inclusive and 23.
Dick, Kerr & Co., Ltd., items 19 to 22 inclusive, and 25 to 29 inclusive.
A. Clare & Co., items 18, 24 and 31.
Manchester Armature Repair Co., item 30.

Electrical Equipment (Controller, Circuit Breaker and other Switch, &c., Details, and Magnetic Brake) Spares.

British Westinghouse Co., items 1 to 21 inclusive, and 24 to 48 inclusive.
Dick, Kerr & Co., Ltd., items 22 and 23.

Contact Fingers and Parts, Segments, &c.

British Westinghouse Co., items 1, 12, 19, 31, 32, 36 and 38.
Dick, Kerr & Co., Ltd., item 47.
Dyer & Young, items 21, 26, 27, 33, 34, 35, 45, 50 and 52.
E. Showell & Sons, Ltd., items 2, 6, 20, 22, 25, 29, 30, 37, 43, 46, 49 and 54.
Tramway Supplies, Ltd., items 3, 4, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 23, 24, 39, 40, 48, 51 and 53.

Electric Cable, Fuse Wire and Cotton-Covered Copper Wire.

B.I. & Helsby Cables, Ltd., item 3.
Hooper's Teleg. and I.R. Rubber Works, Ltd., item 4.
Liverpool Electric Cable Co., Ltd., item 2.
Midland Electric Wire Co., Ltd., item 1.
Saxonia Electrical Wire Co., item 5.

Copper Bonds.

B.I. & Helsby Cables, Ltd., items 1 (*a*) and (*b*).

Moulded Insulators (other than Rubber).

British Westinghouse Co., items 4, 5, 7 and 10.
Crystalate Mfg., Co., item 17.
Ebonestos Mfg. Co., items 1, 2, 3, 21 to 24 inclusive.
Litholite, Ltd., items 6, 8, 9. 11 to 16 inclusive, 18 to 20 inclusive, and 25.

Mica and Micanite Articles.

G. Schultz & Co., Ltd., item 1.

Track Insulators.

Bullers, Ltd., items 1 and 2.
Gaskell & Grocott, Ltd., item 3.
Doulton & Co,. Ltd., item 4 (half the estimated quantity).
Taylor, Tunnicliff & Co., Ltd., item 4 (half the estimated quantity).

Brake Shoes.

Pease & Partners. Ltd., items 1 to 3 inclusive.

The Fire Brigade Committee received the following tenders for the supply of a motor-lorry for use by the Fire Brigade :—

Dennis, Bros. (1913), Ltd.		£650
Belsize Motors, Ltd.		675
London Motor Exchange		675
W. A. Stevens, Ltd.	(accepted)	764
Clayton & Co. (Huddersfield), Ltd.		765
Leyland Motors (1914), Ltd.		765
Albion Motor-Car Co., Ltd.		770
The Daimler Co , Ltd.		792
The McCurd Lorry Mfg. Co., Ltd.		800

Owing to the demands being made upon them by the military authorities, the two lowest tenderers were unable to specify the dates by which they would be in a position to effect delivery, and the Committee was advised that the lorry offered by the third lowest tenderers would not be suitable for the purposes of the brigade. In these circumstances the next lowest tender, amounting to £764, of W. A. Stevens, Ltd., which was for the supply of a lorry propelled on the petrol-electric system, was accepted.

The Committee has accepted the offer of the Crypto Electrical Co. of £58 for the supply of motor-generators and instruments for the electric charging apparatus at the Belsize, Bow and Redcross Street stations.

The Stores and Contract Committee states, in continuation of the report of January 26th, 1915, that as the result of inquiry in a number of cases, it has decided to have no more dealings with eight further firms controlled wholly or largely by enemy aliens, and their names have been removed from any lists on which their names appear of firms to be invited to tender for the supply of stores, &c.

For the reconstruction of portions of the electric goods lift at the Ray Street stores premises, the following tenders have been received :—

Spagnoletti, Ltd. (Park Royal Engineering Works, Ltd.)		£148
Ditto alternative	(accepted)	140
A. W. Penrose & Co., Ltd., 109, Farringdon Road, E.C.		172
Easton Lift Co., Ltd.		188
Ditto alternatives		170 & 196
Waygood Otis, Ltd.		195

Chief engineer s estimate, £105.

Stepney.—The Electricity Committee of the B.C. reports the purchase of 1,440 tons of coal for the electricity undertaking in lots of 10 to 750 tons at prices ranging from 21s. to 26s. per ton.

Battersea.—The Electricity Committee recommends the acceptance of the following annual tenders :—

Prices, Ltd.—Oils, with the exception of turbine oil.
Duckham, A., & Co.—Turbine oil.
Pryke & Palmer.—Engine-room stores, ironmongery, &c.
Beldam & Co.—Packings.
British Insulated Co., Ltd.—Consumers' fuse boxes.
Dussek & Co.—Box compound.
Callender's Cable & Construction Co., Ltd.—Troughing, bridges, bitumen, &c.
Reason Manufacturing Co., Ltd.—Electrolytic meters.
British Thomson-Houston Co., Ltd.—Carbon lamps.

Poplar.—The following tenders have been received by the Borough Council for the supply of two 1,000 kw. converters to be erected at the main station and Glengall Road sub-station :—

Siemens Bros.	(Ferranti transformer, 750 R.P.M.)	£1,850
Alternative	(Brush transformer, 750 R.P.M.)	1,898
General Electric Co., Ltd.	(Ferranti, 500 R.P.M.)	1,900
Alternative	(Brush, 500 R.P.M.)	1,925
British Thomson-Houston Co.	(Brush, 500 R.P.M.)	1,990
First alternative	(Brit. Electric, 500 R.P.M.)	2,117
Second alternative	(Westinghouse, 500 R.P.M.)	2,122
British Westinghouse Co.	(Westinghouse, 500 R.P.M.)	2,013
Bruce Peebles & Co.	(Westinghouse, A 375 R.P.M.)	2,265
First alternative	(,, C 375 R.P.M.)	2,285
Second alternative	(,, G 428 R.P.M.)	2,180
Third alternative	(,, E 428 R.P.M.)	2,150

The engineer recommends the acceptance of the tender of the General Electric Co., for one rotary converter with Brush transformer for £1,925. As regards the Glengall sub-station, the engineer points out that the building is not suitable for rotary machines, and that it is desirable to install a motor converter which will be in line with the existing machines. He recommends the installation of Messrs. Bruce Peebles & Co.'s type A, for £2,265. The Committee has adopted the engineer's recommendations.

The following tenders have also been received, for renewing the electric lighting and heating circuits at the Council Offices, and the substitution of five 1,000-c.p. half-watt lamps in the Council Chamber :—

H. E. Keen & Co.	(accepted)	£125
Duncan Watson & Co.		185
Marler & Co.		818

Woolwich.—The tender of Messrs. Babcock & Wilcox, Ltd., at £256, for steam piping, has been accepted by the Electricity Committee. The tender of Messrs. Seagers. Ltd., has been accepted, at £260, for a cast-iron rain-water tank required in connection with the Globe Lane extensions.

Meter Contracts.—The Electrical Apparatus Co., Ltd., have secured the following contracts :—

Cheltenham Corporation.—Single-phase meters, for 12 months.
Bray U.D.C.—Single-phase meters, for 12 months.

Messrs. Chamberlain & Hookham, Ltd., have received contracts for the supply of meters to Cardiff, Grimsby and Hornsey.

Thanet.—The Joint Hospital Board has accepted the tender of Mr. Pinto, of Ramsgate, for the maintenance of the electric bells and private telephones at the hospital.

Walthamstow.—The following tenders have been accepted by the District Council for annual supplies of electricity and tramway stores :—

W. T. Henley's Telegraph Works Co.—Cables and pure rubber tape.
General Electric Co.—Steel conduits and saddles.
Edison & Swan United Electric Light Co.—Ceiling roses, lampholders, &c.
Chamberlain & Hookham.—Meters.
General Electric Co. and Cryselco, Ltd.—Carbon-filament lamps.
Geo. Angus & Co.—Rubber insertion and packing.

The following tenders are recommended for acceptance for the supply of switchgear and cables :—

British Thomson-Houston Co.—High-tension switchgear, £391.
General Electric Co.—Low-tension switchgear, £230.
W. T. Henley's Telegraph Works Co.—Cables. Price not mentioned.

The Lighting Committee has purchased 200 tons of Shirebrook nutty slack outside contract from Hinchcliffe & Co., at 18s. 10d. per ton.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, April 30th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. Lecture on "The Modern Aeroplane," by Dr. R. T. Glazebrook, F.R.S.

(Graduates' Section.)—Saturday, May 1st. At 7.15 p.m. Discussion on "The Making and Filing of Engineering Notes," opened by Mr. C. Ian Burrell.

Royal Institution of Great Britain.—Saturday, May 1st. At 3 p.m. At Albemarle Street, W. Lecture (I) on "Photo Electricity," by Prof. J. A. Fleming, F.R.S. At 5 p.m. Annual Meeting.

Monday, May 3rd. At 5 p.m. General meeting.

Thursday, May 6th. At 3 p.m. Lecture (II) on "Advances in General Physics," by Dr. A. W. Porter, F.R.S.

Friday, May 7th. At 9 p.m. Paper on "Electrons and Heat," by Prof. O. W. Richardson, F.R.S.

Saturday, May 8th. At 3 p.m. Lecture (II) on "Photo-Electricity," by Prof. J. A. Fleming, F.R.S.

Institution of Electrical Engineers (Students' Section).—Wednesday, May 5th. At 7.30 p.m. At Victoria Embankment, W.C. Annual General Meeting.

(Newcastle Local Section).—Monday, May 3rd. At 7.30 p.m. At the Mining Institute. Paper on "Phantom Circuits in Telephony," by Mr. A. W. Martin.

Salford Technical and Engineering Association.—Wednesday, May 5th. Visit to Gresley Iron Works, Salford.

Junior Institution of Engineers.—Friday, May 7th. At 8 p.m. At 39, Victoria Street, S.W. Informal discussion.

Association of Mining Electrical Engineers (Notts. and Derbyshire Branch).—Joint Meeting with National Association of Colliery Managers. Saturday, May 8th. At 3.30 p.m. At University College, Nottingham. Paper on "Protective Devices," by Messrs. E. Kilburn Scott and L. F. Fogarty.

NOTES.

Institution and Lecture Notes.—Diesel Engine Users' Association.—At the April meeting of the Association, a standard policy for insurance at Lloyd's against breakdown, which had been considered at several meetings of the Committee, was approved and adopted. This insurance includes specially advantageous terms to members of the Association, and arrangements have been made for periodic inspections of the plant, and for advice and full reports to be furnished by fully-qualified Diesel engine experts acting for the underwriters. Until this standard form was framed, no form of policy specially applicable to the Diesel engine had been in use. The forms and conditions generally used were those applicable to a gas engine, and consequently difficulties arose in the interpretation. It is hoped that the immediate offer of specially advantageous terms will lead to insurance of this plant being more generally effected, and in that case the larger volume of business done should result in still more favourable rates for insurance being obtainable within a short time.

A discussion on the lubrication of Diesel engines was opened by Mr. H. L. Alderton, of Guildford, who dealt with the various methods of lubrication by means of ring lubricators, ordinary drip, or forced feed with pumps or centrifugal rings. Mr. Alderton emphasised the importance of carefully selecting the best oil for cylinder lubrication so as to avoid troubles from carbonisation and gumming. He said that apparently large engines required more oil in proportion to their output than the smaller engines. In the discussion it was shown that in some cases one class of oil was used throughout the engine, and in others different oils for the bearings, cylinders and compressors. The methods of filtration of oil, and the extent to which filtration was carried out, also showed a considerable amount of variation. It was decided to ask for returns from the various members of the Association giving information as to the methods of lubrication, with quantities and costs, in connection with their plants, with a view to a further discussion on the subject.

The next meeting of the Association is to be held on Wednesday, May 19th. Information and particulars concerning the Association can be obtained from the acting hon. secretary, Mr. Percy Still, at 19, Cadogan Gardens, London, S.W.

We understand that the special Diesel engine policy referred to in the above report has been drawn up by Messrs. Banks, Warner and Co., of 11, Queen Victoria Street, E.C., who have retained as their inspecting engineers the well-known Diesel experts, Mr. Phillip N. Smith and L. W. Johnson.

Institution of Electrical Engineers.—The fifteenth annual general meeting of the Manchester Local Section was held on Tuesday evening, the 27th inst. The chairman (Mr. P. P. Wheelwright) presided. The annual report was read and approved; the membership was 732, a considerable decrease on last year's figures. The voting for the officers and Committee resulted as follows, viz.:—

Chairman—Mr. B. Welbourn.

Vice Chairmen—Messrs. C. J. Beaver and A. E. McKenzie.

Hon. Sec. and Treasurer—Mr. Julius Frith.

Committee—Prof. A. B. Field; Messrs. H. Allcock, C. C. Atchison, A. P. M. Fleming, W. Cramp, S. L. Pearce, J. S. Peck, H. D. Symonds, H. A. Ratcliff, J. A. Robertson, S. J. Watson and Mr. Alderman Walker.

Votes of thanks were accorded to the chairman and hon. secretary for their services during the year, also to the Committee of the Engineers' Club for allowing the use of the room for holding the meetings. At the conclusion of the meeting, Mr. A. Dickinson's paper on the Bombay hydro-electric scheme was read by Mr. E. S. W. Moore, in the unavoidable absence of Mr. Dickinson owing to indisposition.

Association of Electrical Station Engineers.—A meeting representative of the station and mains engineers of Greater London was held under the auspices of the A.E.S.E. London Branch, on April 27th, at Stone's Restaurant, Ludgate Hill, E.C. Two letters which had been received by the A.E.S.E. Committee were brought forward for the consideration of the meeting: One from the Electrical Trades Union London District Committee, inviting the A.E.S.E. London Committee to a conference "To consider if steps can be taken to secure an advance of wages in view of the abnormal circumstances now prevailing"; the other from the Associated Municipal Electrical Engineers (Greater London), which asked for two or three dates when it would be convenient for the proposed conference. This conference was originally asked for by the A.E.S.E., on February 9th, 1914, but had not been held owing to a difficulty in finding convenient dates.

After a lengthy discussion, the meeting unanimously agreed that the London Committee should meet both organisations in conference with the ultimate object of an increase in wages.

Institution of Civil Engineers.—The Council has made the following awards for papers read and discussed during the session 1914-15:—The Telford Gold Medal to Mr. A. L. Bell (Rosyth); Telford Premiums to Mr. C. W. Anderson (Chakradharpur, India); Sir Thomas Mason (Glasgow); Dr. H. F. Parshall (London); and Mr. H. E. Yerbury (Sheffield); and the Crampton Prize to Mr. F. D. Evans (Kuala Lumpur, F.M.S.). The awards for papers to be published in the *Proceedings* without discussion will be announced later.

Electric-Light Switching Competition.—Those who are interested in the use of special tumbler switches for the control of glow-lamp and other consumption circuits, and who wish to improve and afterwards test their knowledge of the subject, would be well advised to consult the issues of our contemporary *Electricity* during the month of May. This journal is holding the next of the competitions organised by Messrs. A. P. Lundberg & Sons, which have now become a regular feature of the electrical year; money and book prizes and certificates will be awarded to successful competitors. The subject of electric light switching is well worth investigation on the part of all who are in any way concerned with lighting installations.

Wireless Control of Public Clocks.—Writing on the subject of Mr. Ball's suggestion to check the performance of public clocks by wireless reports, in the *Horological Journal* for March, Mr. F. Hope-Jones questions whether the trouble and expense involved are worth the results achieved, and suggests that a simple receiving apparatus should be installed at each clock with which the caretaker could note the time signals from Paris. In this case no licence for transmitting signals would be required, and the ether would not be filled with untruthful time signals.

Mathematical Notation.—In order to facilitate the compositor's task in the setting-up of articles in which vector symbols occur, especially in concrete expressions, where modulus and argument are both required, Mr. F. Jacob, M.Inst.C.E., suggests the use of the dagger "†" inverted for positive, erect for negative arguments, between modulus and argument.

Thus, $\mathfrak{h} = \mathrm{h}$⸸$\theta$ for $\mathrm{h}\,e^{i\theta}$ or $\mathrm{h}\underline{|\theta}$ for positive values, and $\mathrm{h}\dagger\theta$ for negative values of θ. A numerical example, 1·72⸸13° 36′ illustrates the advantage.

The point of the dagger follows the usual convention for + and — direction.

Mr. Jacob points out that we have a very apposite precedent in n!, which, for the purpose above-mentioned, replaces the original factorial symbol $|\underline{n}$.

Electric Vehicle Tire Guarantees.—In view of the fact that the "Ring" of solid tire manufacturers has decided in future only to guarantee such tires for a service of 10,000 miles within a period of 12 months, Messrs. Edison Accumulators, Ltd., have decided to undertake full responsibility of guarantee of all tires sold by them with their electrically-propelled vehicles, and all solid tires coming within this category will be guaranteed for a service of 12,000 miles within a period of 15 months. This decision is based on their experience of the superior qualities of the electric vehicle, both in this country and the United States, in the matter of increased mileage on tires of such vehicles.

Central Station Men and Recruiting.—In the House of Commons on Tuesday, Mr. Touche asked the Under Secretary for War whether he was aware that many men formerly employed in the electrical services in the metropolis had joined the Forces; that others were desiring to join and, owing to the technical and expert training required, their places could not readily be filled, and there was some risk of the power stations, the output of which was largely used for Government purposes, becoming insufficiently manned; that representations had been made, at the instance of the general officer commanding the London district, of the importance of preserving the efficiency of electric and power services of the metropolis, but in the absence of some public service or other badge authorised by the Government, which could not be forged, to protect the men from reproach for not enlisting, it was difficult to persuade them to remain; was he aware that proposals submitted by the Association of Municipal and Electrical Engineers of Greater London had not resulted in any satisfactory solution of the difficulty; and would he consider the question of either authorising the issue of an officially recognised public works badge, or of enlisting the men employed in approved public utility services in a special volunteer body authorised to wear uniform, as in the case of the Civil Service Corps?

Mr. Tennant: Recruiting officers have instructions not to enlist skilled employés of electrical services without the sanction of their employers. I am informed that several electrical companies, who have applied for War Office badges, have been offered such badges for issue to men of recruitable age who would be willing to enlist if called upon in the event of emergency, or of their ceasing to be urgently required in their present employment.

Mr. Touche: Are these official badges what I call War Office badges?—Mr. Tennant: Yes, they have been offered these badges.

Mr. Touche: Official badges?—Mr. Tennant: Yes.

Mr. Terrell wanted to know how these badges would differ from those given to persons engaged upon munitions of war.

Mr. Tennant pointed out that the badges for makers of munitions of war exempted the wearer from all war service, inasmuch as he was helping to produce the munitions of war. The other badges would not in all cases exempt a man from military service, and in the case of emergency arising he would be called upon to serve, unless he were urgently required in his present employment.

Mr. Terrell: Are two classes of badges issued, and to whom is application to be made for these badges?—Mr. Tennant: When the hon. gentleman says there are two classes of badges, that is not so. This has been offered and has not been accepted. We are prepared to issue it. Application should be made to the secretary to the War Office.

Mr. Touche: Is it a condition of the issue of the badge that the man who receives it shall give an undertaking to j in the Colours if called upon to do so?—Mr. Tennant: That is so.

The matter then dropped.

Australian Association of British Manufacturers.—The annual general meeting of this Association was held at the Commercial Travellers' Club, Melbourne, on Friday, February 26th. The chairman, Mr. Geo. Shrimpton, submitted the annual report, which stated, amongst other matters, that the membership had now increased to 238, being 120 British manufacturers and 118 representatives of British manufacturers. During the year a Sydney branch of the Association had been formed, and a Sydney Council had recently been elected. The Executive Council were pleased to be able to report that under the new Tariff a greater measure of preference had been granted to goods of British origin. This matter had been strongly urged by the Association since its formation. A list of those items which received an increased measure of preference, numbering 352, was printed with the annual report. The following members were elected as members of the Executive Council for the ensuing year:—

President.—Mr. Geo. Shrimpton (Geo. Shrimpton & Sons).

Vice-President.—Mr. C. W. U. Adamson (Babcock & Wilcox, Ltd.).

Councillors.—Mr. F. A. Daniel (H. S. Ingamells & Co.); Mr. John D. Campbell (Alexander Fergusson Pty., Ltd.).

Hardware Councillor.—Mr. W. H. MacLennan.

Electrical Councillor.—Mr. G. L. Just (Edison & Swan United Electric Light Co., Ltd.).

Members urged that the Association should take steps to guard against the possibility of any reduction of the increased preference granted to goods of British origin, which might be suggested as a result of agitation on the part of importers of American and other foreign goods. The chairman assured members that the matter would receive the fullest attention of the Executive Council, and that any members wishing for assistance could rely on the fullest co-operation of the Association. The question of duty on catalogues was discussed, and keen disappointment was expressed that the Government had increased the rate of duty. The chairman advised members that the Association was still urging the reduction of this duty, and a letter on the subject, addressed to the Minister of Trade and Customs, was read and approved of by the meeting.

For Sale.—The whole of the electrical apparatus used in lighting the Liverpool Exhibition is to be sold by auction by Messrs. P. Huddleston & Co., on May 12th, at the Exhibition Buildings. Particulars are given in our advertisement pages to-day.

Sydney Electricians.—An Australian newspaper states that the labour market in Sydney is decidedly satisfactory, so far as electricians are concerned. Fitters and mechanics with a knowledge of local requirements are in demand, particularly at Garden Island and the Public Works Department.

More Gas.—We notice in the pages of a provincial contemporary, devoted to the gas interests, an advertisement which purports to illustrate the interior of the gas equipped kitchen of the First Eastern R.A.M.C. Hospital, at Cambridge. Everything appears to be spick and span, including the chains and cocks of the gas lamps. However, it happens that the whole of the hospital is electrically lighted by the Cambridge Electric Supply Co., whose wiring department supplied and fixed all the wiring, together with electric sterilisers in the operating theatre and a motor-generator for X-ray apparatus, and by a regrettable oversight a tumbler switch still remains on the illustration. The illustration bears the legend: So-and-So's gas-heated cooking apparatus installed at the First Eastern R.A.M.C. Hospital, Cambridge—the gas lighting, which is not there, being apparently thrown in to avoid the injury to the feelings of the reader of the paper, which an electrically illuminated kitchen would no doubt cause. By a coincidence, a letter appears on the facing page, headed "Abuse of Advertisements"!

Appointments Vacant.—Two assistant storekeepers, age 25-40 (£250) for Nigerian Government Posts and Telegraphs Department; engineers-in-charge (£120) for Newport Corporation; junior engineers, age about 21 (25s. plus war allowance), for Cleveland and Durham Electric Power, Ltd.; junior assistant electrical engineers for the Newcastle-upon-Tyne Electric Supply Co., Ltd. (15s.). Particulars are given in our advertisement pages.

Inquiries.—Makers of the "Cordless system of heating, as used for irons," and of the Mitchell electric hair-drier, are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Stafford T.C. has decided that Mr. W. H. Robins shall be appointed engineer and manager of the electricity works; and Mr. W. M. Valon, as secretary for the works.

The Aylesbury U.D.C. has appointed Mr. H. H. Sutcliffe, of Hempton Bridge, as assistant electrical engineer.

Mr. C. Clare Atchison, Rochdale borough electrical engineer, who has been on the sick list for some considerable time, has now resumed duty.

Tramway Officials.—Mr. T. C. Winfield has been appointed works superintendent of the West Ham Corporation Tramways. Mr. Winfield formerly held a similar position under the Metropolitan Electric Tramways Co. There were 127 applicants for the vacancy.

General.—After serving as chairman of the Croydon Lighting and Electricity Committee since 1897, when it was formed, Ald. D. B. Miller, J.P., has resigned, under medical advice. Ald. Miller was chairman of the General Purposes Committee in 1890, when an application for a provisional order for electric lighting was decided upon. The Borough Council, on Monday, passed a resolution recording appreciation of the very valuable services of Ald. Miller, and the fact that he leaves the Council electricity undertaking in a state of high efficiency.

Councillor Whiteside and Councillor Marple have been appointed chairman and vice-chairman respectively of the Stretford Electricity and Tramways Committee.

It is announced in the Press that Sir Alexander King, late secretary to the Post Office, has been elected a director of the West India and Panama Telegraph Co., Ltd., in place of the late Sir John Lamb.

NEW COMPANIES REGISTERED.

East Lancashire Electrical Co. (Accrington), Ltd. (140,029).—This company was registered on April 21st, with a capital of £1,000 in £1 shares, to carry on the business of electro, silver or nickel platers and polishers, electric light and power engineers, makers of electric cooking and heating apparatus and machinery for electrical, mechanical and textile purposes, dealers and makers of all kinds of motors and motor-car appliances and accessories, etc. The subscribers (with one share each) are: G. W. Somerville, "Roseneath," Owen Street, Accrington, electrical engineer; F. G. Clarke, 99, Stanhill, Oswaldtwistle, electro plater and polisher. Private company. The number of directors is not to be less than two or more than five; the first are G. W. Somerville and F. G. Clarke. Qualification £25. Solicitor, F. G. Lupton, 11, Dutton Street, Accrington. Registered office: Paradise Street, Accrington.

Ardee Electric Co., Ltd (4,235).—This company was registered in Dublin on April 22nd, with a capital of £5,000 in £1 shares, to acquire and carry on the business of an electric light, heat and power producer, generator and distributor, etc., carried on by J. W. McKeever, J.P., at Ardee, Co. Louth. The subscribers (with one share each) are: J. W. McKeever, Aclare Lodge, Ardee, Co. Louth, farmer; T. W. Storey, Ardeevin, Bailey, Co. Dublin, A.I.E.E., C.E. Private company. J. W. McKeever is the first director. Qualification, 50 shares. Registered office: Ardee, Co. Louth.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Charing Cross, West End and City Electricity Supply Co., Ltd. (29,122).—Capital £2,100,000 in 130,000 pref., 130,000 ord., 80,000 City Undertaking pref., and 80,000 City Undertaking ord. shares of £5 each. Return dated March 18th, 1915. 80,000 pref., 80,000 ord., 80,000 City Undertaking pref., and 70,000 City Undertaking ord. shares taken up. £1,200,000 paid on the pref. ord. City Undertaking pref.; £350,000 considered as paid on the City Undertaking ord. Mortgages and charges, £1,087,178.

W. T. Henley's Telegraph Works Co., Ltd. (13,795).—Capital £400,000 in 40,000 pref. and 40,000 ord. shares of £5 each. Return dated April 2nd, 1915. All shares taken up. £5 per share called up on 39,880 pref. and 32,616 ord.; £362,480 paid; £37,520 considered as paid on 120 pref. and 7,384 ord. Mortgages and charges, £150,000.

Direct Spanish Telegraph Co., Ltd. (6,732).—Capital, £95,000 in 13,000 ord. and 6,000 pref. shares of £5 each. Return dated April 1st, 1915. 12,931 ord. and 6,000 pref. shares taken-up; £94,655 paid. Mortgages and charges, nil.

Notting Hill Electric Lighting Co., Ltd. (25,921).—Capital £201,352 10s. in 17,002 non-cum. 6 per cent. pref. and 2,998 cum. 6 per cent. pref. shares of £10 each, and 27,050 ord. shares of 1s. each. Return dated March 9th, 1915. 11,402 non-cum. pref., 2,998 cum. pref., and 27,050 ord shares taken up; £145,352 10s. paid. Mortgages and charges, £64,000, and jointly with the Kensington and Knightsbridge Electric Lighting Co., Ltd., a further £231,500.

Telephone Co. of Egypt, Ltd.—A memorandum of satisfaction to the extent of £1,300 on April 14th, 1915, of deb. stock, covered by deeds dated from July 27th, 1904, to October 27th, 1909, securing £200,000 has been filed.

Waste Heat and Gas Electrical Generating Stations, Ltd. (91,738).—Capital £350,000 in £1 shares. Return dated March 24th, 1915. 320,000 shares taken up; £320,000 paid. Mortgages and charges, nil.

CITY NOTES.

Anglo-Portuguese Telephone Co., Ltd.

Mr. Herbert Allen presided at the London Chamber of Commerce, on Friday, over the annual meeting. He said it was unnecessary to dilate at any length on the accounts, which, as regarded the profit and loss, presented no particular feature. There was what they had come to regard as the customary growth in gross income, but the increase in net profits was not quite commensurate with the increased revenue. A large additional staff was engaged last year for the company's new exchange in the North of Lisbon, but the actual opening of the exchange did not take place until after the close of the year, so that they had the additional expense without a corresponding increase of income, and it might be said that about £20,000 of last year's capital expenditure was only just beginning to be productive. It was partly in anticipation of this that he thought he ought last year to prepare them for a possible temporary set-back in their dividend, especially in view of the recent increase in the share capital; but, happily, the board had not felt it necessary to encroach upon the usual distribution of 8 per cent. On their new exchange this year they anticipated having a considerable accretion of business with but a moderate addition to their expenses. At the same time, there was no gainsaying the tendency, not only with this company, but with most of the telephone enterprises, to have to lay out more money and do more work than formerly for a given return. Mr. Gill, the company's consulting engineer, had recently visited Lisbon and was well satisfied with the condition of their three exchanges there. With regard to the balance sheet, the only item calling for attention was the reduction of sundry creditors from £28,774 to the more normal level of £13,525. The completion of the North Exchange was the most important work of the year, and accounted for £19,542 of the total capital expenditure of £27,229. The switchboard of the new exchange was of the latest type, being known as the No. 1 relay common battery of the Western Electric Co. It was already fitted for 1,800 subscribers, and had an ultimate capacity of 6,000, so that, although the district served by the new exchange was rapidly extending, its telephone needs for many years to come were amply provided for. They had partly carried out the programme foreshadowed at the last meeting with regard to the question of depreciation. Instead of continuing to build up indefinitely what in the balance sheet was, perhaps, somewhat misleadingly, called the reserve fund—which was liable at any time to be appropriated to a reduction of capital expenditure or written off for depreciation—they were inclined in future to write off depreciation year by year. The 1913 accounts closed with a reserve of £55,000, and £30,000 of this they had since appropriated to a reduction of capital expenditure, from £290,355 to £260,355. That left them with an unappropriated reserve of £25,000, and this sum added to the renewals fund they considered ample to cover any further depreciation. Largely arising out of the political situation of Portugal, which was anything but satisfactory, there had been a further rise in the premium on gold. Fortunately, however, their remittances were protected by bills which they had bought ahead, and this was shown by the fact that although the exchange on London at the end of the year had declined to 36d., they were still remitting at 44d. per escudo. In order to protect themselves as far as possible against any further fall in exchange, they had recently bought bills enough to cover their remittances for the current year, although at a price which compared unfavourably with what they got last year. Although political and commercial conditions in Portugal at the present time were so unsettled they were not reflected in the business of the company, which was continually expanding, and there was no falling off in the demand for telephone facilities. But now that the North Exchange was completed and paid for they ought to be able to meet this demand for some time to come by a very moderate expenditure of capital. That being the case, and having successfully got through what he might perhaps call their financial transition of 1914, there seemed no reason why they should not be able to look for a continuation of what had come to be regarded as their normal 8 per cent. dividend. This, however, was largely a question of the course of exchange.

Mr. F. Kerr seconded the motion and it was carried.

Willans & Robinson, Ltd.

The directors report that the accounts for 1914 show a net profit of £17,058, after payment of debenture interest, provision for depreciation of plant, machinery and stocks, and the proper upkeep of Queen's Ferry Works. These latter have been utilised by the Government in connection with war requirements since August last. Warrants will be issued covering dividends on the "A" and "B" preference stocks, and interest on outstanding funding certificates. A dividend at the rate of 10 per cent. is recommended on the ordinary shares, leaving a balance of £9,108. Of this sum it is proposed to carry £7,431 to the reserve fund, which will thus exceed the minimum provided for by the Articles, and to distribute the balance, £1,677, among the holders of "B" preference stock and ordinary shares in manner provided for in the Articles. In common with those engaged in engineering work similar to that of this company, the outbreak of war largely disturbed the company's usual business, but the directors are glad to report that they were able to be of early service to the Government, and are now largely engaged in that direction. This latter work, though partly undertaken towards the end of 1914, is not reflected in the accounts now submitted. A large number of the company's staff—both from works and offices—having joined H.M. Forces, arrangements were made for substantially assisting their dependents and for re-employment after the war. The number so far serving represents over 20 per cent. of the total male employés. During the year the directors accepted, with regret, the resignation of Mr. Leslie Robertson, and subsequently appointed Major P. M. Peters to the vacancy thus created. As the former would have been the retiring director at this period, it falls to Major Peters to retire, who, being eligible, offers himself for re-election. Mr. G. W. Anderson proposes to retire at the annual general meeting, and the shareholders will be asked to leave to the directors the question of appointment to fill the vacancy.

Annual meeting, May 6th.

Indian Electric Supply and Traction Co., Ltd.

The annual meeting was held on April 22nd at the offices, Orient House, New Broad Street, E.C. Mr. J. G. B. Stone, who presided, said that the directors were glad in these times to be able to record further expansion of the company's business. The net revenue had risen from £10,161 to £12,724, and the balance carried forward to the new year's working was £7,365, against £5,226 in 1913. Interest charges had risen from £3,600 to £3,855. The street lighting contract alluded to at the last general meeting had augmented the income this year and considerable extensions were now being put in hand. The past year had been a notable one, but as far as could be ascertained the progress of the undertaking had not been materially affected. Where there had been any set-back caused by the war, it had been offset by increased sales to customers to whom the war had brought increased business. There was no material change in the tramway position, and they could not hold out any immediate prospect of improvement; but as the supply side of the undertaking continued to grow, their interest in the tramway became of less import- and the amount received per unit was 1·86d. The higher price ance. Generating costs had fallen from 1d. to .83d. per unit, of coal had been more than offset by the increased efficiency of the plant, so that although they paid 14 per cent. more for coal there was a fall in the coal cost from .58d. to .46d. per unit. The board sincerely regretted that Mr. Cruickshank should have found it necessary through ill-health to retire. In his place they had been fortunate in securing the assistance of his partner, Sir George Sutherland, who was well acquainted with Cawnpore and the business. He (the Chairman) had particular satisfaction, in these times, in asking them to approve the increased dividend which, one felt, indicated the progressive nature of a business of this character when once it was firmly established.

Mr. K. A. Scott Moncrieff, in seconding the motion, said that at the last meeting he ventured to forecast considerable improvement in their working costs, and the figures for the year showed that he was quite justified. The growth of the business made it difficult to compare one year with another, as the output had been so largely increased. The actual result, however, might be explained in this way—they had sold 33 per cent. more units last year, and to do that they spent only 6 per cent. more on coal, in spite of a rise of 14 per cent. in coal prices. The extra units sold had resulted in an increase in the revenue of £3,679—a 22 per cent. increase, while the increase in the total costs at Cawnpore was only 8 per cent. The results of their increased operations in the field of power supply was that the average receipt per unit had fallen, but the average profit per unit was practically stationary—1.03d. as against 1.05d. in the previous year. The one feature in considering those results was that of the demand upon their plant. Last year they had used 12 per cent. more of the plant in order to sell 33 per cent. more current. There had been an increase of 14 per cent. in the connections during the year, very largely in the way of motors for power purposes; 13 motors, having an aggregate of 220 H.P., had been added to the mains during the year. Another feature of the year was that the street lighting which they did under contract had been extended, and within the last few months further extensions had been arranged for. The additional lamps last year were 600, and they had in view some 1,300 or 1,400 more. He believed that they had a large field before them for the development of the industrial power supply of Cawnpore, and it was quite possible that the extension of the boundaries of the city might later on lead to a paying proposition for the extension of the tramways. They had no technical difficulties whatever; all they had to do was to keep their plant in order and extend the mains. They could see room for a reduction in working costs and a saving of losses in the mains which, without any increase of business, would give them some increase of profit in the current year.

The report was adopted.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—A dividend for the quarter ended December 31st last of 2s. 6d. per share is recommended, together with a bonus of 4s. per share, payable, free of income-tax, on the 12th prox., making 7 per cent. for the year.

Brisbane City Electric Light Co., Ltd.—The directors' report for the year ended January 31st, 1915, states that, after making additions to the franchise and purchase sinking fund, and renewals, replacements and contingencies account, and reserve fund, there remains a credit balance of £20,637. An interim dividend, with dividend duty in September last, amounted to £8,205, and a further dividend of 3 per cent. on the preference shares and 7½ per cent. on the fully-paid ordinary shares, and 7½ per cent. on the contributing shares, together with the dividend duty, will absorb £12,383, leaving £1,316 to be carried forward.

Dudley and Stourbridge and District Electric Traction Co., Ltd.—The total revenue for 1914 was £50,780, compared with £52,843. It is proposed to pay 1 per cent. for the year on the ordinary shares, carrying forward £851.

Wolverhampton District Electric Tramways Co., Ltd.—The revenue for 1914 was £28,359. The directors propose to pay a dividend of 1 per cent. per annum on ordinary shares, leaving to be carried forward £386.

Southport Tramways Co., Ltd.—The report states that the total revenue, including £106 brought forward, amounted to £17,142. After deducting all expenses, including £5,573 payable to the Corporation under agreements, in addition to £1,053 for maintenance and a provision of £500 for renewals, there is a balance of £650. The directors recommend (says the *Financier*) that £500 be placed to reserve, leaving £150 to be carried forward.

Nairobi Electric Power and Lighting Co., Ltd.—Extraordinary meetings are to be held on May 5th and June 2nd, says a financial daily, to consider a resolution converting the preference shares into ordinary shares as from June 30th, 1915, in consideration of a bonus of 12½ per cent. being paid in fully-paid ordinary shares or cash at the option of the company.

O. C. Hawkes, Ltd.—The net profits for 1914 amount to £7,714. The directors have paid 5 per cent. on preference shares, carrying forward £1,702.

Mexborough and Rawmarsh Construction Syndicate, Ltd.—The report states that the balance to credit of profit and loss account, including £119 brought forward, is £4,826. The directors recommend a dividend of 2¾ per cent. (free of income-tax), carrying forward £14.—*Financial Times.*

West India and Panama Telegraph Co., Ltd.—The directors recommend the following dividends:—6s. per share on the first preference and 6s. per share on the second preference for the last six months of 1914, and 9d. per share on the ordinary shares (free of income-tax).

City of Buenos Ayres Tramways (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share, being at the rate of 5 per cent. per annum, less income-tax, for the three months ended March 31st.

Colombo Electric Trams and Lighting Co., Ltd.—The directors have declared a dividend of 10 per cent, free of tax, for the year 1914, carrying forward £8,010. £20,000 has been transferred to general reserve and renewals fund.

Eastern Telegraph Co., Ltd.—The directors recommend a final dividend of £1 5s. per cent., and a bonus of £2 per cent., both free of income-tax, making a total of 7 per cent. on the ordinary stock for the year 1914.

La Plata Electric Tramways Co., Ltd.

The directors' report for 1914 states that the total length of single track constructed and in operation during the year was 28.67 miles. The total receipts on revenue account amounted to £56,186, and the expenditure to £44,273, leaving a balance of £11,913. After providing for debenture stock and other interest (£5,629) there remains £6,284, plus £330 brought forward, leaving £6,614. The directors regret the falling off in receipts, which is entirely due to the unprecedented depression in Argentina. In view of the necessity of husbanding the company's cash resources owing to the financial conditions caused by the European war, they recommend that the balance of £6,614 be carried forward.

Mr. W. F. Hamilton, K.C., presided, on Tuesday, at Winchester House, E.C., over the annual meeting. He said that the total receipts for the year amounted to £56,186, a decrease of £6,138. The total expenditure was £44,273, a decrease of £2,119. The net result was that, including the amount brought forward, there was a balance of £6,614, which the board recommended should be carried forward. The falling off in the receipts during the past year, and, he was also sorry to say, during the current year, so far as at present known, was very disappointing, and was a matter of grave concern to the board. Their company, however, was not the only sufferer, as nearly all other companies in Argentina, especially tramway and railway companies, have shown great decreases. This was due to the severe financial crisis the country had been going through, which began in 1913, continued through 1914, and had been accentuated since the war broke out. For the first seven months of the year, the decrease in traffics was 7.5 per cent., and for the last five months 12.9 per cent., the percentage for the whole year being 9.7. La Plata had additionally suffered through the financial difficulties of the Province of Buenos Aires, of which it was the capital. Arrangements had had to be made for funding for two years the interest and sinking funds of certain of the external loans of the Province, and to reduce expenditure the salaries of State officials had been reduced by 10 per cent. For years foreign capital had poured into the Argentine, and immigration had largely exceeded emigration. During the past year the influx of capital ceased, emigration exceeded immigration by more than 60,000, and there was considerable unemployment. These drawbacks were increased by deficient harvests and persistent bad weather. On the other hand, it was satisfactory to know that their manager had been successful in his untiring efforts to reduce expenditure. The working expenses for the year averaged only 6.37d. per car mile run, as compared with 6.66d. in 1913. He also deserved great credit for reducing the cost of motive power during the year by no less than £1,012, as compared with 1913, although 12,888 more car miles were run, and the contract price per unit was higher. Traffic charges were less by £925, notwithstanding the increased car mileage. The consumption of electric energy in watt-hours per car kilometre, which was reduced from 777 to 671 in 1914, had been still further reduced this year to 547 for January and 556 for February. While their manager was in this country for a short holiday he devoted most of his time to the problem of reducing the cost of motive power, which now compared very favourably with other systems. In the revenue account there was an item of £606 for the expenses of the action against the late local auditors. Having regard to the costs which had been incurred and would be incurred, which were much heavier than was anticipated, and to threatened litigation in the Argentine, and to the state of circumstances brought about by the war, they thought it prudent, after giving the matter their most anxious and careful consideration, to settle the action upon the terms that the parties should pay their own costs and that an end should be put to all litigation between the parties. Referring to the balance sheet, the item of sundry creditors was composed principally of the amount due under contract for motive power for December, the men's wages for the last fortnight of December, the directors' fees for the last half-year, which had not yet been paid, and an advance by Mr. Western of £500 to help the company's finances. On the other side of the balance sheet, the item "payments under protest for paving including amounts embargoed" were payments made in respect of accounts rendered by the Municipality for paving on a basis which the company did not admit. The payments had been made under protest, in order to avoid law costs. But they were assured that the overcharges by the Municipality would be refunded by the Government, or credited to the company in respect of amount properly chargeable to them for paving in accordance with their concession contract, and he wished to acknowledge the friendly attitude of the Government in dealing with this question. During the year the extension of their line along Calle 17 to the Meridiano Quinto Station, representing nearly 1,800 metres of single track, was completed and was to be opened soon after the new year. They also had in hand the construction of a short piece of line some 1,300 metres long on the embankment along the canal at Ensenada, the cost of which would be small. This work was to be completed last month. They hoped that both these extensions would be profitable. Out of the balance available they would have liked to pay a small dividend on the preference shares, but as their capital account was indebted to revenue, they would require to borrow money to do so, and this would be a matter of extreme difficulty, if at all possible, just now. When he last addressed them he told them that they had under consideration the issue of some of their available debenture stock to recoup revenue and pay off their existing loan. In normal times they could have done so, but at present it was out of the question, so that they saw no alternative but to carry forward the balance of revenue account to next account. There were indications of an improvement in the state of affairs in Argentina, but he was afraid they could not look forward to much improvement that year. If the business of the company improved and their cash position justified it, the board would be pleased to declare and pay an interim dividend out of the carry-over.

Mr. W. T. Western seconded the motion, and the report was adopted.

In moving a vote of thanks to Mr. Brown, the manager, and the staff, the Chairman spoke in high terms of the work done by the manager, who, he said, had secured several concessions for the company at no cost to them, which might be of value later on.

Mr. Boutell, the local director of the company, remarked that he had never known such times before in the River Plate during the 42 years he had been there, but he was certain things would gradually improve and that the company would benefit.

Direct United States Cable Co., Ltd.

Sir James Pender, Bt., presided over the annual meeting, held on Tuesday, at Winchester House, E.C. He said that they had received the rent stipulated in the lease from the Western Union Co., and they had been exceptionally fortunate during the year in regard to the cost of maintaining cables. In the year ending March 31st, 1913, they had an expenditure in this connection of over £42,000, and in the following year of over £58,000, or a total for the two years of over £100,000. The effect of this heavy charge was a material increase of the capacity of the cable by the insertion of two long lengths of cable of the latest type, and possibly this accounted for the freedom from interruption the cable enjoyed in the past year, when the cost of maintenance was less than £2,000, which he believed was less than they had expended on cable repairs in any year since the inception of the company. The result had been to increase the reserve fund from £451,490 to £476,986, or an addition of £25,495. There might be a feeling in the minds of some of the shareholders that out of such a large surplus on the year's receipts the directors might have paid a bonus. He felt, however, that they were best serving the interests of the shareholders by continuing the policy that had always been followed of building up reserves to such a figure that they provided for any contingencies which human foresight could foresee, and as the fund had been so largely depleted in the two previous years by the heavy charges to which he had referred, he was sure the shareholders would agree that they had acted wisely in deferring the payment of a bonus. They had had evidence on many occasions of the keen interest the shareholders took in the old staff of the company, who were now, of course, in the service of the Western Union Co., and it might be noticed that the contribution to the pension fund was slightly increased. That fund existed for the benefit of the late employés of the company, and under the conditions of the lease the position of the fund required to be periodically reviewed, and the annual contribution by the Western Union Co. would thus from time to time be varied. The figure which appeared in the present accounts would remain in force for the next five years. The only other item on which he need remark was the cable on hand, which appeared in the balance sheet at £77,661. In view of the two deep sea interruptions which occurred in 1913 and 1914, the board came to the conclusion that it was necessary that they should keep a sufficient length of cable in hand to ensure the successful carrying through of any similar repair. The contract for its manufacture was very favourable from the company's point of view, and the present value of the cable was largely in excess of the figure at which it appeared in the accounts. In addition to that, they might congratulate themselves upon having laid in this necessary stock of cable at a time when they were able to realise investments to pay for it without incurring the great loss which would result from the sale of securities at the present time. Heavy depreciation in all classes of securities since the war had had the effect of reducing the present value of the company's investments to such a figure that the provision of £50,000 on account of market depreciation was insufficient. In the present unsettled condition of affairs the directors thought it unnecessary to increase that sum, and they were hopeful that when the war was concluded, and business conditions resumed the normal, investments would recover their original value, and until that time they hoped it would not be necessary to realise any of them. Their relations with the Western Union continued to be of the most friendly nature, and, notwithstanding the war, he believed that the cable traffic had been more than maintained.

Mr. John Varney seconded the motion, and the report, which recommended a final dividend making 4 per cent. for the year, was adopted.

Potteries Electric Traction Co., Ltd.

Mr R. J. Howley (Chairman) presided on Monday at the annual meeting at the Electrical Federation Offices, Kingsway. He said that at the outbreak of war Mr. G. F. M. Cornwallis West was recalled to the Colours, and later, for private reasons, intimated that he had decided to resign the chairmanship of the company. Mr. West had for many years ably directed the fortunes of the company as chairman, and they all regretted his resignation and wished him a safe return. At the time Mr. West had to leave, the company was actively negotiating with the Stoke Corporation for an extension of the dates at which the tramways within the borough could be purchased, and as he had been associated with Mr. West in the negotiations he was asked to join the board. With regard to the accounts, a little explanation was necessary owing to the inclusion in the receipts and expenses of the omnibus services, which made a comparison with last year's accounts of little value. In the revenue account the traffic receipts had risen from £109,924 to £115,082, an increase of £5,158. The increased revenue brought in by the omnibus services amounted to £9,947, so that the tramway section showed a decrease compared with last year of £4,789. This was most disappointing, and was wholly attributable to the war, as at the beginning of August the tramways were doing better than ever before, and showed an increase of some £2,000. Parcel receipts, which were this year shown in a different form, amounted to £1,325, and represented net receipts, which, as compared with last year, was an increase of £131. Advertising receipts showed a slight decrease, due to a rearrangement of the business with their contractors. On the other side of the accounts, power and running expenses showed an increase from £33,828 last year to £41,973 this year, and this was due to the inclusion of the cost of working the motor omnibuses. When the war broke out the directors took immediate steps to reduce the tramway expenditure, and to a large extent had been successful. He did not propose to split up the various figures between the tramways and the omnibuses, as it was not, he thought, in the interests of the shareholders, but they might take it that between August and the end of the year the saving on the tramway side of the business was nearly £2,000. The saving was really greater than it appeared, because earlier in the year an increase had been granted in wages to the employés, and this increase affected to some extent the saving made in the second half of the year. Administration and general expenses showed an increase from £10,232 to £11,009, to some extent accountable by the omnibus business, whilst the negotiations with the Stoke Corporation had necessarily increased the legal expenses. At the outbreak of the war the British Electrical Federation, of which they were members, took steps to care for the wives and dependents of the employés of the federated companies called up for service. A fund was established, called the British Electrical Mutual Aid Fund, to which the employés contributed weekly, and the amount so subscribed was doubled by the subscription of the company. The fund was distributed by a local committee of the men themselves working under a general committee in London, and it had been a complete success. The company also associated itself with the other companies in a joint contribution of £1,500 to the Prince of Wales' National Fund, £250 to the Belgian Relief Fund, and £100 to the British Red Cross Fund. With regard to the capital account, the only point was the new expenditure during the year amounting to £12,072. Of this £8,608 was incurred in connection with the establishment of the motor omnibus branch of the business, and the remainder on small works of improvement incidental to every undertaking. For the time being this expenditure had been financed from the fund set aside for renewals and general reserve, but this arrangement was only temporary, and before long further capital must be raised, both for releasing the renewals fund and to provide for the doubling of portions of the line and the provision of new rolling stock which would be necessary if the negotiations with the Stoke Corporation proved successful. Including £10,000 set aside for renewals, the fund available for distribution amounted to £36,571, as against £39,074 last year, a decrease of £2,501. In view of the prolongation of the war through the current year, and the necessity for the company to husband its resources, the directors thought it wise to reduce the dividend on the ordinary shares from 3½ per cent. to 2½ per cent., and to carry forward an increased amount. £10,000 was set aside for renewals, which amount set aside each year over a term of years should be sufficient to keep the tramways going in an efficient condition. The amount allocated to general reserve had been increased, which was a prudent course in the present circumstances of the company. With regard to the negotiations with the Stoke Corporation, their undertaking was subject to the usual tramway terms, and became purchaseable in 1917-18. Naturally, towards the end of a term the undertakers were unwilling to incur fresh obligations and carry out improvements, and he was glad to say the Corporation had recognised the difficulty. The points under discussion were the postponement of the date of purchase to 1940, the expenditure of a maximum sum of £35,000 on improvement, and the payment of £2,000 on wayleaves, and he hoped a satisfactory solution would be arrived at. The company had expended between £700,000 and £800,000 on the undertaking for the public service with little profit to itself, and they were entitled to some consideration from the public authorities and the protection of their property from direct competition. During the year the motor 'bus services had been worked under great disadvantages. Owing to the difficulty of obtaining delivery the full fleet of 14 'buses was only completed in August, just as the war broke out, and new routes had to be surveyed and services arranged. All this preliminary work took time, and it was not until the autumn that the service was established. The result of the working till the end of the year was little or no profit, but a considerable amount of experience had been gained, and the board were satisfied that it would in future prove a valuable adjunct of the business.

Mr. S. Mear seconded the motion, which was carried without discussion.

Indo-European Telegraph Co., Ltd.

The directors report that in consequence of the state of war between Great Britain and Germany, the German section of the company's lines has been interrupted since July 31st, 1914. The question of re-establishment of the company's through route at the earliest possible moment is engaging the board's earnest attention. Owing to existing arrangements with other companies, the receipts derived from telegraphic traffic for the year have been maintained. The state of war has also put an end, for the time being, to practically all experimental work on wireless telegraphy, and the development of the Galletti system previously referred to has been accordingly suspended. The company's revenue from message account and other sources amounts to £189,384, an increase of £16,852. The expenses are, on commercial and general account, £59,856, and on maintenance account £28,540, making a total of £88,395, as against £91,441 for 1913, a decrease of £3,046. The revenue account, therefore, shows a balance of £100,988, which is carried to profit and loss account, 1914, and after deduction of income tax paid is reduced to £91,631. Adding the balance brought forward of £6,461, there is a total of £98,092. Deducting £25,000 provided for investment fluctuations, and the interim dividend of £10,625 already paid, there is available for distribution £62,467. The directors now recommend a dividend for the six months ending December 31st, 1914, of 17s. 6d. per share (making with the interim dividend already paid 6 per cent. for the year) and a bonus of 20s. per share, both free of income tax. They also propose to provide £10,000 for wireless and other technical development work, carrying forward £20,592. They propose further to make a special distribution to the shareholders of £12,750, equivalent to 15s. per share, out of interest upon certain investments and advance accounts. This distribution also will be free of income tax. The names of Herr Koehler as German official director, and of Herr Carl Joerger, Berlin, have been removed from the directorate. The directors propose to alter the minimum and maximum numbers of directors, now fixed by the Articles at 8 and 18 respectively, to the more convenient numbers of 5 and 10.

The annual meeting was held yesterday.

Calcutta Tramways Co., Ltd.

The annual meeting was held on Tuesday at the offices, 1, Queen Victoria Street, E.C., Sir Henry Kimber presiding. The Chairman said that the additions to the capital expenditure during the year had been £18,900 for additional rolling stock. On the other hand, capital had been credited with £8,100, the cost of some Lancashire boilers which were purchased in 1910 and 1911, and which had now been superseded by far superior equipment. The loss of £8,100 on the transaction had been taken from depreciation account, which account, however, had been increased by their having taken £15,000 out of the past year's profits, which brought the fund up to £80,000 as against £65,000 at which it stood a year ago. They had expended about £44,000 more on capital account than they had received, but having their depreciation fund and sufficient cash resources, they felt that that was a very small sum to have overspent themselves by. With regard to the earnings, last year the Chairman told them that they had then earned £10,000 more than in the previous year, which was a record. For several years past their earnings had been on the up grade, but last year, owing to the war, the increase was only £1,032. Up to the time of the war they were still on the up grade, as they had made £9,000 more gross profit than at the corresponding period of 1913, but the war turned the tide, with the result he had indicated. It was remarkable that the war should have had such a transcendent effect upon India, but there it was, and he thought they had great reason to be thankful that in the end they had been able to beat the best previous year's earnings by £1,000. They were paying the same dividend as last year—9½ per cent., free of income tax. The down-grade, he was sorry to say, still continued, although not to such an extent as gave rise to any fear as to the result of the year. Up to the present their receipts were really magnificent—1,151,756 rupees, which was only 71,000 rupees less than at the corresponding period last year.

Mr. J. G. B. Stone seconded the motion, and the report was adopted.

Cuba Submarine Telegraph Co., Ltd.

The total receipts for the year ended December 31st last were £38,245, and the expenses were £16,702, leaving £21,542, plus £7,849 brought forward. £3,000 has been placed to the reserve against loss on investments, £2,500 to the pension fund, and £2,000 added to the general reserve fund, which now stands at £100,000. Interim dividends were paid on October 22nd, viz., at the rate of 10 per cent. per annum, less income tax, on the preference shares, and at the rate of 5 per cent. per annum, free of income tax, on the ordinary shares. These interim dividends absorbed £7,000, and leave £14,891, out of which final dividends at the same rates, making total dividends for the year of 10 per cent. on the preference shares, less income tax, and 5 per cent. on the ordinary shares, free of income tax, are to be paid, the balance, £7,891, being carried forward. Mr. J. P. Hooper has been appointed a director in the place of the late Mr. Robert Kaye Gray, whose death occurred on April 28th last year.

Annual meeting: May 5th.

Berlin Elevated and Underground Railway Co.

The report of the Gesellschaft für Elektrische Hoch und Untergrundbahnen, of Berlin, states that an increase in the receipts took place in 1914, in consequence of the inclusion for the whole of the year of the contributions made towards the working expenses of the new connecting lines operated by the company, as compared with a similar period of only three months in the previous year. Down to the occurrence of the war the traffic, especially on the new lines opened in 1913, developed in a satisfactory manner, but after the mobilisation changes in the traffic and working conditions were manifested. It was possible in general to maintain the services by securing substitutes for the men who were called to the Colours. The sum of £15,000 was appropriated from the fund for extraordinary expenditure for the purpose of granting war relief. The route length of railway in operation was 17 miles, being the same as in the previous year. The accounts show the following figures for the past two years:—

	1914.	1913.
Ordinary shares (paid up)	£2,625,000	£2,625,000
Preference shares (5 per cent.) ...	1,000,000	—
Loan capital	3,991,000	3,992,000
Gross profits	418,000	355,000
Interest on loans	149,000	97,000
Redemption and renewal funds ...	57,000	49,000
Net profits and balance forward ...	190,000	184,000
Reserve fund	7,200	7,300
Dividend on ordinary capital ...	118,000	127,000
Dividend on ordinary capital, p.c.	4½	6
Carried forward	31,000	31,000

The number of train miles run amounted to 3,937,000 in 1914, as compared with 3,666,000 miles in 1913; the passengers carried increased from 71,525,370 in 1913 to 77,027,513 last year; and the average receipt per passenger was 1.54d., being the same as in the preceding year. It is added that the preparatory works in connection with the connecting line between the "triangle" and the Nollendorf Platz have been begun, and arrangements been concluded with the town of Schonberg in regard to the construction and operation on joint account of a two-storey underground section at the Nollendorf Platz.

STOCKS AND SHARES.

Tuesday Evening.

Something like a halt has been called to the steady upward progress of prices in the Stock Exchange markets, though it cannot be said that there has been a decided tendency one way or the other. The news of the week-end was construed by some as disappointing, although many took an optimistic view, arguing that such incidents as a German advance towards Ypres are amongst the natural events of such a campaign. But the buying movement received a check, and in some of the markets prices showed a disposition to go back a little—which, after all, is by no means surprising, having regard to the rises of this month. The more reassuring communiqué of Tuesday did much to revive confidence.

Continued strength characterises the market for Home Railway stocks, more attention being paid to them than has been the case for the past four months. In view of the good yields still obtainable on the leading stocks, and still more by reason of the Government's slight concession in favour of the companies, the notice of investors has been drawn to this section. The Undergrounds have been little more than steady, this being due to the request for advanced wages on the part of Underground Electric Railways employés, which has been met by substantial concessions from the company. How far this is likely to be made up from one direction or another it is impossible to guess, so the stocks are hanging back in the general advance established by those of the steam lines.

London Electric Railway ordinary shares are firm at 28s. 3d., this price comparing with the end-July level of 30s. Districts, it may be noted, are 4 points below their quotation at the time when war broke out; and Metropolitans are 7 points lower. The latter company's 3½ per cent. debenture stocks have been changing hands at about 83. District and London Electric Railways 4 per cent. rent charge was dealt in the other day at 89. District 6 per cent. debenture, by the way, now stands at 130, with dividends due in January and July, so that the return on the money at the present time is nearly 4¾ per cent., and the security looks ample. Metropolitan Surplus Lands has been negotiated this week at 54½.

It is satisfactory to notice that the London and North-Western Railway Co. are still making steady progress with the electrification of the local line (high level) between Willesden and Broad Street, in spite of the double handicap of reduced staff through enlistment, and the extra demands made upon the system by the military authorities. Work on the last section, that between Dalston Junction and Broad Street, is now well in hand, although several isolated portions farther down the line have yet to be linked up. Beyond Hampstead, however, the work is so far advanced that the wooden guard to the outside rail is now in position. The scheme is, apparently, some way from completion as yet, but there is no doubt that it will prove a serious competitor with the tubes and trams linking up North-West London with the City.

Most of the Colonial and foreign electrical issues remain in public favour. Mexico Trams 5 per cent. bonds have gained 3 points at 58. There has been some nibbling at Mexican Light and Power 1st and 2nd bonds, at 50 and 30 respectively. With the re-entry of these issues to public notice, we have included some of them in our lists of prices. Two or three stocks of the British Columbia Electric Railway Co. are regaining a little popular attention. With regard to the deferred stock, it is known that the 8 per cent. dividend will not be continued; there is, in fact, some doubt as to whether the preferred ordinary will get the full 5 per cent. to which it is entitled. The price of the 5 per cent. cumulative preference stock has risen within the past few days from 75 to 80, and even now returns 6¼ per cent. on the money. The preferred, which stood at 50 about ten days ago, has gained 10 points since then.

Brazilian Tractions have receded to 58. There seem to be many sellers about at anything like 60, because the price has great difficulty in getting up to it. The 6 per cent. cumulative preference hardened to 95, and this is another security which gives 6¼ per cent. on an investment at the current price. Canadian Generals are firm at 90 and 107 for the common and preference stock respectively, with little business doing in either. Montreal Light and Power Capital stock at 237 is actually higher than it stood at the outbreak of war. Mississippi Power preferred have firmed up to 45, and Vancouver power debenture to 79½. Pachuca bonds changed hands recently at 35, and Shawinigan Water Capital stock at 127½. Victoria Falls preference are also amongst those which command a better price now than they did last July, the current quotation being 15s.; while the 5½ per cent. second debentures at 88½ compare with 83, which was the price when hostilities started.

The Electrical Supply market is generally firm, with another rise of ⅛ in County of London preference. Metropolitans hardened to 3⅛, but City Lights at 14⅜ are ⅛ lower.

Nearly all the movements in the Telegraph market are in the upward direction, and the substantial rises recorded last week have been maintained in addition. Globe ordinary went back ¼, but otherwise the changes have all been to the good of holders. The trouble still is to obtain stock. New York Telephone 4½ per cents. have now reached par. Business in the United States is reported as booming, more especially in such branches as those engaged, directly or indirectly, in the manufacture of munitions and war stores. Within the last day or two, however, some reaction has overtaken the bounding buoyancy of the share market; and the check administered to such bullishness has been slightly reflected in a few of the markets dealing with Home investments. Marconis went back to 1¼, a fall of ⅛, apparently on sales by holders a little disappointed at the failure of the market to get about 1⅜, which seems to be the sticking point. Indo-Europeans have held the recovery of £4 which they enjoyed ten days ago.

Amongst Manufacturing companies, General Electric preference at 10⅜ are the fraction harder, but Edison & Swan shares of both classes remain dull, although the partly-paid at 30s. are a few pence better on the week. British Insulated preference have risen to 6⅜, and the ordinary to 11¾. The rest of the list shows steadiness. The rubber market keeps good on the whole, in consequence of the output of company reports showing costs to have been reduced below 1s. per lb. Most of the producing concerns have got their expenditure down to the neighbourhood of 11d., and some as low as 9d. per lb.; while hopes are entertained that even the last-named figure will be reduced in respect of the current year. People are buying the lesser-known shares which pay at least 10 per cent. on the money, and with a fair prospect of higher rates to come. In the Armament group, the Armstrong Co. has declared a dividend making 12½ per cent. for the year, the same rate as that paid by Vickers, but the shares of both undertakings are a little easier at 40s. and 36s. 6d. respectively, both prices including dividends of 1s. 6d. per share. The Projectile Co. is said to be contemplating repayment of all its debentures by June 1st next, and the 1s. shares, after going as high as 16s., retain a rise on the week at 15s. National Explosives are also better.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	April 27, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	8¼	—	£6 1 3
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4½	—	5 11 1
do. do. do. 4½ Pref.	4½	4⅜	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4½	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	14⅜	— ¼	6 5 2
do. do. 6 per cent. Pref.	6	12¼	—	4 18 0
do. do. 5 Deb.	5	112	—	4 9 3
do. do. 4½ Deb.	4½	98	—	4 11 10
County of London	7	11⅜ xd	—	6 3 1
do. do. 6 per cent. Pref.	6	11 1/16	+ ⅛	5 3 [illegible]
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	97	—	4 12 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1¾	—	6 18 0
do. do. 6 per cent. Pref.	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	3½	3⅛	+ ⅛	5 12 5
do. 4½ per cent. Pref.	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	75	—	4 13 4
St. James' and Pall Mall	10	8	—	6 5 0
do. do. do. 7 per cent. Pref.	7	6⅜	—	5 9 10
do. do. do. 3½ Deb.	3½	80	—	4 7 6
South London	5	8	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7½	—	6 0 0
do. 4½ Pref.	4½	4⅞	—	4 12 4

Telegraphs and Telephones.

	Dividend, 1914.	April 27, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	106½	+ ½	5 12 8
do. Def.	1½	23	—	6 10 4
Chile Telephone	8	6⅝	—	6 0 9
Cuba Sub. Ord.	5½	8¼	—	6 5 9
do. Pref.	10	15½	+ ½	6 9 0
Eastern Extension	7	13¼	+ ¼	5 6 8
do. 4 Deb.	4	92	—	4 7 0
Eastern Tel. Ord.	7	136	+ 1	5 3 0
do. 3½ Pref.	3½	74	+ ½	4 14 7
do. 4 Deb.	4	93	—	4 7 0
Globe Tel. and T. Ord.	6	11¼	— ¼	5 6 8
do. Pref.	6	12¼	—	4 17 2
Gt. Northern Tel.	22	30	—	7 6 8
Indo-European	65	55	—	6 0 0
Marconi	20	1¾	— ⅛	11 8 6
New York Tel. 4½	4½	100	+ ½	4 10 0
Oriental Telephone Ord.	10	2	—	6 0 0
do. Pref.	6	1 3/16	—	5 1 1
Tel. Egypt Deb.	4½	88½	—	5 1 8
United R. Plate Tel.	8	6¼	—	6 8 0
do. Pref.	5	6	—	5 0 0
West India and Pan.	1½	1 5/16	–	5 0 0
Western Telegraph	7	19⅝	—	5 2 8
do. 4 Deb.	4	93	—	4 6 0

Home Rails.

	Dividend, 1914.	April 27, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented	4	77½	+ ½	5 3 3
Metropolitan	1½	30½	—	4 9 0
do. District	Nil	17¼	— ¼	Nil
Underground Electric Ordinary	Nil	1 3/16	—	Nil
do. do. "A"	Nil	5/9	+ 3d.	Nil
do. do. Income	6	81	—	7 8 3

Foreign Trams, &c.

	Dividend, 1914.	April 27, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref.	5½	4 5/16	+ 1/16	6 7 6
do. 2nd Pref.	5½	3⅞	—	7 2 0
do. 4 Deb.	4	83	— ½	4 16 5
do. 4½ Deb.	4½	90	—	5 0 0
do. 5 Deb.	5	89½	+ ½	5 11 9
Brazil Tractions	6	58	— 1	10 6 10
Bombay Electric Pref.	6	10⅜	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	80	—	Nil
do. 5 per cent. Bonds	—	58	+ 3	Nil
do. 6 per cent. Bonds	—	85	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	42	—	Nil
do. 1st Bonds	—	50	+ 3	—
Adelaide Sup. 6 per cent. Pref.	6	5¼	—	5 14 3
do. 5 Deb.	5	103	—	4 17 1

Manufacturing Companies.

	Dividend, 1914.	April 27, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	52/-	—	5 7 8
British Aluminium Ord.	5	20/6	—	4 17 7
do. Pref.	6	19/6	—	6 9 9
British Insulated Ord.	15	11½	+ ¼	6 10 5
do. Pref.	6	6⅛	+ ⅛	5 0 0
British Westinghouse Pref.	7½	1 15/16	—	7 15 0
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	99	—	6 1 3
Callenders	15	12	—	8 6 8
do. 5 Pref.	5	4⅞	—	5 2 7
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	3 3/16	—	4 14 1
Edison & Swan, £3 pd.	Nil	13/-	+ 6d.	Nil
do. do. fully paid	Nil	1¾	—	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5 Deb.	5	60	—	8 6 8
Electric Construction	5	13/6	—	7 5 6
do. do. Pref.	7	1	—	7 0 6
Gen. Elec. Pref.	6	10⅛	+ ⅛	5 18 5
Henleys	20	11½	—	6 18 0
do. 4½ Pref.	4½	4⅞	—	4 12 4
do. 4½ Deb.	4½	97	—	4 13 9
India-Rubber	5	9⅛	–	5 9 7
Telegraph Con.	20	37	—	5 8 6

Alderley and Wilmslow Electric Supply Co., Ltd.

The profit on the year's working, according to the *Financier*, was £3,122, plus £631 brought forward. Debenture interest takes £1,711. The directors recommend that £1,000 be placed to the reserve fund and that £1,012 be carried forward.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, April 28th.

CHEMICALS, &c.		Latest Price.	Fortnight's inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a " Nitric	"	19/-	..
a " Oxalic	per lb.	..	..
a " Sulphuric	per cwt.	..	..
a Ammoniac Sal	"	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	"	£9	..
a Bisulphide of Carbon	"	£21	..
a Borax	"	£22	..
a Copper Sulphate	"	£29	..
Lead, Nitrate	"	£35	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
c Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	6d.	..
a Potash, Caustic (88/90 %)	per ton	..	..
a " Chlorate	per lb.	1/6	..
a " Perchlorate	"	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	"	£11 10	..
a " Recovered	"	£8	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %)	"	£10 2 6	..
a " Chlorate	per lb.	10¼d.	..
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	3½d.	..

METALS, &c.		Latest Price.	Fortnight's inc. or Dec.
b Aluminium Ingots, in ton lots	per ton	£90	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	£120	..
b " Sheet, in ton lots	"	£120	..
p Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	11½d.	1½d. inc.
c " Tube (brazed)	"	1/-	..
c " " (solid drawn)	"	1/0½	1½d. inc.
c " Wire, basis	"	1/-	1¼d. inc.
c Copper Tubes (solid drawn)	"	1/1¾	1½d. inc.
g " Bars (best selected)	per ton	£100	£6 inc.
g " Sheet	"	£100	£6 inc.
g " Rod	"	£100	£6 inc.
d " (Electrolytic) Bars	"	£86	£6 inc.
d " " Sheets	"	£104	£6 inc.
d " " Rods	"	£93	£6 inc.
d " " H.C. Wire	per lb.	11¼d.	¾d. inc.
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	1/9	1d. inc.
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/6	1d. dec.
j Iron Pig (Cleveland warrants)	per ton	65/6	1/6 dec.
l " Wire, galv. No. 8, P.O. qual.	"	£20	£1 inc.
g Lead, English Pig	"	£21 to £22	..
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£12	..
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e " " " medium	"	3/- to 5/-	..
e " " " large	"	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/2 to 1/3½	..
p " " rolled strip & sheet	"	1/3½ to 1/5½	..
o Platinum	per oz.	135/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£70	..
g Tin, Block (English)	"	£165 to £165	..
n " Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

North of Scotland Electric Light and Power Co., Ltd.—The company made good progress during the first half of 1914, but the war has occasioned a serious falling off during the latter half. The lamp connections in Montrose have increased from 30,192 to 33,750, equivalent 8-C.P. lamps; in Brechin from 21,506 to 22,360, and in Inverness from 35,872 to 38,969, making a total of 95,079 connected in the three towns. The gross profit, including £1 859 brought forward, is £8,795, and after meeting interest on debentures and loans, amounting to £2,819, and writing off £57 from suspense account, there remains a net profit of £5,920. The directors recommend a dividend at the rate of 3 per cent. for the year, absorbing £1,500, that £2,000 be placed to renewal reserve account, and that £2 420 be carried forward. The annual meeting was held on April 21st.

Kidderminster and District Electric Lighting and Traction Co., Ltd.—The report for 1914 recommends a dividend of 2½ per cent., carrying forward £163.

RATIONAL RATING FOR FILAMENT LAMPS.

By S. M. POWELL.

It is now some five years since the writer had the privilege of writing in these columns in favour of candle-power rather than wattage rating for filament lamps, and as this problem is still not definitely settled but rather, for reasons given below, seems likely to become a more contentious matter than ever in the near future, the following remarks may be of interest as giving a brief review of both sides of the question and, in particular, as dealing with arguments which have been advanced in favour of watt-rating.

It may be, in fact it has been, contended that since watt-rating is used by 80 per cent. of metal lamp manufacturers it must be right, or it would never have been adopted so extensively. The writer does not support this view. Owing to patent complications and the economic necessity for manufacturing on a large scale, the number of metal lamp manufacturers is relatively very small, and manufacturers have been in a position to do practically what they liked in the rating matter. It is convenient from the manufacturing standpoint to adhere to a fixed watt-rating, and hence that rating has been adopted, but it is neither desirable nor convenient from the user's standpoint. How is it, then, that the public has not complained and compelled the adoption of candle-power rating? Simply, in the writer's opinion, because of the fact that watts and candle-power have been numerically equal during recent years (at first in claim, based on the Hefner candle-power, and more recently in fact, based on the British candle-power). This coincidence is, however, purely accidental and temporary. As lamp efficiencies improve further, the numerical value of candle-power will exceed that of watts, and the desirability of candle-power rating will be much increased. It is more than probable that consumers will demand a candle-power rating, and though the position of lamp manufacturers is such that they need not accede to that demand, it would be against the best interests of the electrical industry as a whole not to fall in with consumers' wishes.

The ordinary householder is notoriously ignorant on all electrical matters, so that it is quite possible he will not be able to locate and express the cause of the confusion and dissatisfaction which he must feel if we persist in selling him lamps which are of constant wattage but steadily increasing candle-power. If we put ourselves in his place, we can only arrive at the conclusion that what he wants is a standard series of candle-powers, whether or not he has the perception to realize, and the ability to express, the fact.

The user of any lamp sets out to buy light. He is interested in what fuel or power expenditure is involved, because that determines what he has to pay for his light. The fact that so many lamps of such and such candle-power are charged for power on a wattage basis has nothing to do with the rating of the lamps, any more than a gas engine of so many horse-power is rated in cubic feet per hour, because the quarter's gas bill is based on cubic feet consumed.

Admittedly, the candle-power rating of lamps has been abused, special filament shapes and reflectors being used to obtain polar curves giving very high candle-power values in certain directions, but wattage is equally subject to abuse, as can be particularly easily seen by comparison of any arc lamp lists. As a matter of fact, wattage is only a guide to the illuminating power of a lamp when the type and distribution curve of the latter are known. From the user's point of view, to specify by watts is no more instructive, or less liable to abuse, than specification by candle-power. A candle-power figure does bear directly on what the user wants, viz., light, but if candle-power is not stated, watts and efficiency (*i.e.*, watts per candle-power, which again brings us back to candle-power) are both required to tell the user what sort of a light-producing unit he is getting. Moreover, the user has to make a calculation to arrive at the candle-power value in the second case. It is a devious and quite illogical course to expect a user to get in the way of thinking of lamp sizes by watts. Perhaps a 40-watt lamp meets his needs now, but when a more efficient lamp is produced a 30-watt unit will suffice—the man has to keep on changing his purchasing unit.

The argument that a user purchases light by the candle-power is countered by the advocates of watt-rating saying they are prepared to mark lamps with candle-power as well as watts. This is a very insidious offer, and is not a solution to the problem, since it does not permit the user to get year after year lamps of the particular candle-power which meets his needs. Suppose that standard watt-ratings be adopted, as in Table I. Using lamps of 1·2-watt efficiency, a householder found that 30-watt lamps met his needs very well. Along came the 1-watt lamp, and the householder now gets 30 c.p. where he used to have 25 c.p. So far there is not much to grumble at (though if he had had the option he would doubtless have preferred to stick to 25 c.p. and get 15-20 per cent. off his lighting bill). Soon, however, the 0·8-watt/c.p. lamp will come along, and the householder has the option either of using 37½-c.p. lamps or of returning to the original 25-c.p. size (now taking only 20 watts).

TABLE I.—Candle-Powers Available on Watt-Rating at Various Efficiencies.

Constant watt rating.	Candle-powers available. 1·2 w. per c.p.	1·0 w. per c.p.	0·8 w. per c.p.	0·5 w. per c.p.
10	8½	10	12½	20
15	12½	15	19	30
20	16½	20	25	40
30	25	30	37½	60
40	33½	40	50	80
60	50	60	75	120
80	67	80	100	160
100	83	100	125	200

Neither alternative is satisfactory. Continuously increasing the candle-power of an installation is not only unnecessary, but is, after a time, objectionable and harmful, and reference to fig. 1 will show that the gaps in the candle-powers available become rapidly greater as efficiency rises, the watt series remaining constant. The fact that the consumer has to make fresh compromises with every increase in lamp efficiency—using a lamp either more or less powerful than the one he wants (except for accidental coincidences)—leads inevitably to a certain amount of dissatisfaction, whereas, on a constant c.p. system of rating, there would be nothing but satisfaction caused by the higher efficiency, every consumer getting the same light as before at less cost.

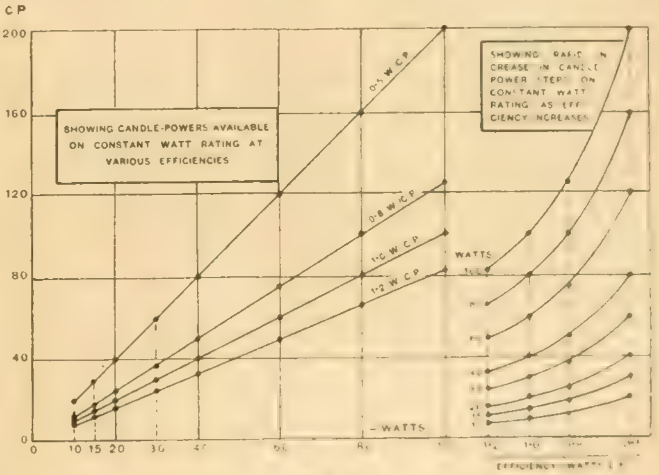

Fig. 1.

If this state of affairs is to be mitigated by introducing fresh values in the watt series as efficiency improves, why not do what will alone give the consumer full satisfaction—alter all the watt values to keep the standard candle-power values and increments, adding, of course, any higher or lower candle-powers made possible by improved construction or higher efficiency?

Table II shows that maintaining a constant range of candle-powers would necessitate finer wattage grading, as efficiencies increased. It is no doubt a manufacturing convenience to build to a fixed scale of watts, but it is totally illogical to sell any energy-converting device of variable efficiency on the basis of its power input. Who would dream, for instance, of sizing turbines or steam engines by the lb. of steam used per hour? Yet that would be a manufacturing convenience, for the design of turbine and engine starts from the flow of steam known to be necessary to produce the horse-power which the purchaser requires. Of course the steam consumption matters to the engine user just as the energy bill matters to the lamp user, but, in both cases, it is the output, the work-doing ability of the apparatus on which the latter must be sized. For another and closer analogy—does the manufacturer who had laid himself out to build quantities of $\frac{1}{100}$, $\frac{1}{16}$, $\frac{1}{8}$, and $\frac{1}{4}$-H.P motors change the rating of these to 0·012, 0·075, 0·15 and 0·3 H.P. when, by some means, he secures 20 per cent. increase in efficiency? Certainly not, he alters the proportions of the machines and beats rivals because his machines do a certain amount of work for 20 per cent. less energy consumption. Electric lighting is not a costly luxury. Everyone already uses just as much electric light as he needs, and what he wishes for the future is to get that light at lower and lower prices as time goes on, and not to have the amount of light manipulated and his energy bill the same till development happens to reach such a stage that he can use a lamp of lower wattage than before. It is only in dealing with such a commodity as light, which cannot be easily measured by the purchaser, that such a totally illogical practice would ever be tolerated for a moment. The thing to do is to keep on making half-pint and pint soup tablets, and not to expect the purchaser to drink stronger and stronger soup till suddenly he finds that what used to be a half-pint tablet will now make a pint of soup.

TABLE II.—Watt-Grading Necessary for Fixed Candle-Powers at Various Efficiencies.

Constant candle-power rating.		Watts	Consumed	
	1·2 w. per c.p.	1·0 w. per c.p.	0·8 w. per c.p.	0·5 w. per c.p.
8	9½	8	6½	4
16	19	16	13	8
32	38·4	32	25½	16
64	77	64	51	32
100	120	100	80	50
10	12	10	8	5
15	18	15	12	7½
20	24	20	16	10
30	36	30	24	15
40	48	40	32	20
60	72	60	48	30
80	96	80	64	40
100	120	100	80	50

One of the chief advantages of electric lighting, viz, its constancy, is threatened by the constant-watts, variable-candle-power system of rating. It has been suggested that the greater constancy of watts, as compared with candle-power, is a cogent reason for rating by watts. Such an argument might apply to laboratory practice, but the user of electric light wants constant candle-power within, say, 10 per cent., and he gets it in modern lamps. The fact that the watts vary only 5 per cent. or so is of no interest to him; did they not vary at all that would not affect his primary interest in the candle-power.

The peculiar polar curve of many modern lamps and reflectors has been made an objection to rating by candle-power. The objection does not apply at all if lamps be rated, as they should be rated, in mean spherical candle-power. By so doing we preserve a logical basis of rating, and one on which the layman has quite reasonably accurate ideas. Mean spherical candle-power is a measure of total flux of light, and as such is a thoroughly suitable unit. It requires only a minimum of intelligence to see that the flux of light must be greater (*i.e.*, lamps of higher candle-power must be used), if the light is to be distributed from an indirect fitting, than if the same working illumination is required over a limited area which can be served by a concentrating reflector. Any difficulty which exists is certainly aggravated if lamps be sized by watts.

A 20-watt lamp may be insufficient for a medium-sized room, but amply sufficient for a motor-car headlight illuminating several hundred feet of road. The wattage gives no idea of illuminating value in the two cases, but candle-power rating does not require the type of lamp to be known. The mean spherical C.P. is the basis on which to rate the lamp for use in the room; for the headlight projector the total flux of light in the beam is again what matters, and is expressed proportionately by the mean spherical C.P. of the lamp. To meet the competition of acetylene and other headlamps it is particularly desirable that the direct C.P. of the beam should also be specified; it has a definite significance and use.

The specification and design of illumination schemes on a basis of watts per sq. foot of floor area is piling one absurdity on another. Already the use of half-watt lamps in indirect fittings has vitiated watt per sq. ft. tables compiled for ordinary tungsten lamps, and as time goes on, confusion will be worse confounded. Candle-power per sq. ft., on the other hand, is a true constant for each system of lighting and class of interior.

The difficulty is not to find arguments against watt-rating, but to find any reasonable argument supporting it. Since wattage is related to useful effect only by the efficiency factor of the lamp, and since the latter varies with voltage, a 40-watt lamp, say, is of distinctly different candle-power and lighting value according to the supply voltage—could anything be more confusing, absurd, and liable to cause dissatisfaction? Admittedly it is easier to check watts than candle-power, but one is no further forward unless the efficiency also can be verified, and this again introduces candle-power. Any checking by the purchaser is unnecessary in the case of standard makes of lamps, and surely a deliberate misstatement of candle-power and efficiency by a second-rate maker is within the cognisance of the law.

The argument generally used to give the *coup de grace* to the unbeliever in watt-rating is that this rating is used by most manufacturers, and has been justified by practice. The writer wishes flatly to contradict this statement. The watt-rating has been imposed on the public by consideration for the maker's convenience, and it has, so far, been tolerated because wattage rating is practically a candle-power rating on 1-watt per C.P. tungsten lamps. Directly higher efficiency is reached in lamps for household use, the watt-rating must either break down, or cause endless confusion and no little dissatisfaction if it be persisted in.

Undoubtedly lamps should be made now and always in a convenient range of mean spherical candle-powers. Marking with mean spherical candle-power and wattage will tell the ordinary user all he wishes to know. In addition, polar curves of candle-power should be available to any person competent to tell therefrom how lamps should be placed. This point and the lamp candle-power required have to be decided only when the lighting installation is first erected. At that time the user has expert or at least intelligent assistance. Thereafter, the maintenance of efficient and satisfactory results requires simply the periodical replacement of lamps by others of equal candle-power. Without such constancy of candle-power, which cannot be maintained under a watt-rating system, permanent satisfaction is impossible.

Both watts and mean spherical candle-power should be *marked* on lamps, but *candle-power should be the basis of sizing.* By all means let the manufacturer work if he likes on a watt basis in his factory, so long as he changes this basis when necessary to preserve acceptable candle-power values and increments.

Australian Railway Scheme.—The plans for the Sydney railway, authorised by Parliament, have been modified by the Government with the object of reducing the expenditure. The modification consists in raising the levels at terminal stations at Redfern and Circular Quay, which will be open-air stations, the four other stations being underground. The raising of the levels at the two points will reduce the cost of construction by £1,000,000. On account of the easier grades there will be a saving in power for working the railway, also with the present proposal 42 trains per hour can be run on each track, as against 36 in the original proposal.—*Sydney Morning Herald.*

THE PREVENTION OF ELECTROLYSIS IN BOILERS.

A GREAT many cases of corrosion in boilers which have occurred both in marine and land practice, have caused extended investigation to be made from time to time as to causes of such corrosion, and the best means of security against deterioration due to such causes. Such investigations have been extended in many directions, and frequently the chemical and engineering treatment of the structural parts, and of the water used in the boilers, has proved of great benefit.

It has, however, become increasingly recognised that electrochemical action is responsible for very much of the deterioration which occurs in connection with such metallic structures as ships, boilers, condensers, pumps, and so on, with the result that for a long time past both private experimenters and public institutions have directed their attention to the problems underlying electrolytic corrosion.

In a recent report by the Corrosion Committee of the Institute of Metals, the abandonment of brass for condenser tubes was advocated. It was suggested at the same time that greater attention might be paid to electrolytic methods of combating corrosion. For many years auxiliary plates of iron, zinc or aluminium have been used with some effect in minimising corrosion by forming a galvanic couple with the metal to be protected, and this process is still largely used. When new, the action of such slabs is beneficial, because they are electro-positive to the metals they protect. Unfortunately, however, they are quickly transformed into zinc sulphates and iron hydrates, which substances are electronegative. Obviously, therefore, when this occurs these substances join the attacking forces, and are doing more harm than good.

For this reason it may be of use to refer to an electrolytic process for the prevention of scale and corrosion developed by the Cumberland Engineering Co., of London, which has yielded interesting results. Mr. Cumberland's success can be attributed to the fact that a stronger force than the one which it is desired to eliminate is brought to bear permanently by the introduction of electricity from an external source, this being distributed in the following manner:—Anodes suitably insulated are fitted in the vessel to be protected and immersed in the water contained therein. A low-pressure current is then supplied which is regulated by suitable resistances fixed on a switchboard. The current is generally used at a pressure of from 6 to 10 volts, and by means of an ammeter fixed on the switchboard the operator is able by the aid of the resistance to adjust the amount of current supplied to any vesssel or parts of it. The iron anode is connected through an insulated bolt to the positive side of the circuit, and the vessel which it is desired to protect is connected to the negative side, making it the cathode.

When the current is supplied the elements of the water in the vessel become electrically charged, and by the laws of electrolysis the positive radicals or anions assemble at the anodes, and hence we find a film of hydrogen formed all over the immersed portion of the vessel, protecting it. The oxygen, acids and other destructive agents are attracted to the iron anode, which suffers from their attack, and, in course of time, becomes so reduced that it has to be renewed. By the use of this process the parts which used to suffer from deterioration through the corrosive effects of substances in the water are protected, the destructive action being transferred from the receptacle itself to the inserted anodes.

Moreover, in addition to preventing corrosion, this method removes all foreign matter from the immersed surfaces of the vessel. This is because the hydrogen is given off in minute bubbles on the surface of the metal, but underneath any scale, grease or other adherent matter. These bubbles mechanically loosen such deposits, and when the surfaces of the vessel are once clean the hydrogen given off prevents the settling of any solids. This cleaning effect will be seen to be most important, when one remembers that $\frac{1}{10}$th of an inch of hard scale may cause a drop in fuel efficiency of 10 per cent. in a furnace.

The cost of electricity and of anodes is extremely small when compared with the expense previously incurred for new tubes and for laying off plant for repairs; therefore it is not surprising that owners and engineers of large undertakings are showing great interest in what is to many an entirely new system. It is also worth noticing that most of the leading shipping companies have installations on the boilers and condensers of their vessels, while numerous progressive firms in Great Britain have also adopted this system for land practice. For example, Messrs. Marshall, Sons & Co., Ltd., of Gainsborough, applied the process to eight of their boilers and an economiser, with the result that the corrosion inside the boilers, which was previously very active, and because of which the apparatus had been specially installed, entirely ceased to spread, while there has been a considerable improvement in the amount of deposit in the economiser; a great deal of the old scale in the boilers was shelled off, and there was less new deposit than before the adoption of this process. Many similar results could be quoted. Demonstrations of the working of the system can be seen at the company's head office, together with some interesting phenomena associated with it.

THE POWER SUPPLY OF THE CENTRAL MINING-RAND MINES GROUP.

By J. H. RIDER, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *April 15th*, 1915.)

THIS paper deals with the power (electricity and compressed air) supply given by the Rand Mines Power Supply Co., Ltd., to those gold-mining companies of the Central Mining-Rand Mines group which have contracted with the power company for the whole of their power requirements, and treats the subject from the consumers' point of view. The paper entitled "Power Supply on the Rand,"* read by Mr. Hadley before the Institution on March 13th, 1913, dealt with the general power supply given on the Rand by the Victoria Falls and Transvaal Power Co., Ltd., and its associated company the Rand Mines Power Supply Co., Ltd., and treated the subject from the power company's point of view.

The companies of the group crush at present about 8,500,000 tons of ore per annum and produce about 36 per cent. of the total gold output of the Transvaal, or about 14.5 per cent. of the total gold output of the world.

The entire working and operation of the system of the Rand Mines Power Co. are under the technical control of the Victoria Falls Co.

Each of the mining companies in the Central Mining-Rand Mines group has its own separate contract with the Rand Mines Power Co., under which it "agrees to take from the power company all the motive power needed by it, in the form of electricity and of compressed air."

The whole of the compressed-air supply (with the exceptions noted later) is given from the air mains of the Rand Mines Power Co., and only to the mines in the Central Mining-Rand Mines group. The Victoria Falls Co. has, so far, no air-compressing system.

An interim electrical supply, without any liability for damages for stoppages, etc., had been given to certain mines, up to about 8,000 K.V.A., from the stations of the Victoria Falls Co. The permanent supply under the terms of the contract began on March 1st, 1911.

The history of the first three years of the supply under the contract teaches one outstanding lesson, namely, that it is only courting failure to attempt to give a permanent and reliable supply without a proper reserve of generating and transforming plant. During 1911 and 1912 interruptions were frequent, both in the electrical and air supplies, and as the fourth generator at Vereeniging was not put to work until October, 1913, a considerable amount of load (principally winders) was not changed over to electric drive until then, but was kept working on steam. It was not until August, 1914, that the power company was able to supply the whole of the compressed-air load, and up to that date a number of the old steam compressors on the mines were still used.

It is not for the author to explain the reasons for the frequent and sometimes lengthy breakdowns of the generating plant. He has little doubt, however, that some of them were caused by nothing else than continuous overloading, in an attempt to give as large a supply as possible from the existing plant, before the spare plant was ready. A reserve of [illegible] per cent. is not by any means too great, particularly with such large generating units as are used in the power company's stations, considering that the necessary periodical overhauls must put a certain amount out of action almost all the time. Since the full amount (25 per cent.) of reserve plant has been available the supplies have been quite reliable, and any troubles have been generally local and of no long duration.

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* Abstracted in the ELEC. REV., March 28th, 1913.

At the end of March, 1911, the power company was notified by the Rand Mines, Ltd., that its companies would require a total of 70,000 K.V.A. of electricity supply, and 21,000 lb. per minute of compressed-air supply at a gauge pressure of 100 lb., these demands being the aggregate of the demands of the individual mines as measured at the points of delivery.

Experience has shown that the maximum individual demands of the mines for electricity supply have a diversity factor of about 1.14, while the power factor averages about 0.77, so that the above aggregate demand represents a maximum demand upon the electrical system of about 47,300 KW. The load factor of the electrical system is about 75 per cent., and the annual consumption at the rate of about 310,000,000 units.

Considerable economies have been made in the use of compressed air since 1913, and the maximum aggregate air demands now vary in the neighbourhood of 18,000 lb. per minute. The diversity factor is also very variable, but averages about 1.13, so that the maximum demand upon the compressed-air system is about 15,800 lb. per minute, or 37,900 KW. The load factor is about 34 per cent., and, as an air unit represents 27.441 lb. at 100 lb. gauge pressure, the annual consumption is about 103,000,000 air units. The energy value of the air unit represents 0.641 of the energy in one electrical unit, assuming isothermal conditions of air compression.

A flat price is paid for the electric and air unit, and is subject to special rebates, depending on the working costs of the power company and the cost of railway carriage of coal.

Owing to the great expense which would have been incurred in carrying air mains to the outlying mines, it was agreed that four mines should obtain their compressed-air supply from their own electrically-driven compressors erected on the mines.

Mr. Hadley says in his paper that the electricity "supply is furnished to all mining consumers at 2,100 volts and 525 volts." Unfortunately the contract allows a variation of 10 per cent. up and down from the mean pressures, or a total range of 20 per cent. before any damages become due from the power company. That is, the higher pressure of supply can be anything between 2,310 volts and 1,890 volts, and the lower pressure anything between 577.5 volts and 472.5 volts. Such a range is much too great.

Damages are only payable for pressure variations beyond the above limits which last for more than ten consecutive minutes. If, however, the pressure variations cause a stoppage of any of the pumping, mining, and metallurgical operations, the damages due for failure to supply are payable.

The standard frequency of the electricity supply is 50 periods per second, but the contract allows a variation of 5 per cent. up and down from this, or a total range of 10 per cent., before any damages become due.

The whole of the transforming and extra-high-tension control apparatus at each point of supply on the mine properties is provided by the power company. The transformer and switch houses, however, are provided by the consumer. The transformer houses are brick or concrete structures, and including the switch-house section, cost about £450 per cubicle, to accommodate a 1,000 or 1,250 K.V.A. 3-phase transformer.

There are altogether 23 transformer houses at the various points of supply, and the ratings of the transformers installed (1914) aggregate 125,750 K.V.A. About 6,000 K.V.A. additional rating is to be added in 1915.

Metering the Supplies.—The arrangements for measuring the various supplies have been the subject of very careful consideration by both parties. The number of units of electricity supplied to the consumer is ascertained by three integrating watt-hour meters placed in series and connected in circuit at each point of delivery on the low-tension side of the transformers. One complete set of meters is installed for each pressure of supply.

The first meter of each set is the property of and kept in repair by the power company; the second is the property of and kept in repair by the consumer; and the third is the property and kept in repair at the joint expense of the consumer and the power company.

The consumer pays for the number of units represented by the mean of the readings of the three meters at each pressure of supply, together with an allowance for the actual losses in the transformers installed by the power company at each point of supply, which does not exceed 2 per cent.

If the reading of each meter is within 3 per cent. of the mean of the reading of the three meters, each meter is considered correct for the purposes of the accounts. If, however, the reading of any meter at any time shows a difference from the mean of more than 3 per cent., the accuracy coefficient of each of the meters is, as soon as possible, re-determined by a test, and each meter having a coefficient which shows an error of more than 3 per cent. is re-adjusted.

The power company's electric meter and the joint electric meter at present installed are both of the A.E.G. make, while the consumer's electric meter is of the General Electric Co.'s (U.S.A.) make.

The number of units of compressed air supplied to the consumer is ascertained by an air meter or meters provided by and maintained at the expense of the power company, and connected in the air-pipe line at the point of delivery. The consumer may also provide and maintain at its own expense an air meter or meters at the points of delivery.

The number of units of compressed air paid for by the consumer is the mean of the readings of the meters. If the reading of any air meter at any time shows a difference from the mean of the readings of all the meters of more than 3 per cent. such meter is, as soon as possible, tested and re-adjusted.

In addition to the tests referred to above, routine tests on all electric and air meters are made periodically by the technical staffs of both parties acting jointly.

The air meter used by the power company is of the Venturi type, while that used by the consumer is of the swinging-gate type. The former was described in Mr. Hadley's paper.

The gate type of air meter consists essentially of a weighted door or "gate," swinging from the top on horizontal pivots within a section of the main air pipe. The motion of the gate, the angular position of which is a measure of the flow of air, is transmitted through bevel gearing to a vertical spindle which is connected to the external counter mechanism. This is similar to that used for the Venturi meter, and is described in Mr. Hadley's paper. It contains automatic temperature and pressure correcting cams, and the indications of the dials are given direct in air units.

The "gate" meter has a much wider range than the Venturi meter, and will read with accuracy down to 2 per cent. of the full flow. The Venturi meter is not accurate below 10 per cent. of the full flow. Both the Venturi and the gate meters were designed by Mr. J. L. Hodgson, of Messrs. Geo. Kent, Ltd., and were first made for the Rand Mines Power Co., Ltd., and Rand Mines, Ltd.

Electric meters are tested *in situ* where necessary by means of portable secondary standard meters, which have previously been tested against the primary standard instruments of the power company in its laboratory.

Air meters are, where possible, tested *in situ* by means of portable secondary standard instruments, which have been previously tested against the primary standard instruments erected at Ferreira Deep, Ltd.

The large displacement air meter, belonging to Rand Mines, Ltd., which is used in the air-testing station at Ferreira Deep, Ltd., is described in Mr. Hadley's paper. It is in constant use, and has proved itself to be a most reliable, accurate, and effective apparatus.

All the electric meters at each point of supply are fixed in a special electric meter house adjoining the sub-station, and the connections to the various current and potential transformers are made through terminal panels, so that check meters and instruments can be readily inserted in the circuits.

The air meters at each point of supply, together with the main control valves and the temperature and pressure recorders, are fixed in the main air-pipe line within a special air-meter house.

The Use of Electrical Energy by the Mines.—The number of motors installed (1914) is about 1,500. They vary in size from 2 H.P. to 2,000 H.P. (R.M.S. rating), and the total horsepower is about 142,300, made up as follows:—

Winders	57,340 H.P.
Pumps	30,330 ,,
Stamp mills	13,890 ,,
Compressors	11,700 ,,
Tube mills	10,170 ,,
Hauling and conveying	5,290 ,,
Crushers	5,350 ,,
Workshops	2,110 ,,
Ventilating	1,370 ,,
Miscellaneous	4,750 ,,

Electric Winders.—The most important service is that of winding. There are at the present time 38 shafts in use on the mines of the group, many of which have underground winders for the lower depths, in addition to surface winders.

For the purpose of winding, shafts may be divided into three classes, viz. (*a*) incline shafts, which approximately follow the dip of the reef; (*b*) vertical shafts, which strike the reef at its lower depths; and (*c*) compound shafts, which descend vertically until the reef is struck and then follow on the incline.

A few of the compound shafts are still served by single-stage winders, the skip or cage first descending the vertical portion, then turning the corner, and finally descending the incline; but the majority now use a separate winder for the incline portion.

The deepest shaft of any mine in the group is No. 3 Shaft, Village Deep, Ltd., which is 4,144 ft. deep in the vertical. An incline shaft has already been sunk at the bottom of the vertical for a distance of about 1,200 ft., and will be continued for an additional 5,000 ft., which will make the total length of vertical and incline over 10,000 ft. The incline shaft is at an angle of about 35° to the horizontal, and will probably be served by two winders on different levels, in addition to the surface winder which deals with the vertical only.

When the general electrification scheme was decided upon, it was resolved, for financial reasons, to use as many of the existing steam winders as possible, by removing the connecting rods and connecting up the motors to the drum shafts, either directly or through gearing.

At the end of 1914 there were 69 electric winders in use or on order, as enumerated in the accompanying table. The figures do not include small winches, etc.

Out of the total number of winding motors now in use 51 of the 3-phase type and four of the Ward-Leonard type were ordered before the advent of the author on the Rand at the end of 1910. The policy which guided his predecessor in deciding to use 3-phase motors in such large numbers for winding was that of saving fresh capital outlay, as is indicated in a paper by Mr. H. J. S. Heather,* in which the theory of the control of such motors is investigated.

Mr. Heather thought the saving effected could not be under £30,000. Such a saving is certainly worth having, if there are no serious practical disadvantages from the operating point of view, and, generally speaking, it must be admitted that the three-phase winding motors on the Rand are working quite satisfactorily. Whether their use is justified, however, under all conditions, and whether Ward Leonard sets would not have proved more economical in working in many cases, are debatable points.

	New.		Converted.		
	Direct-coupled.	Geared.	Direct-coupled.	Geared.	Totals.
Ward Leonard ...	7	1	1	—	9
Three-phase ...	2	12	10	35	60

A 3-phase winding motor *per se* is a much simpler machine than a continuous-current winding motor, with its necessary adjunct on a 3-phase system of supply, the motor-generator, but its control is not nearly so simple.

The control apparatus consists essentially of :—

(*a*) Stator reversing switches, operated by the first motion in either direction of the driver's control lever.

(*b*) A variable rotor resistance, controlled by the further motion in either direction of the lever.

The rotor resistance usually comprises a tank in which are suspended metallic electrodes connected to the three slip-rings. One side of the tank is closed by a moving weir or shutter, so that the level of the electrolyte, which is circulated by a small centrifugal pump, can be raised or lowered at will, which varies the resistance across the slip-rings accordingly. The rate of rising of the electrolyte, and therefore the acceleration of the winder, are independent of the driver, being determined only by the rate of delivery of the pump, which is adjustable. This is much simpler than the complicated resistances, switches, and connections required by the Ward Leonard system. In practical operation, however, the Ward Leonard winder is much the easier to control, and for the following reasons :—

(*a*) The manual energy required to operate the control lever is much less. In the Ward Leonard system there is only a cylindrical or face-plate resistance switch to rotate, which has no appreciable weight or inertia to overcome.

In the ordinary 3-phase control there is the heavy weight of the weir to move up and down, and, although it may be balanced by external or internal weights, all the masses have to be put into motion and stopped by the driver every time. This is not only very tiring, but militates against accurate or fine adjustments of the position of the weir.

(*b*) In the Ward Leonard system the winding motor can be converted into a generator for braking, by bringing the control lever back just sufficient to lower the voltage of the generator (of the motor-generator set) below the back electromotive force of the motor.

In the 3-phase system the control lever has to be brought back beyond the neutral point, before braking (by reverse current) is obtained. That is (1) the weir and electrolyte have to be lowered, (2) the stator switches opened, (3) the stator switches closed again for the reverse direction, and (4) the weir and electrolyte raised.

(*c*) It is much easier to move the skip or cage of a Ward Leonard winder for a few inches (as is frequently necessary when coming to the landing place or tip) than to do the same with a 3-phase winder, for the reasons given in (*a*) and (*b*) above.

The above features are obvious to anyone who has ever handled both types of winders, and appeal strongly to the drivers.

Attempts have been made to relieve the driver of the manual labour required to operate the control lever of a 3-phase winder, by using electricity or compressed air for opening and closing the stator switches, and compressed air for raising and lowering the weir. So far as the stator switches are concerned, both agents are quite successful, although electricity is to be preferred from the author's experience, and is in common use on the Rand. For raising and lowering the weir, however, compressed air proved a failure, because it was found impossible to predetermine the exact position to which the weir would come, owing to the elasticity of the operating medium. Its trial showed conclusively that the driver must have direct mechanical control of the weir to work his winder properly.

There are other points which only affect the relative economy of working. In the Ward Leonard winder electrical braking requires no electrical energy from the line, and will easily return energy by running the motor-generator slightly over synchronous speed. This is a material saving, as electrical braking with a 3-phase winder can practically only be obtained by using either reverse current or an auxiliary braking machine, such as an eddy-current brake, both of which make a direct call for energy from the line.

The eddy-current brake, of which several made by the British Westinghouse Co. are in use on 3-phase winders at City Deep, Ltd., and Village Deep, Ltd., consists of a rotating field-magnet system, exactly similar to that of a low-speed alternator, fixed on the winder drum shaft, and revolving within a hollow cast-iron stator ring, with a smooth circular face opposite to the field pole-faces. Eddy currents are set up in the face of the ring when the magnet system is excited, which exert a very considerable and effective braking force without jerk or jar of any kind. Water is circulated through the hollow of the stator ring to carry off the heat which is generated. Fig. 1 shows the eddy-current brake on a winder at Village Deep, Ltd.

The energy for the magnet system is obtained from a motor-generator. As originally fixed it was intended that one motor-generator should serve the brakes on several winders, and, to this end, the regulating resistance was placed in the main circuit of the brake magnet-system. The final breaking of the field circuit at each operation proved very destructive to the switch contacts, besides setting up insulation strains, and the arrangement has recently been altered by employing a separate motor-generator for each brake, with a rheostat in the field of the generator, so that the main circuit is never broken. This has proved very effective.

Each eddy-current brake was guaranteed to lower a net unbalanced load of 7,200 lb. at a rope speed not exceeding 1,750 ft. per minute, which is half the normal running rope speed for the winders in question. In practice it has been found that the brake will do much more than this, as, with an unbalanced load of 9,000 lb., the rope speed can be brought down to 250 ft. per minute, with an expenditure of energy in the field magnet-system at the rate of about 45 KW. The application of the mechanical brakes will then stop the winder in a few seconds. To obtain an equivalent result by applying reverse current to the winding motor required an expenditure of energy at the rate of about 1,600 KW.

The obstacle to the more general use of the eddy-current brake for 3-phase winders is capital cost, which amounts (with the motor-generator, etc.) to nearly two-thirds of the cost of the winding motor, and, in the cases above mentioned, makes the cost of the equipment practically the same as for the Ward Leonard system.

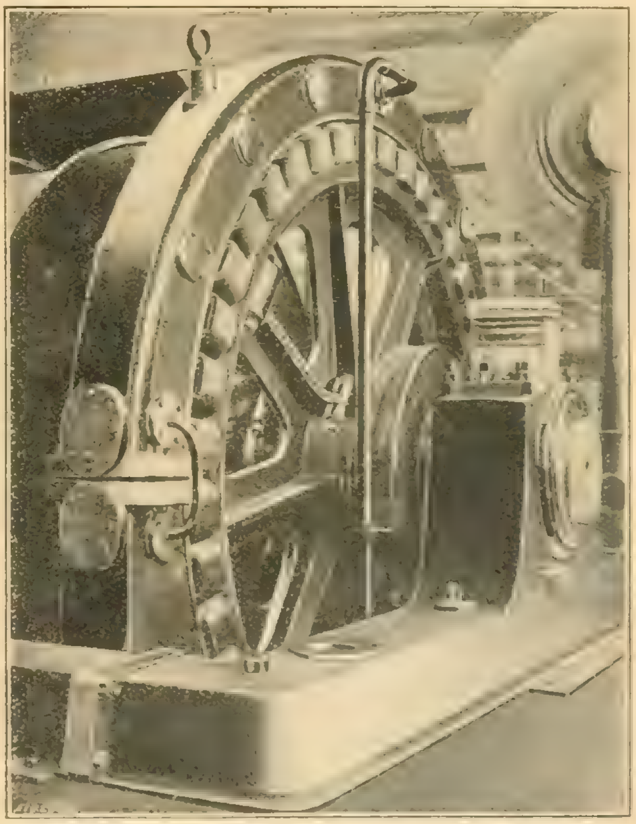

Fig. 1.—Eddy-current Brake at Village Deep, Ltd.

While general motor troubles are dealt with later, the two principal ones peculiar to 3-phase winding motors may be mentioned here. The first relates to the stiffness of the stator frame. A frame which may be quite strong and stiff enough for a motor running always in one direction, and only started and stopped say once per day or week, frequently is quite insufficient for a winding motor, which is not only started in opposite directions usually about once per minute, but has to stand the severe mechanical strains due to electrical braking just as frequently.

Some makers do not pay nearly enough attention to this point, and have supplied 3-phase winding motors of which the frames distort visibly when current is switched on to the stator, so much so that the radial air-gap has disappeared at certain points. In many cases the rotor core has had to be ground down, and radial stiffening arms made for the stator.

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* Abstracted in the Elec. Rev. June 2nd, 1911.

Deep frames of box section, with heavy external or internal stiffening rings, are absolutely essential.

The second trouble relates to the rotor slip-rings and the control gear. If a 3-phase motor is running at full speed and reverse current at full pressure is applied to the stator, the induced open-circuit standstill rotor voltage is doubled. Many of the 3-phase winding motors on the Rand have an open-circuit standstill pressure of 750 volts, so that in such cases the application of reverse current at full speed, with the rotor on open circuit, would give a rotor pressure of 1,500 volts.

To avoid working with an open rotor circuit at any time, a sill is arranged at the bottom of the weir opening in the control tank, so that the tips of the electrodes are always immersed, but even with this a high rotor voltage is always obtained.

Manufacturers of 3-phase motors do not always provide sufficient insulation between the rotor slip-rings, between the slip-rings and the shaft, and between the brush holders, even for the full open-circuit standstill rotor voltage, if kept on for any length of time. The idea apparently is that, as the motors are run with the slip-rings short-circuited, the insulation is therefore of no great importance. Unless the insulation of those parts of such motors is kept scrupulously clean, trouble is often experienced in starting up.

With 3-phase winder motors this point is even more important, not only because such motors are started and reversed frequently for many hours together, but also because of the higher rotor voltage obtained when reverse current is applied.

The rotor resistance tanks which were originally supplied with the large majority of the 3-phase winders gave considerable trouble, because they were too small for the required duty and the electrodes were arranged much too closely together, a spacing of about ¾ inch between phases being common.

During straight winding operations no great difficulties were experienced, but flash-overs between the electrodes were frequent when reverse current was applied, and even when these did not occur the electrolyte soon reached too high a temperature, as the retarding losses were then added to the accelerating and winding losses. As soon as a flash-over takes place the automatic circuit-breaker opens and cuts the winding motor off the supply circuit, leaving only the mechanical brakes for stopping the winder.

The capacities of a number of the tanks were afterwards increased and the disposition of the electrodes altered. This has been quite effective in removing the risks of flashing over, but the resistance at full load is somewhat high, which not only wastes energy, but causes a comparatively high rotor "slip."

Some experiments were then made to determine the safe minimum distance apart between phases, so as to avoid any chance of flashing over. At ¾-in. spacing the flash-over voltage was 850-900 volts; at 2½ in. it was 1,620 volts.

It would be impracticable to arrange all the electrodes with no less distance than 3 inches between them, as the sizes of the electrodes and tanks would have to be very great in order to give a sufficiently low resistance at full load and speed, when the electrodes are fully immersed. As, however, the rotor voltage decreases to practically zero as the rotor attains full speed, and from twice the normal to less than normal as the winder and its load are gradually brought to rest by reverse current, it follows that the proper arrangement is to use electrodes of such varying shapes and lengths that the distances apart of those portions of the plates of the three phases actually within the electrolyte are gradually reduced as the electrolyte rises, and that the increase in the areas of the immersed portions of the plates is such that the current density is kept at a low value. A density not exceeding 1 ampere per square inch has been found to be a safe limit.

In other words, if the immersed portions of the electrodes are far enough apart and of such areas as will always keep the current density at a value not greater than the figure given, it will be found that they will be close together and of large area at full immersion when the rotor voltage is low and the current high; and at safe distance apart and of small area when the rotor voltage is high and the current low.

Various designs of flat-plate electrodes were tried with this object in view, but they all proved more or less impracticable. The experiment was then made of using a large number of rods (actually angle iron) of varying lengths, arranged in the tank so that their disposition could be easily changed to obtain the required result. This was successful, as no flashing over was observed under working conditions, and the increases and decreases of areas and resistances were quite satisfactory.

(*To be continued.*)

Discussion in London.

Mr. **Hadley** said the paper described the largest installation, he thought, which purchased energy from a power company and gave some idea of the power contract. The power company had had to expend some 3½ million pounds to give this supply to the mines, and as regarded variations in periodicity and voltage, the plant was undoubtedly started at first without adequate reserve, but the position was now quite satisfactory. The power contract did not impose any particular obligation on the consumer as to use of the supply, as was often the case, and the power company also had considerable freedom. Big loads very often occurred suddenly, and he thought if the author had had his way, fewer direct driven winders would have been installed, and no doubt better results would have been secured.

Mr. **Shepherd** said he was struck with the enormous size of the undertaking, and asked whether 25 per cent. reserve plant was really sufficient with large turbine sets. It seemed to him that there was every advantage in putting in the Ward Leonard type of winder, but he was surprised that overwinding devices received so little mention, as the small headroom ought to make them useful. He asked whether the limiting head for centrifugal pumping had not been reached, and if it could be taken that practically no trouble had been experienced from insulation and dust in connection with the electrical plant.

Mr. C. P. **Sparks** said he gathered that the very large winders were all of the Ward Leonard type, and if that was so it coincided with the practice here. In moderate sizes the three-phase winder could be used efficiently, but for large sizes some other system should be used; he thought they would probably adopt metallic controllers with three-phase winders in view of the author's experience. In this country very large high-head centrifugal pumping plants had been used for some years. Ventilation underground seemed to be an entirely different problem on the Rand, and judging from the small power used it was possible that the efficiency of labour could be much improved by increasing it. In England pressure variation was confined to 2½ per cent. up or down, and this could very well be brought down to 1 per cent.

Mr. **Hunter** commented on the standardised size of H.T. oil switches; it appeared that mechanical methods in the mines were so settled that attempts at improvement were seldom successful. He asked whether the cam profile on the stamps had been altered in the author's experiments. The paper seemed to show that only the best apparatus should be used for large powers.

Mr. **Roger Smith**, referring to the question of measuring the purchased power, said the value of the accuracy given as 3 per cent. was some nine million KW.-hours, which was a large amount. When there were three meters in series, it was important that they should have different qualities of errors so that they cancelled out. He asked whether this was the case with the meter types used. Was there much difference between the results from meter calibration on site and in the laboratory, and what was the usual practice? The design of slip rings in induction motors was the weakest part and demanded the attention of manufacturers. His own experience was that it was worth while to use contactors for motors of smaller powers. He asked whether iron tube resistances, with water circulating in the tubes, had been tried.

Dr. **Railing** said he had discussed the technical features of the paper elsewhere, but as regarded the author's remarks on the relations between manufacturers and their customers, he agreed that no doubt the former had sinned in the past and not supplied exactly what the purchaser wanted. He thought, however, that during the past five years the position had quite changed, and that the manufacturer was now prepared to meet requirements.

Mr. **Robert Hammond** said the great feature of the centralised supply was that the advantages of diversity were obtained; this was not realised a few years back. The paper showed that in the case mentioned there were 142,300 H.P. of motors installed, and the maximum demand was only 47,000 KW. He had been confronted some years back with the suggestion that the winding peaks might synchronise, but there were 69 winders in use with a total of 57,000 H.P. in this group of mines.

Mr. Ll. B. **Atkinson** said the scheme of power supply in this case emanated from the consumer—the Rand mines group—but the originators did not succeed in convincing the mining people that the proposition was good enough for them to put their money into it. English engineers advised against the scheme in London, because it was thought that the proposals favoured the consumer too much, and consequently the money was found on the Continent. Another point was the possibly short life of the mines, which would have meant writing down the capital in, say, twenty years; but the mines would probably last longer than that. English people were prepared to finance the scheme, but English engineers said it was not good enough.

Mr. E. J. **Fox** said this explanation was quite different to that usually given of the matters referred to. He always understood that German financial methods enabled them to find money better than ourselves; the only money found by them was in the form of debentures, and they reserved to themselves the right to supply plant. He thought the City of London did find all the capital, but others got the plums.

Mr. J. H. **Rider**, in his reply, said that with good generating plant 25 per cent. spare was sufficient; the troubles referred to in the paper took place at a time when there was not 25 per cent. As regards trouble due to pressure variation, momentary fluctuations were not referred to, but times when the pressure was very high or low for many hours; the motors often took heavy currents for considerable periods and ran hot. Not until the Power Co. exceeded the limits mentioned could any redress be obtained. Now that the control system was improved the three-phase winder was perfectly safe; there was a little greater risk if the supply was cut off, but it could be counteracted if the mechanical brakes were in good order. No braking troubles had arisen with hoists which were constructed for electric working, but there had been trouble with converted hoists. He had not much faith in overwinding devices; devices which took control out of the hands of the driver brought trouble. The risk of overwinding, he thought, was not serious, but there was a risk of starting in the wrong direction, and such cases were the more frequent. The high heads mentioned for centrifugal pumps probably did not represent the limit of the pumps, but were very near the limit of the pipe line. No particular trouble had arisen with insulation, but the Rand climate was very dry. The largest winders, of 4,000 H.P., were of the Ward Leonard type, but many of the three-phase winders had single motors of 1,500 H.P. capacity. It must not be imagined that there was a shortage of mine ventilation on the Rand, as an immense amount of air was discharged into the workings from the drills. The stamp mill was exceedingly simple and robust—and "efficiency," in its case, meant something that would not stop. As regarded the metering arrangements, each meter had its own transformers, and, speaking generally, there was no very great difference in the curves of the two types of meters. The metering was one of the most satisfactory features of the whole supply, and it was very seldom that any question arose with regard to it. The advantage of the contactor control was the easy work for the drivers.

MEASUREMENT OF WIRELESS SIGNALS.

A general meeting of the Wireless Society of London was held at the Institution of Electrical Engineers on April 20th, when Prof. E. W. Marchant delivered a lecture on Methods of Measurement of the Strength of Wireless Signals. Dr. Marchant said that the Duddell-Taylor formula had been found consistent with subsequent investigations, and Zenneck's theoretical results had been verified by Austin's researches, but though these and similar formulæ were useful in giving an idea of the order of magnitude of received currents to be expected, it was the considerable fluctuations in signal strength which had to be investigated, and this could only be done experimentally. Variations of the order of 2 : 1 were commonly observed at different times of day and under different weather conditions in the received strength of signals which were sent out by constant power. In seeking to make quantitative measurements on the strength of signals, the first essential was constant conditions in the receiving aerial, which should be of standard, easily reproducible form, and as free as possible from surrounding obstacles. The resistance of the aerial circuit and the earth connection should be constant. He had found a water-pipe earth very constant in resistance at 20 ohms. The ordinary central-station type of earth connection, a copper plate in moist coke, gave good results, and there was under construction at Liverpool an "earth" consisting of a copper strip and 6 sq. ft. plate laid in a sandstone trench. It was particularly interesting that this sandstone contained 10 per cent. moisture, though it had been covered by buildings and concrete for ten years past.

The most obvious method of measuring signal strength was by measuring the received aerial current or the voltage on the receiving circuit. About 1 microwatt was available on the Liverpool antenna (two 500-ft. horizontal wires 10 ft. apart, at a height of 150 ft.) from Paris, and these signals were very powerful. On the rectifying principle as little energy as 250 micro-microwatts could be made to give records. The Einthoven galvanometer would respond to 1 micro-microwatt, but it was a costly instrument, and some simpler and more generally accessible apparatus was desirable. The Duddell thermo-ammeter required about 1 microwatt. The Wolf heterostatic system gave good results; thread electrostatic instruments had not yet attained much success; hot wire barretters were too easily burnt out by a rush of current. A variable condenser in series with the aerial was extremely convenient, and to reduce trouble from atmospherics, weak coupling should be employed and an inductive leak arranged between aerial and earth; such a leak was very effective and did not interfere with normal working. The greater selectivity obtainable by indirect measurement seemed quite to outweigh the lower efficiency; disturbance by atmospherics and other signals was eliminated. Fleming's arrangement of an "artificial aerial," so that an inductance could be connected either to the aerial or to an inductance and capacity corresponding to the wave to be received, was very convenient.

As regards the type of detector to be used, the perikon crystal type (zincite-chalcopyrites) in conjunction with a sensitive galvanometer had been found best at Liverpool. This detector gave better and more constant results than any using softer crystals; unfortunately it and others followed a square law, and so were insensitive for very weak signals. The Fleming valve, having nothing to go wrong, and being unaffected by bad atmospherics, appeared very tempting for measurement work, but results at Liverpool had been disappointing. An auxiliary voltage was generally required in the detector circuit to bring the valve to the sensitive part of its characteristic. On trying to eliminate this by using a U-carbon filament and plate electrode only 1 mm. apart, it was found that the sensitivity of the valve changed considerably, but not definitely (*i.e.*, not so that the detector was either "right" or "wrong"). Several recent developments of the audion valve gave promising results. Magnetic detectors were hardly sensitive enough for measurements on very weak signals, and one would not expect electrolytic detectors to be very reliable for measurements. The present tendency was to use continuous waves for long wave-lengths, generally in conjunction with the heterodyne telephone or other beats receiver. A constant local current of high frequency was then required for measurement purposes. Heterodyne receivers were nothing like so efficient on spark as on continuous waves.

The Broca galvanometer used in the first quantitative work at Liverpool was satisfactory on good, sustained signals, and galvanometers were now available of sensitivity 240 mm. per micro-ampere, and period 0.1 second. The speaker's experience was that the best arrangement yet available was a high-frequency galvanometer in conjunction with a crystal detector. Members of the Society should take up the question of perfecting instruments and measuring signal strengths, since this, in conjunction with meteorological observations, would do more than anything else to increase our knowledge of the conditions affecting wireless transmission.

Mr. P. R. Coursey said that, using Fleming's "artificial antenna" method, the chief difficulty was to measure the current in that circuit. Damping must be constant, and should be the same in the receiving and auxiliary circuit; Dr. Marchant's coupling method was preferable to direct connection. An alternating-current buzzer gave very steady oscillations, much better than obtainable working on its own contacts. It was possible to select Fleming valves which gave maximum sensitivity on zero auxiliary voltage. Rectification was much more perfect with a cylindrical than with a plate electrode. The tone wheel should be one of the best receivers for quantitative work with continuous waves. With it, an Einthoven galvanometer could be got swinging slowly so that half the amplitude of swing could be read at any moment; on moderately damped spark waves individual readings might be possible. When using a telephone in series with an Einthoven galvanometer, external noises often produced kicks and vitiated results.

Mr. W. Duddell said that he still hoped to be able to build an electrostatic R.M.S. voltmeter suitable for measuring aerial voltages. Using a tiny gold-leaf electroscope, it was possible to read signals under the microscope.

ELECTRICAL SUPPLY TRADE IN BRAZIL.

Pernambuco will soon be one of the best fields for the sale of electrical supplies, as well as many other lines, in South America. It is the main port and capital of the great sugar producing State of the same name, and the Pernambuco Tramways and Power Co. has only recently inaugurated the first electric railway and lighting system the city has had.

An American Government report recently submitted points out that the city has under construction a modern power house of ferro-concrete which is being equipped with the latest design of machinery from the British Westinghouse Co. Three 1,000-KW. 50-cycle 6,000-volt turbo-generators have been installed, and the foundation for a fourth is being prepared. The boilers and boiler-room equipment were furnished by Babcock and Wilcox. The engine-room and switchboard equipment are British Westinghouse, and the wire and cables are also English. The street railway is 1 metre gauge. The company has 110 cars—70 single-truck cars from the Brill Car Co., and 40 double-truck cars from England.

The city is the first port touched by the large lines from the United States and Europe. It is served by five submarine cables, three to Europe, one to the north, and one to the south of Brazil. Telegraph lines connect the city with the most important towns of the State, and a wireless station affords communication with the station at Fernando de Noronha (an island belonging to Pernambuco which has a long-range station and is of great service to the large liners). Three railroads connect the city with the principal coast towns and the extreme western part of the State. Construction work in the docks has been stopped on account of the war, as most of the officials were French and have returned to France. A complete sewerage system is almost completed. The central sewage station contains three electrically-driven pumps, each of the capacity of 300 litres per second. The central and sub-stations are supplied with power from two 250-KW. generators bought in France.

In October, 1914, the Pernambuco Tramways and Power Co. bought the telephone system from a Brazilian company. The system will have to be reconstructed from the switchboard to the subscriber. The present plant is on the earth-return system, with 800 telephones, mostly from Sweden, though a few are from England and France, a switchboard from Germany, iron poles from England, and wire from the United States. It will require a 1,200 drop board, 1,000 telephones, 2,000 iron poles, and 10 miles of cable and several tons of wire to reconstruct the system. The general manager of the Pernambuco Tramways and Power Co. will have charge of the rebuilding, and it would be advisable for companies intending to tender to communicate with him. It is to be hoped that firms tender-will be careful to quote on just what the manager wishes rather than attempt to supply other goods, as has happened in the case of other cities.

The prospects for the sale of electrical machinery and supplies in Pará are not so good as they have been, but there is a steady demand for domestic specialities and a few motors. Most of the sales are being effected by the Pará Electric Railway and Lighting Co. (Ltd.), which is making a special effort to get as much apparatus installed as possible by selling at cost and allowing long credits. The company has had three public exhibitions, which have resulted in the sale of about £2,000 worth of household appliances, and the sales are running at about £300 per month.

Most of the household appliances sold and on hand are American made, and as they have been properly demonstrated the public appreciates their superiority, and buys them in preference to European goods which are selling at a lower price. As the lighting company is selling at cost it is not advisable for American manufacturers to sell to the local dealers.

The Pará Electric Railway and Lighting Co. (Ltd.), incorporated in England, with a board of English directors, and operated by J. G. White & Co. (Ltd.), of London, who are the engineers and purchasing agents, took over the street railway and lighting system in 1906 and has built up a modern installation. The company has material on the ground for the extension of its lines as soon as the financial conditions will permit.

The current for the lighting system is supplied at 2,200 volts through H.T. underground cables to feeder boxes, thence to the aerial lines, from which it is stepped down by single-phase, 50-cycle, oil-cooled transformers to 240 volts for power and to 120 volts for lighting. There are about 50 factories operated by electricity, with motors varying in size from 1 to 100 H.P.

The present price for current for lighting is 2s. 1d. per KW.-hour, and for domestic appliances 3d. per KW.-hour. Power prices range from 3d. up, according to the quantity consumed. The company has on hand sufficient material to last one year, with the exception of a few minor supplies which will be handled through J. G. White & Co., Ltd., of London.

Maceio is a small town on the coast, 180 miles north of Bahia. The population is estimated at 15,000. The power and lighting system is owned by J. Basto & Co., under the name of Empreza Luz Electrica de Maceio. The power plant consists of three Belliss & Morcom high-speed enclosed type engines, directly connected to 120-KW. 3-phase, 50-cycle, 2,200-volt generators, and two German oil engines connected to 240-KW., 600-volt direct-current generators. The generators, switchboard and instruments are from the Electrical Construction Co. The firm has been using English materials. It furnishes power, however, to the street railways, the manager of which is said to be favourably disposed towards American materials. The electric railway was started in June, 1914. There are 12 miles of single-track metre gauge, 10 single-track cars, 12 trailers, and 5 flat cars. All the equipment rails, poles and wires are from the United States, and are giving satisfaction. Street railway supplies will be considered by this company if presented by letter or catalogue, but the language used should be Portuguese or French.

The town of Bahia has a great future in the electrical trade. There are two railway systems, one owned by the city and the other by Guinle & Co., a Brazilian firm which owns the street railways in Petropolis and Nichtheroy. The city owns the lighting system, but would like to dispose of it if a fair offer could be obtained. Guinle & Co. also have under construction a hydro-electric installation 70 miles from the city calculated to furnish 30,000 H.P. in a dry season, but it will not be completed for at least two years.

There is a good opening here for firms that will enter this market with a full line of electrical and general machinery supplies, but there are one or two points that will have to be observed if much trade is secured. One is that reasonable credit should be allowed, with paper as security on which the banks of the United States would loan money. This is the method followed by the German firms which have made a success in this trade. Another is that an American firm doing business here should have a representative on the ground, who can exhibit and push the goods. "I called on a hardware dealer here who handles a small line of electrical fixtures from Europe," says an American Consul, "and when I tried to impress upon him the superior quality of American goods he agreed with me, but said the fixtures he handled were cheaper, the designs were more popular, and the goods were lighter in weight, an important item when the duty is considered. These considerations will be effective as long as there is no American representative of a fixture manufacturer here, but a live man could convince the people of the advisability of buying the best."

It is also important for the American firm to get in as close touch with the actual buying public as possible. The manager of the Singer sewing machine branch here said that if they did not have an organisation of branch stores throughout the city they would not sell one-fifth of the machines they do, as the people want to trade direct with the company and do not care to buy from an agent. The expense of entering this market properly, however, is more than most average American houses can afford, and it would be of value if a number of manufacturers could combine to push the export trade.

The sale of electrical machinery and supplies is being neglected in Bahia, because of the fact that Guinle & Co. are retiring from the market. This firm was organised by Mr. Guinle some years ago and has been of great service to the United States in placing American goods on the market. It was the agent of a large American company and had a head office in Rio and branches in Sao Paulo, Petropolis, Nictheroy, Bello Horizonte, Bahia, and several smaller places.

There are at present three firms carrying a small line of supplies, 85 per cent. of which are made in the United States. The only European house here has no stock at present. It is a branch of a Hamburg firm and was organised through the efforts of German manufacturers, who own the stock and control the company through the Hamburg office.

The firm handles the goods manufactured by the stockholders, and only German manufacturers are allowed to purchase stock. The local manager explained the system upon which the firm is working, and by which it has been able to secure most of the contracts for materials used in the small installations in the interior and many of the smaller supplies in the cities. The head office is in Rio, with branch stores in Sao Paulo, Santos, Rio Grande do Sul, Porto Alegre, Bello, Horizonte, and Bahia, and in each place the firm is in a position to handle complete installations of hydro-electric machinery, street railways, lighting systems, cotton mills, sawmills, and many smaller lines.

With this organisation, good banking facilities, and Government co-operation, the firm has been able to furnish about 75 per cent. of the materials used by the companies not controlled by American interests. It allows credit according to the amount of the order, and the interest ranges from 6 to 8 per cent. If the manufacturer does not want to carry the customer he can go to the bank and discount the bill, but the manager says that in most cases the bank is glad to get the paper without a discount.

A local hardware house handles a small line of fans, wire, lamps, fixtures and specialities which are American, with the exception of the lamps and fixtures, which are German. The latter are made of cheaper materials and the fixtures are more ornamental and of much lighter make. The manager says the fixture trade is a new line here, and the people have not had time to see the necessity of buying the best.

The United States has furnished over 40 per cent. of the electrical machinery and supplies used in Brazil, not through any concentrated effort, but because the street railway and light-power systems in various cities are under the management of Americans.

THE LUBRICATION OF BALL BEARINGS.*

By ARTHUR V. FARR.

The more general use of ball bearings on electric motors has brought up a number of questions on the proper means of lubricating them: "Should I use oil or grease in my ball bearings?" "What kind of lubricant should I use?" One user of ball-bearing motors stated his question as follows: "I have been offered two grades of grease for use on the ball bearings of my machine. To me these two greases look the same, yet one costs almost twice as much as the other. How can I tell a good grease?" The purpose of this article is to answer these questions.

It should be recognised at the outset that although ball bearings must always be lubricated, the lubricant in a ball bearing performs a function different from the one it performs in plain bearings. In plain bearings the lubricant is used to keep a film between the shaft and the bearing lining, and this film must be maintained constantly in order to prevent wear and heating. The purpose of a lubricant in a ball bearing, however, is merely to preserve the highly polished surfaces of the balls and races. The balls and races are always in point contact, which necessarily means metal-to-metal contact. As a general principle, it might be stated that any lubricant that will not cause rust or destroy the polished surfaces of the balls and races, and that will properly circulate through the bearing and lubricant chamber, will be satisfactory.

To preserve the highly polished surface of the steel balls and races, therefore, the lubricant must be chemically neutral; that is, it should be neither acid nor alkaline. A good way to determine whether a lubricant is either acid or alkaline is to place some of it on a highly polished steel surface for a time and then compare this surface with that of a similar sample which is still in its polished condition. If the finish has been at all attacked, the lubricant is not desirable. Use can also be made of litmus paper, which will change its colour to pink if the lubricant is acid and to blue if the lubricant is alkaline.

It is also necessary that the lubricant should not undergo any chemical change owing to heat or other causes. In order to guard against such a change, it is, therefore, usual to employ a clean mineral oil or mineral fat of best quality.

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* From the *Electrical World*.

It is also essential that the lubricant should not contain any solid particles which would cause wear, and the lubricant chamber should be so sealed as to prevent the entrance of dirt, grit or other foreign substances into the bearing. It is quite a usual occurrence to find that a bearing wears down owing to solid particles of dust, etc., having found their way into the lubricant.

From the above statements it is evident that, in all cases where one need consider only the actual lubrication of the bearing, a clean, thin mineral oil can be used with advantage. The greater the speed, the thinner the oil.

On the other hand, in those cases where there is a possibility of risk of exposure to dust, moisture or acids, the ball bearing should be protected by means of a solid grease. To ensure proper protection, the whole housing around the bearing should be filled with this grease, which should be of such composition and consistency that the internal friction of the lubricant and the increase in temperature which may result from its use will not cause it to become fluid. For this reason pure mineral greases, such as vaseline, will often be found unsuitable, as they usually have a melting point of 86 deg. Fahr., and when melted are of about the same viscosity as water.

One should, therefore, in such cases select a solid grease of the very best quality—that is, it must have the lowest possible internal friction and, above all, be absolutely neutral so that there will be no risk of its attacking the polished surfaces of the bearing. Moreover, it should not contain resin or resin-forming matter. The presence of any large quantity of resin can be detected by the smell.

The solid grease suitable for ball bearings should contain about 90 per cent. of mineral fat.

When the temperature of the bearing can rise to 140 deg. Fahr. and higher, the bearing should be lubricated with a thick flowing machine or cylinder oil.

For vertical shafts where no special arrangement has been made for reliable lubrication with oil it is, of course, necessary to use grease, and what has been said with regard to the use of solid grease in general, of course, also applies to vertical mountings.

Many machine manufacturers who use ball bearings make a practice of attaching a card with instructions printed thereon for the care of the ball bearings on the machines. These instructions do not go into detail at all, but they contain an excellent outline of the solution of the lubrication problem, as follows:—

"To renew the lubricant in the bearing, remove the bearing cap, clean out all dry or caked grease, and wash out with gasoline or kerosene. Refill with a clean, fresh lubricant, being sure that the bearing and bearing housings are properly filled. Keep the lubricating and drain holes of the housing closed to prevent the leakage of lubricant or the entrance of dirt.

"Nothing but the purest mineral lubricant should be used, as any acid, grit, rust, etc., quickly ruins the highly polished surfaces of the balls and races, thereby materially shortening the life of the bearing."

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

BAHAMAS.—The Government of the Bahamas has recently passed an Act providing for a surtax of 10 per cent. to be levied on the amount of duty payable on all goods imported into the Islands. The Act, which came into force on March 8th last, is to remain in force for one year, and from thence to the end of the next session of the Legislature.

SPAIN.—The Spanish Government has decided to prohibit the exportation to foreign countries of the following goods: Scrap-iron, steel and other metals, aluminium, tin and crude rubber (natural or artificial), and similar materials.

RUSSIA.—The Board of Trade have received information from Russia to the effect that a Decree was published on April 11th by which the rates of the Russian General Customs Tariff for European Trade are increased by one hundred per cent. in respect of all German, Austro-Hungarian and Turkish goods, and on goods imported into Russia after passing in transit through Germany, Austria-Hungary or Turkey. Enemy goods which were free of duty under the Tariff are subjected to a special tariff, which is appended to the Decree. In virtue of the same Decree certificates of origin for foreign goods imported into Russia will be required from the date of the receipt of the text of the Decree by the various Russian Custom houses. A summary of the very detailed regulations contained in the Decree is being forwarded, and further information as to these will be given in due course.

CANADA.—Permission has now been given by the Postmaster-General of the United States for the use of Canadian Customs duty stamps on advertising matter for Canada, provided the stamps are affixed on the reverse side of the package. It will, therefore, now be possible to prepay the duty on catalogues sent to Canada by means of these stamps, whether they proceed direct to Canada or *via* the United States.

SWEDEN.—A Royal Decree dated March 12th revokes the Royal Decree dated October 20th, and provides a new list of articles the exportation of which is prohibited. Amongst the articles now prohibited are the following: Wire of copper and of alloys of copper with zinc, tin, or other non-precious metal, twisted into cords or cables not insulated; wire of copper and of alloys of copper with zinc, tin, or other non-precious metal, also electric cables or lines (a) furnished with sheath of lead or other metal with or without armouring, (b) insulated with rubber, gutta-percha, asbestos, or varnish, or in any other way.

SWITZERLAND.—Amongst the articles whose exportation has recently been prohibited are the following: Magnetos for automobiles, copper ore, lead ore, antimony ore, and other crude ore. The prohibition takes effect as from April 7th.

INDIAN NOTES.

[From our Special Correspondent.]

Kanchrapara Eastern Bengal State Railway.—A very up-to-date electric power house has recently been equipped at Kanchrapara, the chief loco and carriage workshops of this State railway. The scheme was designed and carried out under the supervision of Mr. A. R. Gundry, the electrical engineer to the line. Formerly the workshops were steam-driven, now the drive is entirely electric. For day working the generators are steam-driven, and for night loads, mostly for lighting purposes, the generator drive is by Diesel crude oil engine, manufactured by Messrs. Mirrlees, Bickerton & Day, Ltd. The entire electrical equipment was manufactured by the Lancashire Dynamo Co., and consists of generators, balancers, and motors for shop drive and various other purposes. A Rees Roturbo condenser and boiler feed-pump has also been provided. Some of the high-tension generating plant from the Sara Bridge power-house is to be removed to Kanchrapara to be used for long-distance transmission to Chitpore, for pumping purposes.

Railway Electrification.—Before the war it was confidently hoped that Government would sanction a scheme for electrification of the State Railway suburban lines from Sealdah to Barrackpore and Naihati; but in all probability this scheme will be hung up until more prosperous days.

Punjab Electrical Inspector.—It is reported that Mr. C. C. T. Eastgate, a well-known Calcutta electrical engineer, has recently been appointed to this post, and will shortly arrive in India from England to take up his new appointment.

Electrolytic Manufacture of Sodium.—The apparatus used to manufacture sodium industrially resembles the Castner cell; it has a conical base in which iron and other impurities collect, and a cylindrical cathode and narrow ring anode are placed close together, so that only 4½ to 5 volts are required per cell. According to a detailed paper on the subject by B. Neumann and S. Giertsen (abstracted in *La Revue Electrique*), it is best to employ a large number of small cells, each holding 155 lb of molten soda and consuming 1,200 amperes. The caustic soda is melted in cast-iron pots and poured into the electrolytic cells when starting work, and from time to time during operation. The distance between the electrodes is regulated to maintain a suitable temperature, which is not generally measured. The cathode is not cooled artificially, and the whole question of temperature regulation seems to be left to the discretion and crude devices of the operators. The bell cover dips 2 or 3 in. into the bath, and sodium is collected only at long intervals. The molten soda is rarely anhydrous, hence considerable foaming occurs and hydrogen collects and burns beneath the cover; explosions are of frequent occurrence. According to the impurity of the caustic soda, the bath becomes black and frothy, and needs renewing every two or three weeks; if the soda contains silica, hard crusts form in the cover. From time to time the sodium formed is freed from soda, cast in iron moulds and stored in petrol or paraffin. The mean current efficiency in industrial working hardly reaches 40 per cent., and is more often only 30 per cent. On the basis of 40 per cent. current efficiency and 5 volts per cell, the energy consumption is 14·5 KW.-hours per kg., *i.e.*, 6·6 KW.-hours per lb.

Russian Patents.—A Decree, to which assent was given on March 6th, supplements the existing laws and regulations with regard to patents, with a view to enforcing certain restrictions on enemy subjects. Under the provisions of this Decree, patents for industrial inventions or improvements will not be granted to subjects of countries at war with Russia, and procedure in connection with such applications already received is suspended. Patents of concern to the national defences and belonging to enemy subjects become the property of the State without compensation.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED.)

[illegible] Messrs. W. P. Thompson & Co., [illegible] Agents, 285, High Holborn, London, W.C., and at [illegible]

5,486. "[illegible] controlling alternating currents." British Thomson-Houston Co., Ltd. April 12th. (General Electric Co., United States.)

5,489. "[illegible] machines." I. Rosenberg. April 12th.

5,511. "[illegible]" Akt. Ges. Brown, Boveri et Cie. April 12th. (Convention date, April [illegible], 1914, Germany.) (Complete.)

[illegible] "[illegible]" O. Oldham. April 12th.

5,533. "Coin-freed apparatus for testing manual strength of pull and elec[illegible]" W. Keast. April 13th.

[illegible] "[illegible]" British Westinghouse Electric & Manufacturing Co., Ltd. April 13th. (Convention date, April 15th, 1914, [illegible])

[illegible] "[illegible]" J. A. Kennedy-McGregor. April 13th.

[illegible] "[illegible] operating the same." British Thomson-Houston Co., Ltd. April 13th. (General Electric Co., United States.)

5,584. "Electric switchboards, telephone-boards and the like." H. B. Prentice & H. [illegible] April 13th.

5,591. "System for the generation of electric currents." C. F. Benitez. April 14th. (Addition to 17,811/14.) (Complete.)

5,594. "Field telephone or telegraph wire reel." G. Dod. April 14th.

[illegible] "[illegible] relays." J. Savin & Automatic Telephone Manufacturing Co., Ltd. April 14th.

5,602. "[illegible] systems [illegible] apparatus for use in mines and the [illegible]" G. [illegible] J. Davis & Son, [illegible], Ltd. April 14th.

[illegible] "[illegible] systems." Siemens & Halske Akt. Ges. April 14th. (Convention date, April 16th, 1914, Germany.) (Complete.)

[illegible] "[illegible]" British Thomson-Houston Co., Ltd. April 14th. (General Electric Co., United States.)

5,628. "[illegible] lock." W. G. [illegible] April 14th.

[illegible] "[illegible]" [illegible] & Universal Indicator Co. April 14 [illegible]

5,630. "Mounting of electric oscillators for submarine signalling." W. J. Mellersh-Jackson. April 14th. (Submarine Signal Co., United States.)

[illegible] "[illegible]" April 14th.

5,657. "Trolley-setting guide for use on tramways." J. A. Walshaw. April 15th.

[illegible] "[illegible] electric wires." J. H. Collin. April 15th.

5,672. "Brushes or connections for magneto-electric machines." C. C. W. Simpson. April 15th. (Divided application on 19,784/14. September 15th.)

5,673. "Contact-breakers for magneto-electric machines." C. C. W. Simpson. (Divided application on 19,784/14. September 15th.) April 15th.

5,676. "Alternating-current voltmeters." H. S. Dransfield. April 15th.

5,684. "Electric-discharge controlling devices and methods of operating same." British Thomson-Houston Co., Ltd. April 15th. (General Electric Co., United States.)

5,696. "Automatic switching apparatus for electrically-illuminated signs and the like." E. Savoye. April 15th. (Addition to 823/15. Convention date, April 30th, 1914, France.) (Complete.)

5,697. "Apparatus for recording phonetic sounds transmitted by means of a [illegible]" A. F. [illegible] April 15th.

5,708. "Electro-magnetic solenoids." L. B. Farmiloe. April 16th.

5,717. "Electric switches." J. H. Tucker & J. A. Crabtree. April 16th. (Divided application on 21,175/14. October 19th.)

5,723. "Magneto-electric machines." P. A. Bentley. April 16th.

5,725. "Electrical apparatus for therapeutic and like purposes." G. Vernon-Ward. April 16th.

5,726. "Electrical apparatus for therapeutic and like purposes." G. Vernon-Ward. April 16th.

5,727. "Means for attaching electric cables or conduits to switches and the like." G. Ellison & J. Anderson. April 16th.

5,731. "Portable primary batteries or cells." C. H. Elliott. April 16th.

5,741. "Electrical discharge devices and methods of operating the same." British Thomson-Houston Co., Ltd. April 16th. (General Electric Co., United States.)

5,753. "Method and means of constructing electrical measuring instruments." M. J. E. Tilney & N. C. F. Jensen. April 17th.

5,768. "Electric lighting." I. Frankenburg & Sons, Ltd., and E. Fleming. April 17th.

5,783. "Aerial conductors for wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd., & C. S. Franklin. April 17th.

5,784. "Means for indicating and correcting small changes in the speed of a machine." Marconi's Wireless Telegraph Co., Ltd., & C. S. Franklin. April 17th.

5,794. "Electric arc forming device for use in electric valves or rectifiers or in oscillation generators." Edison & Swan United Electric Light Co., Ltd., [illegible] R. [illegible] April 17th.

PUBLISHED SPECIFICATIONS.

[illegible] of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at [illegible] and Bradford, price post free, 9d. (in stamps).

1913.

[illegible] Duplex [illegible] Radio-telegraphic Light [illegible] December 7th, 1912.

[illegible] Terry. December [illegible]

1914.

[illegible] Dynamo [illegible] Motors. G. [illegible]

4,941. Electric Heaters. J. R. Quain. February 25th.

[illegible] for Sending Time [illegible] Signals by Telegraph [illegible] March 13th.

[illegible] Electric Machines for Starting and Lighting Motor-cars [illegible] A. H. Midgley & C. A. Vandervell. March 13th.

8,173. Protection of Alternating-current Electric Generators. British Thomson-Houston Co., F. H. Gough, & J. Whitcher. March 31st.

8,717. Electric Regulating Devices. British Thomson-Houston Co., D. E. Jewitt. April 6th.

9,134. Electrically-controlled Block Systems for Railways. J. Sayers, W. C. Acfield, G. Salt, & B. W. Cooke. April 11th.

10,823. Electro-magnetic Apparatus for Controlling Electric Circuits. C. P. Wells. May 2nd. (July 9th, 1913.)

12,721. Electrical Signalling Apparatus. W. A. Heyes & L. O. Heyes. May 23rd.

13,524. Automatic Switching Mechanisms, more particularly for use in connection with Telephone Systems. Western Electric Co. (F. T. Woodward acting for Western Electric Co.). June 3rd.

17,326. Electric Incandescent Lamps. I. Langmuir. (September 4th, 1913.) July 21st.

Ultra-Violet Rays from the Oscillating Spark.—The quartz enclosed mercury vapour arc, which first rendered practicable the application of ultra-violet rays to such services as the sterilisation of water, has now a rival in the oscillating spark which, according to Prof. J. Kowalski, of Fribourg, forms under certain conditions a more economical source of ultra-violet rays. Working on an industrial scale with a step-up transformer feeding the oscillating circuit (which comprises a battery of condensers, self-induction and spark-gap paralleled across the condensers and discharging the oscillating circuit at intervals), it is claimed that water sterilisation requires no more than 45 to 90 watt-hours per 1,000 gallons treated. Laboratory tests show from 200 to 400 watt-hours per 1,000 gallons to be necessary for complete sterilisation, but water treated in practice is less infected than laboratory samples, and conditions generally are more favourable to rapid sterilisation. The wave-length of maximum radiation from the oscillating spark is displaced towards the ultra-violet as the amplitude of the oscillating current is increased and as the spark is more strongly damped (*i.e.*, as the energy expenditure in the spark increases). In order to increase the amplitude of the current, the capacity of the oscillating circuit must be as great and the inductance as small as possible. There is a risk, however, of increasing inductance as well, if it be sought to provide large capacity by using a great number of condensers. There is a certain value of $\sqrt{CL}$ (corresponding to the wave-length of current produced in the oscillating circuit) which should not be exceeded for best radiation efficiency. The material of the electrodes is an important factor and should be such as to give maximum damping. Ultra-violet radiation between electrodes of invar, aluminium, brass, zinc and copper is found to be proportional to the numbers 128, 99, 85, 78 and 73. The frequency of sparking is also important, the ultra-violet intensity from a 22-mm. gap between invar electrodes being proportional to 2, 1·6, 1·3 and 1·0 with 20, 30, 40 and 50 sparks per second respectively.

The percentage distribution of radiation horizontally in the direction of the axis of a 110-volt Heraeus lamp, operating at 90 volts, 3·1 amperes, is given thus:—Heat, 24 per cent.; visible, 41 per cent.; ultra-violet, 35 per cent.; wave-length, 436-334, 24·7 per cent.; 334-275, 13 per cent.; 275-233, 11·3 per cent.; 233-223, 11 per cent. The radiation from a 22-mm. invar gap, operated at 30 sparks per second, with 50·5 amperes in the oscillating circuit, is analysed, by the same method, as follows:—Heat, 22 per cent.; visible, 18·6 per cent.; ultra-violet, 59·4 per cent. These figures show the oscillating spark to be 70 per cent. richer than the mercury arc in ultra-violet radiations. The spark gains a considerable initial advantage in that it can be produced directly in the water to be treated, without the necessity for the quartz envelope which absorbs up to 20 per cent. of the ultra-violet radiations from a high-pressure mercury arc, and those, moreover, which have the greatest sterilising value. To meet industrial requirements for a simple instrument determining the ultra-violet radiations of any source, Prof. Kowalski utilises the property possessed by ultra-violet rays of decomposing lævulose (and certain other carbohydrates) to liberate carbonic oxide. The beam to be tested is simply passed through the windows of a small closed vessel containing lævulose and connected to a mercury-filled capillary tube which indicates the amount of gas liberated, and so, subject to a temperature correction, the intensity of the ultra-violet radiations.—*La Revue Electrique.*

Russian Views on Municipalisation.—At a recent meeting (March 18th) of the Imperial Russian Technical Society, held to consider the proposed purchase of the electrical concerns of Petrograd by the town, to which reference was made at a previous meeting, the majority of those who took part in the discussion spoke emphatically in favour of the municipalisation of the Electrical Trust. Some, however, felt compelled to point out that such concerns as tramways and telephones, run by towns, often proved to be unsatisfactory; some involved loss, as in the case of gas supply; and, generally, they did not efficiently attain their object of serving the interests of the consumers; whereas gasworks in private hands yielded good profits. One of the speakers specifically instanced towns where the electricity was already municipalised—Karkoff and Samara—where the position was very unsatisfactory. Experts, representatives of electrical companies, contested the assertions of the lecturer, K. Ya. Zagorsky, that with the adoption of turbo-generators of great power, production would be cheaper. The experience of one company had, they said, demonstrated the inaccuracy of that opinion. Another speaker, analysing the figures on which Prof. Wolf concluded that the price of energy could be much reduced, said it was impossible. The town would gain nothing, and the concern would yield too little profit. It were better to try to reduce the rates of existing companies. The discussion became heated, and lasted till midnight, when the meeting stood adjourned.

THE

ELECTRICAL REVIEW.

VOL. LXXVII. MAY 7, 1915. No. 1,954.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: May 7, 1915. [No. 1,954.

Page
The War and Future Trade 641
Lead 642
The Kenotron 643
The National Electrical Code Revised, by Frank Broadbent 643
The Kenotron Rectifier (*illus.*) 544
The War and the Electrical Industry 646
New Electrical Devices, Fittings and Plant (*illus.*) 647
Legal... 648
Parliamentary 649
Our Legal Query Column 649
Correspondence—
The Engineering Industry and the War... 650
Mathematical Notation 650
War Items 650
Business Notes 651
The Bombay Hydro-Electric Scheme, by A. Dickinson, M.I.E.E. (*illus.*) 657
Notes 661
City Notes 664
Stocks and Shares 668
Share List of Electrical Companies 668
Power Plant Testing 669
The Power Supply of the Central Mining-Rand Mines Group, by J. H. Rider (*illus.*) 670
The Rheostatic Control of Separately Excited Generators, by L. Boothman (*illus.*) 673
Publicity—The Soul of Business, by E. P. Bennett... ... 674
Utilisation of Solar Energy 675
Notes from Canada... 675
Indian Notes 676
New Patents Applied for, 1915 676
Abstracts of Published Specifications 676
Contractors' Column ... ... Advertisement page xxii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

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LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

NOW READY.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C

THE WAR AND FUTURE TRADE.

IN the early days of the war, when the production of war requirements for ourselves and our Allies was not engrossing the attention of between two and three thousand British factories, and when the closing of the Home and overseas markets to German manufactures possessed more of novelty than it does now, there was a considerable liveliness in agitations for the formulation of a future trade policy which should appropriately express our national determination to be more independent of Germany. In the interests of manufacturers who were perplexed as to whether it would prove worth while to commit themselves to capital expenditure for the production of new lines, we ourselves expressed the hope that the Government would see fit to appoint a Commission to report on certain aspects of the new situation. Though we do not find it necessary to withdraw from the position that we then assumed, we have to recognise that as the months have passed by, the trade war agitation in these islands at least has become much subdued. The lull is in all probability only temporary, and at a later date the movement will doubtless gather even greater force than characterised it a few months ago. That there should be this comparative pause is most natural and reasonable when we consider the unparalleled extent of the struggle in which we are engaged, and the strange and tragic experiences through which we are passing.

The determination to crush Prussian militarism is as strong as ever in the mind and heart of Britain, and we with France and Russia, Belgium and Serbia, are paying the huge and inevitable price, and while we are so strenuously engaged with this and all the thousand things that it means, touching our lives on every side, we can hardly expect to gain an attentive and sympathetic ear either from legislators or from the common people for matters appertaining to future trade, however vital they may seem to us.

There are very many things that we should like to see the Government do to assist the British manufacturer to put up a more successful fight against the German industrial and trading systems, and probably one or two more special war-time Committees will be added to the 30 or 40 that have already been appointed, which will have such matters expressly relegated to them. But it seems that it must of necessity be a long time before this present or any other Government will be able to formulate an after-the-war trade policy for the United Kingdom, for it must in a large measure be affected by the course things take both in the remaining period of hostilities and in the complicated and lengthy negotiations which will settle the terms of permanent peace.

It becomes more and more obvious as we study the problems of peace, even as superficially as is possible at this date, that that stage of this world conflagration will be only slightly less difficult than are our vast and unprecedented Naval and Military operations. And who can say what will be the nature of questions then arising which shall affect our future trading relations with the millions of people who will remain in what we now know as the German and Austrian Empires? Notwithstanding all the obscurity in which such matters are necessarily involved at present, there is undoubtedly deep down in the British breast a fixed determination that German manufactures shall never have the place here in the future that they have occupied in the past. Already measures have been taken, under the compulsion exerted by the closing of the market to enemy goods, and because of the more favourable opportunities that the same circumstance has afforded us, which will go some way toward enabling British works to carry that determination into effect when trading relations, on whatever basis may be ordained, are resumed between the industrial nations of Europe. Every month that the war is prolonged and the British Navy prevents enemy countries exporting manufactured goods, the position of Teutonic export trade becomes weaker, and the task of its ultimate recovery is made more difficult. Meanwhile, we shall go on exporting as energetically as the Government war demands will permit, and the information and organisation of the Board of Trade will continue to be placed at our disposal. May we hope that in readiness for whatever may be the new state of things when hostilities cease, the Board of Trade's recent activities will be carried a step or two further? We trust that Mr. Runciman will recognise the need that exists for a measure of modernisation and organisation with certain supplementary alterations making for greater efficiency and usefulness, supposing that he cannot see his way to adopt the proposals that are being again advanced in some of the more ambitious schemes that have been put before him by critics and advisers.

Whatever may be our views in regard to the adoption of a new trade policy for the United Kingdom, it is clear that our blood relations in the Colonies are freer than we are from some of the hampering influences. It has been already stated that the Colonies will be taken fully into consultation whenever the happy but difficult days of peace deliberations arrive. It will be but reasonable, too, that they be allowed to have a voice in the formulation of a future British world trade policy. They have given to the Mother Country, to the Empire, to the general cause of Civilization, of their best in both blood and treasure, and they have a pretty clear idea of the need for a strong policy for the future so that no repetition of these terrible experiences shall be possible. And from what we have read of Colonial newspaper and other comment, in regard to no other aspect of the situation are they so determined as in relation to the prevention of future Teutonic commercial supremacy in their lands. We receive letters from Australia with envelopes bearing the legend: "Don't let German goods in after the War!" "Why should Germans have a Vote in this country?" This attitude is also reflected in letters in the Australian Press where public men write: "Unless we frame an after-the-war policy, which does not include the German and his friends, we are going to have some pretty strenuous times in Australia during the next few years." "Immediately the war is over, Germany will endeavour, at all costs, to recapture her lost foreign trade, and we may reasonably expect she will flood the world with low-priced German goods. What sacrifices will she not make in order to undersell her opponents, and once again gain access to foreign markets?" Thinking in this strain, it is small wonder that some authorities there who have British interests at heart hold that this menace constitutes a grave danger to Australia, and are asking for the strongest possible policy to be adopted. Of course, the Colonies are freer from restriction than we are in dealing with import trade, and in whatever measures they see fit to introduce they will be but consistently following along the preferential lines that they have hitherto adopted. Here, of course, the position is not so easily handled, where departure from principle or long approved policy is involved. But we shall be wise if in the Home Country we keep ourselves fully informed as to the attitude of the Colonial mind, and the thoroughness which they desire to adopt in excluding the enemy from trading operations in their lands in future. Only this week we have received from an esteemed correspondent in Victoria a piece of news which shows which way the wind is blowing. Failing ability to completely exclude German or Austrian goods, they will make it as difficult as possible for them to compete with British-made manufactures. To that end the Berwick Shire Council on March 22nd unanimously carried the following resolution:—

> That the Council circularise all municipalities, inviting their co-operation in urging the Government to place a duty of 50 per cent. on all German goods imported, and all goods of German manufacture that might be made in other countries after the war.

We quote this as an illustration of the Australian trade agitation that is spreading; all the municipalities in Victoria, at least, are being approached. The importance of the matter to our readers lies in the fact that Germany has in the past had so strong a position in the Australian electrical field, and Australians, in adopting this British trade policy, are anxious to have the fullest possible co-operation and support from our manufacturers in the United Kingdom.

Lead.

There has been an irregular and weaker tendency observable lately in lead. The restraint which has been put upon export trade has had a notable influence in reducing the premium upon early deliveries, and has thus brought about much healthier fundamental conditions, while the reduction in price will eventually stimulate buying. Prompt lead at one time sold down to about £20 10s., but the fall to this level was brief, for at the reduced prices the metal looked cheap, and buyers came forward in large numbers to take advantage of their opportunities, a large business being done, particularly by France, while speculators have displayed increased activity. At the same time export business is much restricted, and the recent closing of navigation with Holland put a further obstacle in the way of shippers of lead. Now that communication with Holland has been reopened, it is probable that fair quantities of lead may be shipped there from here, while export demands are likely to undergo considerable expansion from other quarters. From time to time considerable business has been done for shipment to Russia, but there are still difficulties in the way of obtaining shipping permits, and there is a decided abundance of lead available for early delivery.

While the United States has not been exactly pressing lead, there are indications that considerable quantities are available across the Atlantic, and at any improved level of prices it is thought that sellers in America will again display more interest in the European position. As regards the home trade, activities have been rather in a state of suspense, but there seems to be some small indication of an improvement in demand, though general trade can hardly assume anything like normal proportions in these days of almost universal warfare.

There can hardly be much reduction from the current level of prices, though temporary fluctuations are to be expected. The general trend of sentiment seems now to be slightly in favour of higher prices. It must be borne in mind that the authorities are determined as far as possible to prevent any undue appreciation in the price of early over distant deliveries. There is no doubt that they would have no hesitation whatever in enforcing an entire cessation of shipments from this country, if circumstances appeared to justify the taking up of such a position. The world's requirements are exceedingly heavy and practically confined, of course, to the production of war munitions, hence the integrity of the British market so far as national requirements here are concerned becomes a matter of vital importance. Under no circumstances will any outside consideration be permitted to interfere with this necessity.

The position in the United States has varied but little, the conditions being regarded as intrinsically sound, and very little interest has been taken in the movements notified from the London market. The home trade demand across the Atlantic is rather poor, but this is bound to improve owing to the large ammunition orders which are being executed for the allied Powers, and independent producers are so well sold up that they are not offering metal for anything earlier than June shipment. It is commented upon as very curious that the war should so far have had but a trifling effect upon lead prices, while it has quadrupled the price of antimony, trebled the price of spelter, and added about 50 per cent. to the price of copper.

The Kenotron. We have often remarked upon the importance of scientific research, and the illimitable field which still remains open to investigators, and recent developments have emphasised these points. Unfortunately, they seem to be more fully realised abroad than at home.

In the early days, when electrical discoveries could be made with simple apparatus and scanty resources, this country led the world in scientific progress. At a later date, while our manufacturers were busily cultivating the industrial—and, alas ! the financial—fields thus thrown open to them, the Germans, with their keen appreciation of the value of science to industry, forged ahead, but were always handicapped by their deficiencies on the practical side. The United States, while fertile in ideas, and quick to grasp the commercial possibilities of a new invention, erred like ourselves in undervaluing scientific research, but not many years ago the General Electric Co. awoke to a realisation of the facts, and established at immense cost a special boratory for research, which was equipped with apparatus *ad libitum*, and a staff of investigators of the highest ability. Thanks to the admirable combination of commercial acumen with scientific insight, the result has been the evolution of a series of inventions of the highest importance to mankind, of which the laboratory may be justly proud. Foremost amongst these are drawn tungsten wire, the nitrogen-filled lamp, and the Coolidge X-ray tube ; but the laboratory is not content with working on narrow lines towards set objects such as these ; its scope is far wider—and the fruits of its labours have been, and no doubt will be, correspondingly rich and abundant.

The staff of researchers sets to work to find out all that can be discovered in a particular field, and accomplishes its task with skill and thoroughness that compel our admiration ; and when the facts have been discovered and principles deduced from them, the way is clear to turn them to some practical use. Nor do the investigators neglect to avail themselves of the fruits of the work of others in kindred fields ; and thus it is that the "Kenotron" has been brought into existence.

Starting with the "Edison effect" as basis, from which Dr. Fleming had developed the "valve" so useful in wireless telegraphy, the investigators brought to bear upon this embryo rectifier the powerful resources of the Research Laboratory. They had at command unrivalled facilities for the production of vacua of a degree hitherto unattainable—be it noted that they employed the Gaede pump, which drags out the individual molecules of air—and by this means they found out the cause of the erratic behaviour of the valve previously observed, and reduced the phenomena to order and discipline, so that they could be reproduced at will. In this work they had the benefit of the scientific work of an Englishman, O. W. Richardson, who had covered a good deal of the ground. In the end they produced an instrument subject to perfectly definite laws, and having an extremely high efficiency ; it is true that at present it has been constructed only for small currents, but it deals with enormous voltages—100,000 to 200,000 volts—and already a single kenotron can rectify 10 KW. The device is as yet in its infancy, but, as Dr. Dushman points out, it offers great possibilities.

The most striking feature of this new instrument is the fact that it depends for its operation upon the discharge of a stream of electrons from a heated body in an almost perfect vacuum, under the influence of an applied potential difference—a discharge which is unidirectional. It utilises the fundamental principles of electric flow, as now understood, and at the same time affords a singularly convincing demonstration of the truth of the theory itself. The current is conveyed through empty space by particles of negative electricity, each $\frac{1}{1800}$th of the mass of an atom of hydrogen. Surely the thought of that swarm of infinitesimal particles hurrying to do our bidding should inspire us with hope for the future unravelling of the mystery of the ether, and the unlocking of the secrets of the energy contained in the molecules of matter.

THE NATIONAL ELECTRICAL CODE REVISED.

By FRANK BROADBENT, M.I.E.E.

The National Electrical Code, which is the American equivalent to our Institution and other Rules relating to electrical installations, has just undergone its biennial revision. As was pointed out recently in these columns (*) the Code is rendered unnecessarily bulky by the inclusion of detailed specifications relating to the manufacture and testing of cables and apparatus, regulations which do not very greatly concern the wireman or contractor working under the National Code, inasmuch as his responsibility ends by specifying in his orders to the manufacturer that the material must have received the official approval of the National Board of Fire Underwriters.

It is, therefore, interesting to note that it is now proposed to omit these detailed specifications from the Code, and to include only skeleton outlines of the requirements. The manufacturing specifications referred to will be published separately and will, therefore, be available for those whom they particularly concern.

The method of revision of the National Code differs somewhat from that adopted by our own Institution, where the regular practice is to appoint a Revision Committee, which has power to consult interested parties or experts in the various branches of installation work, and, having come to a decision, the Committee has power to make such revisions as it may consider necessary or desirable.

In America the opposite course is adopted ; the Committee first of all revises the rules, and then a public meeting is called to vote upon the details of the proposed revision. If such a practice were adopted here, it is doubtful if half-a-dozen persons besides the members of the Revision Committee would think it worth while to attend at the Institution premises on the Embankment in order to record their views and votes. In marked contrast to this apparent apathy, the American meetings are well attended and the subjects vigorously discussed. At the meeting held on March 24th, in the premises of the New York Board of Fire Underwriters, to consider the suggested modifications in the Code and to go over the reports of the various sub-committees, the auditorium was filled to its utmost capacity, a portion of the audience being able to secure only standing room.

One of the points which gave rise to considerable discussion was the use of refillable fuses, by which is meant what we should call cartridge fuses. It was supposed that the use of refillable fuses would largely, if not entirely, prevent the abuse to which the ordinary open type of fuse is subjected. The Electrical Committee had recommended a further trial of refillable fuses and the accumulation of more experience. This was strongly opposed by several speakers, who contended that refillable fuses were unsafe, that they were just as liable to abuse as the old types, and that further experiment was quite unnecessary.

The Committee's recommendation was finally defeated, and the following resolution adopted :—

> It is the opinion of the Committee that experience has not yet shown that fuses in which the fuse element is intended to be replaced or renewed by the user are satisfactory in test or in field service to a degree warranting the recognition of the principle of refillable fuses in the rules of the National Electrical Code.

This resolution, it would appear, bears hardly on those manufacturers who, during the period of probation, had standardised replaceable fuses in the hope and expectation that this type of fuse had come to stay, and it is not surprising, therefore, to learn that representatives of some of the manufacturers present questioned the authority of the meeting to quash the Electricity Committee's recommendations. The protest, however, was without effect, as it was held by the Chairman that the final court of appeal was "a meeting of the public interested in the subject." In view of the headway which the replaceable type of fuse has made in this country, the above decision is particularly interesting to English electricians.

In our rules we have as yet nothing specifically referring to the installation of "gas-filled lamps," but the

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(*) Reference is to the author's recent article on The National Code and British Wiring Rules.

National Code recognises their use, and, among other rules, the following now appears :—

> Must not be used in shop windows or in other locations where inflammable material is liable to come into contact with lamp equipment, except where used in connection with approved fixtures where temperature of any exposed portion of same does not exceed 200° F.

This rule will, no doubt, cover mercury-vapour lamps, Moore tubes, half-watt lamps, and others in which the vacuum principle is not used.

Another point in which the National Code differs from our own rules is that the carrying capacity of wires used in connection with motors must be higher than for lamp circuits. Formerly the National Code specified that all conductors on motor circuits must be designed to carry a current at least 25 per cent. greater than the rated motor current. This rule is now altered to read as follows :—

> Wires carrying the current of only one motor must be designed to carry a current at least 25 per cent. greater than that for which the motor is rated.

From this it would now appear that the wires to individual motors must have a 25 per cent. margin, whereas the main circuit conductors feeding a distributing-box from which several motors are fed need not be so highly rated.

On the subject of "service wires" the rules neither of the Institution nor the Home Office are concerned, this subject coming within the jurisdiction of the Board of Trade, assuming the supply to be given from outside under B. of T. regulations. On a self-contained installation, however, in which there are several blocks of buildings connected to the generating plant through outside wires, the latter would be regarded as service wires, and these would then come within the scope of our Institution rules, and, in the case of a factory, under the Home Office rules also. On this subject a new paragraph has now been added to the National Code to the effect that metal conduits containing service wires must be insulated from the metal conduit or armouring of cables, or any other metal on or near the building. Alternatively they must be permanently and effectively earthed to water or gas piping, or other suitable earths. If earthed to gas piping, the connection must be on the street side of the gas meter. The earth connection must, however, be in addition to any other earth connection on the metal conduit or armouring within the building. The reason for this rule is not quite obvious, as if all the earth connections are properly made there would appear to be no reason why they should not be bonded together, and it is common practice here to bond the interior conduit system to the supply sheathing, and to rely upon that for "earthing."

Another new paragraph which is not quite in accord with the general opinion obtaining in this country is that the main supply switch should be protected by the main cut-out, "unless the switch is of the knife-blade type and enclosed in an approved box or cabinet, under which conditions the switch may be placed between the source of supply and the cut-out." The standard practice in this country is to use nothing but the enclosed type for service switches, and although the practice has not yet been quite standardised, it is becoming more and more the custom to protect the fuse or cut-out by the switch and not *vice versâ* ; so that, in the event of a fuse requiring replacement, the terminals can be made dead by means of the switch. Under the Home Office requirements, this method is compulsory unless the fuses are of a switch-handle type which can be handled without risk of shock when the fuse terminals are alive.

In the former article already referred to, it was pointed out that, according to the Code, four two-wire and three three-wire circuits could be run in one metal tube; whereas, in this country, although there is no restriction in the Institution Rules, there are some local authorities who limit the number of conductors to four, which is, no doubt, a good practice. It is, therefore, interesting to observe that an amendment has now been made to the National Code, prescribing that not more than four No. 4 B. and S. gauge rubber-covered conductors shall be placed in metal conduit, and that no single lighting circuit shall carry more than 1,320 watts. There are many other modifications in the rules, but as these apply essentially to American practice they do not call for special comment.

THE KENOTRON RECTIFIER.

In the *General Electric Review* for March a description is given by Dr. Saul Dushman of a new device for rectifying high-pressure electric currents, called the "Kenotron" (from the Greek adjective *kenos*, meaning "empty," and the suffix *tron* signifying an instrument or appliance). This rectifier, which is one of the many products of the Research Laboratory of the General Electric Co., of Schenectady, is based upon the phenomena of emission of electrons from incandescent metals, which have been the subject of extended investigations by Dr. Irving Langmuir for several years ; it will be remembered that Dr. Langmuir's results bore fruit in the development of the half-watt lamp and the Coolidge X-ray tube, and as the editor of our contemporary points out, "the construction of a high-voltage rectifier illustrates the old expression that the theory of the present may become engineering practice of the future."

The emission of negatively charged corpuscles or electrons from heated metals may be illustrated by the following arrangement. In an ordinary lamp bulb containing a tungsten or carbon filament there is also sealed in a metal plate. After the lamp is well exhausted it is observed, on charging the filament negatively (making it cathode) with respect to the plate, that a current passes across the vacuous space. If the filament is charged positively this current disappears. Furthermore, the magnitude of this electron emission (thermionic current) from the heated cathode increases with increase in the temperature of the filament.

This effect had been observed by Edison, and was more fully investigated in the case of carbon lamps by Fleming. In view of the unilateral conductivity possessed by such an arrangement as that described above, Fleming applied it as an "electric valve" to rectify electric oscillations such as are obtained from a "wireless" antenna, and therefore to render it possible for these oscillations to affect a galvanometer or telephone.

That the current from a hot cathode in an exhausted bulb is due to a convection of electrons, that is of negatively charged corpuscles having a mass which is about 1/1800th of that of a hydrogen atom, may be shown by deflecting the current in magnetic and electrostatic fields and determining the ratio e/m.

The subject was taken up by Dr. Langmuir, who found that in the case of heated tungsten filaments the electron emission at constant temperature increased as the vacuum improved until a constant value was attained, which varied with the temperature in accordance with an equation laid down by Richardson. In the types of hot-cathode rectifiers exhausted by ordinary methods, the electron emission is accompanied by a blue glow, and the cathode gradually disintegrates ; it was found that the blue glow was due to the presence of positively charged gas molecules (ions), and that the disintegration of the cathode was due to bombardment by these ions. When the vacuum is made as perfect as possible, however, conduction occurs only by means of electrons emitted from the hot cathode, and there is no blue glow.

By means of a Gaede molecular pump in series with two other pumps, with a liquid-air trap between the rectifier and the molecular pump, Dr. Dushman has succeeded in attaining a vacuum as high as 5×10^{-7} mm. of mercury. The thermionic current in a high vacuum depends directly upon the nature of the electrodes and the temperature, values for tungsten being as follows :—

Absolute temperature.	Milliamperes per cm².
2 000	4·2
2 200	48·3
2 400	364·8
2 600	2,044·0

There is, however, another factor influencing the electron current, namely, the electrostatic field or "space charge," observed by Dr. Langmuir, which is set up by the electrons emitted from the hot cathode ; the effect of this charge is that with a given voltage, the current increases with temperature, according to Richardson's equation, only up to a certain temperature, after which it remains constant. The higher the voltage between the electrodes, the higher is the temperature at which the limit is reached, but in no case does the current at a given temperature exceed the value given by Richardson's equation, no matter what the voltage. As the absence of positive ions and therefore of gas is essential, the appropriateness of the name kenotron is obvious.

The current-carrying capacity of a kenotron, when given sufficiently high voltage between the electrodes, is limited only by the area of the surface emitting electrons and its temperature. It is necessary to limit the temperature to such a value that the life of the filament is at least 1,000 hours, and taking the life as the time required to evaporate 10 per cent. of the diameter, the following figures are obtained : —

Diam. of filament in mils.	Safe temperature (life over 2,000 hours).	Electron emission ma. per cm. length.	Heating watts per cm. length.
5	2,475	30	3·1
7	2 500	50	4 6
10	2,550	100	7·2
15	2,575	200	11 3

The space charge necessarily gives rise to a voltage drop in the kenotron ; the current is limited to the maximum value corresponding to the temperature, and if by any chance, such as a short circuit beyond the rectifier, an excessive voltage is thrown on the latter, the instrument will be in danger of destruction. Because of the high degree of vacuum, none of the electrons lose energy by collision with gas molecules ; the whole of their kinetic energy is therefore liberated as heat at the anode, like that of rifle bullets on an iron target, and the anode may thus be quickly melted. Moreover, if the anode is highly heated, rectification naturally becomes imperfect. The rectifier must, therefore, be protected against excessive pressure, and be so designed that the space charge voltage is not great enough to cause undue heating of the anode with the normal current. It is found that about 10 watts per sq. cm. of anode area is permissible, corresponding to a temperature of 1,600° absolute, a bright red heat ; at this temperature the electron emission from the anode is still less than 0·02 ma. per sq. cm.

Another important point in design is the prevention of electrostatic strains on the filament due to the high voltage, the electrostatic attraction between the electrodes being proportional to the square of the voltage. During the rectifying phase the P D. is very low, but during the other half cycle the electrodes are subject to the full P.D. of the line. The space charge increases with the distance between the electrodes, so that they must be kept fairly close together. Various symmetrical arrangements, such as a straight filament in the axis of a cylindrical anode, a V or W-shaped filament between two parallel plates, or a headlight filament inside a molybdenum cap, have been devised to meet this difficulty. Figs. 1 to 3 are examples of these.

In fig. 1 a molybdenum cylinder A encloses a coaxial filament F. For direct-current pressures up to 15,000 volts the diameter of the cylinder need not exceed ½ in., while the length may be up to 4 in., with a 10-mil filament as cathode. At a temperature of 2,550° absolute the maximum current obtainable from such a kenotron is about 400 milliamperes, and the voltage drop is 145 volts.

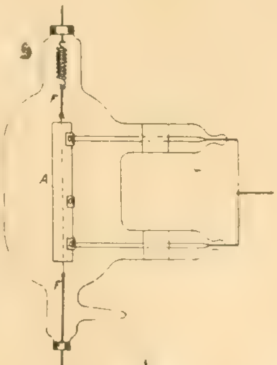
The space-charge loss is therefore 58 watts, and the heating of the filament requires 72 watts, making a total loss of 130 watts in the rectifier, or 1·5 watts per sq. cm. of the anode, which attains a dull red heat. The kenotron is capable of rectifying ·6 KW., so that the loss in the tube amounts to 2 per cent.

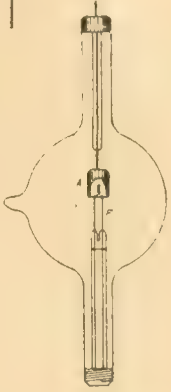
For D.C. pressures up to 75,000 or 100,000 volts, the diameter of the cylinder is increased to about 5 cm. A tube intended to rectify 10 KW. at 100,000 volts, with a carrying capacity, therefore, of 100 ma., had a loss of only 1·25 per cent.

The type of kenotron shown in fig. 2 is suitable for voltages not over 10,000, and currents ranging up to 100 ma. : it consists of a small filament such as is used in automobile headlights, inserted in a molybdenum cap about ⅝ in. in diameter. The loss at 10,000 volts, 100 ma., is about 5 per cent.

A V-shaped filament between tungsten plates is shown in fig. 3, the plates being 2 to 4 cm. apart. A current of 100 ma. can be carried up to 40,000 volts with a space-charge voltage of 260 volts, the temperature of the filament being 2,500° absolute.

With two kenotrons, connected as in fig. 4, both half waves of the current can be rectified with a connection to the middle point of the transformer. Fig. 5 shows an arrangement of four kenotrons for utilising the full voltage of a transformer.





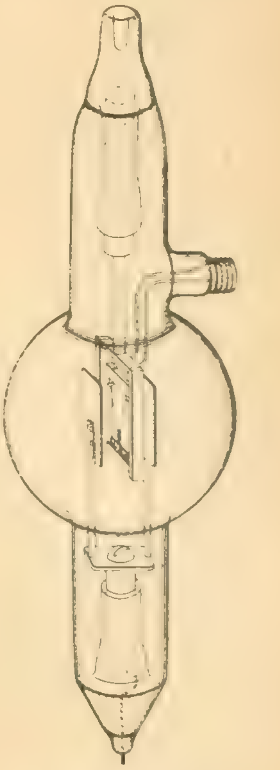


Fig. 1.—Kenotron with Cylindrical Anode.
Fig. 2.—Kenotron with Molybdenum Cap.

Fig. 3.—Kenotron with Filament between Parallel Plates.

Kenotrons have been constructed for D C. voltages up to 100,000 volts, and currents up to 1·5 amperes ; the author has every expectation of extending their application to 200,000 volts. It is preferable to construct them in the form of 10-KW. units when the voltage exceeds 25,000 ; for lower voltages, smaller units are advisable. Unlike the mercury-vapour rectifier, they can be operated in parallel.

In the laboratory the kenotron facilitates the production of small direct currents at very high voltages, for spectroscopic work, &c., and for testing the dielectric strength of insulation. By inserting capacity between the high-pressure D C. terminals, as at C, fig. 4, the fluctuations in the direct current can be reduced to any desired extent. For the operation of X-ray tubes, the precipitation of dust, &c., the instrument is well adapted. But the author's vision is not restricted to minor uses such as these ; he regards high-voltage D.C. transmission as being "very much within the limits of possibility." "To transmit 1,000 KW. by 100 kenotrons, working in parallel at a voltage of 50,000 to 75,000, is quite a feasible proposition."

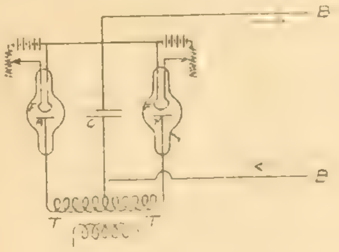


Fig. 4.

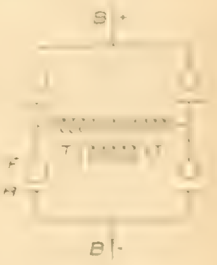


Fig. 5.

Fig. 4.—Arrangement for Rectifying both Half Waves.

Fig. 5.—Arrangement for Utilising Full Voltage of Transformer.

THE WAR AND THE ELECTRICAL INDUSTRY.

We have lately made further inquiries among a number of firms connected with the electrical industry in regard to the effect of the continuation of the war upon their operations.

Our inquiries related to the effect of the demands of the Government for war materials, the extent of present home and foreign business, the probable effects of restriction of municipal electrical expenditure, the wearing of badges by workpeople, the shortage of skilled labour, the shortage of raw materials, and the progress being made in the manufacture of new lines and with trading operations in new markets.

A firm of scientific instrument-makers replies as ollows :—

Home and foreign orders are about up to the average. On account of the large amount of Government work in hand, however, it is not possible to actively push foreign business. No effect of limitation of municipal expenditure has yet been felt. About 20 per cent. of the men have enlisted. It is not anticipated that many more will do so voluntarily. Service badges have been obtained, but not yet issued pending an anticipated visit from the War Munitions Committee. The shortage of skilled labour is severely felt, and is greatly handicapping output. Shortage of raw material has not been seriously felt, but there are difficulties, of course, in obtaining deliveries.

Inquirers often ask for substitutes for Continental instrument-makers' goods, but the pressure of Government work has prevented any serious effort to enter new foreign markets.

The Walsall Electrical Co., Ltd., state :—

We have at the present time sufficient orders to keep our works more than fully occupied. We have secured a fair amount of Continental trade, most of which, as far as we can trace, has previously been transacted by the enemy.

The restriction of municipal expenditure will not materially affect us, as the slump in our standard lines has been more than counterbalanced by new business.

We are at present experiencing a great difficulty with labour, as something like 33⅓ per cent. of our staff and employés have joined the Colours and things are not improving.

We are having considerable difficulty in obtaining skilled labour —more so than unskilled ; this is materially affecting our deliveries. Our supply of material is very much restricted, and at the present time is causing serious inconvenience.

We have certainly started to manufacture new lines formerly purchased from the Continent, but it is impossible to say to what extent this business will prosper until the present difficulties have disappeared.

A well-known firm of makers of electrical instruments and apparatus writes :—

We are receiving orders freely both at home and abroad, but of course the bulk of our work is from this country, and it is largely dependent on the war. At the present moment we are not feeling the restriction of municipal electrical expenditure, but in connection with this we would point out that a large amount of such expenditure is necessary in order to keep war industries going. A considerable proportion of our men have enlisted, and we are feeling very considerably the loss of the services of the intermediate class of man. Material also is difficult to obtain, and is becoming increasingly dearer. There is always a certain amount of development going on in our works, but this is naturally directed at the present time to carrying out the various orders for the Government which we have in hand.

A large electrical manufacturing company reports :—

We continue to receive orders freely for our manufactures from buyers at home and abroad and have no complaint to make in this respect, but rather the other way about, that is, in some departments we receive orders much too freely for our comfort from the point of view of execution. We do not consider that the restriction of municipal electrical expenditure will affect us, as business from other sources will apparently fully make up for any falling off there may be due to that cause. Approximately 600 of our employés have enlisted, and from time to time we continue to lose a few. No badges are worn by our workmen. In certain of our departments the shortage of skilled labour has affected us to a certain extent, but we cannot say that it has done so materially, taking into consideration the works as a whole. We have experienced difficulty from time to time through shortage of raw materials, but we have now been able to remedy this to a large extent. We have had very little opportunity to follow up new lines of manufacture in view of the fact that since the outbreak of war our works have been continuously overloaded with our normal lines of business.

A firm of switchgear manufacturers states :—

We are switching all our available resources on to war service work. The greater proportion of our eligible men have enlisted, and we expect within the next week or so that the whole of our staff and other employés will be engaged on war service in one form or other.

A firm of engine-makers reports :—

We are devoting ourselves almost exclusively to the manufacture of engines, &c., required by the Government, and, consequently, are not seeking to secure new business either at home or abroad. The shortage of skilled labour materially affects our output, as it prevents us from working night-shift.

A prominent electrical firm in the Provinces, which is very extensively engaged in the supply of munitions of war, but without any hindrance to usual manufacturing and selling operations, reports that it is receiving home and foreign orders freely, and it anticipates that restriction of municipal electrical expenditure will have a considerable effect ; 15 per cent. of the employés have enlisted ; others are going ; no badges are worn. Shortage of skilled labour is serious, and shortage of raw materials also causes difficulty. No progress is being made with new lines of manufacture, but efforts to enter new foreign markets are meeting with very satisfactory results.

Messrs Gent & Co., Ltd., of Leicester, are receiving orders freely for their manufactures from buyers at home and abroad. They do not anticipate that restriction of municipal electrical expenditure will materially affect them. About 15 per cent. of their staff have enlisted, and a fair number are leaving every week. War service badges are worn by their workpeople. The firm suffer a good deal from the shortage of skilled labour. At the present moment considerable difficulty is also caused owing to shortage of raw material, but great efforts are being made to overcome the difficulty. Progress in new lines of manufacture, formerly chiefly Continental, is not as rapid as they would like owing to heavy Government demands upon the works.

Messrs. Veritys, Ltd, of London and Birmingham, have experienced extreme activity in all directions since the commencement of the war. The mere fact that foreign supplies have been cut off, and this country thrown on its own resources, seems to have done untold good, and without going into political or economic questions, it is believed that if, at the end of the war, some tariff wall can be erected against the aggression of the companies abroad, assisted by banks and subsidies as they are, it would be a splendid thing for the electrical industry in this country. It is all very well, during peace time, for agents over here, having small offices and employing only a few clerks, to earn a living by importing against their countrymen large masses of electrical machinery, but in times of crisis, such as the present, the weakness of this policy can be seen. The tendency hitherto has been to turn this country into a large factoring department for foreign firms, whereas the backbone of the Empire is the manufacturing industries which employ Britishers ; industries which are ready to supply requirements in war time, and from which alone can a permanent prosperity be assured. If the Government and municipal authorities will only recognise this and stand by the home manufacturer, there is no reason whatever why the electrical trade should once more fall into the degree of servitude which it had undoubtedly reached when hostilities were commenced.

Mr. George Verity, chairman of the company, has been appointed an Honorary Colonel of the Royal Engineers (T). He is also chairman of Charing Cross Hospital, and has had through his hands over 1,000 wounded soldiers—the care of whom is undertaken without cost to the nation. Messrs. Veritys' works director, Colonel Lister, R.E., has been transferred from the Territorial Forces to the Royal Engineers, and as such, has been in constant employment since mobilisation. He has been over in Flanders, and is at present engaged in raising a further corps of Signal Troops for dispatch to the front. His place has been taken at the works by Mr. T. l'ons, long a member of the company, and Col. Verity's work is largely being carried out by Mr. Evans, sales director. Orders are being received fairly freely for the firm's manufactures from both at home and abroad, although foreign trade is naturally somewhat restricted, owing to the financial crisis in South America and elsewhere. The restriction of municipal electrical expenditure has not, so far, affected them, and if, after the war, as stated above, the municipal councils, will only see their way to give preference to British manufacturers, as is done in Germany and elsewhere, both for big and small plant and supplies, the effect of the war will be a blessing in disguise.

A large number of the firm's men have enlisted, both at the sales depôts and the works ; their dependents are being looked after by the company. Recruiting from the works has now been stopped by order of the Admiralty, who have given the directors a number of badges to be worn by men engaged on Government work, and who consider that the men remaining are doing their duty as well at the bench as in the trench. Messrs. Verity feel the effect of the shortage of skilled labour, and to some extent the shortage of raw materials, but their men have worked hard and loyally, and have largely made up for the difficulties experienced in other directions.

All the firm's endeavours are being concentrated, during the war, in developing new lines of their manufactures for both at home and abroad. It remains to be seen whether they, like other British manufacturers, are going to be supported.

Swedish Electrical Exports to Canada.—Figures lately issued show that during the last fiscal year, electrical apparatus valued at £185,906 was imported into Canada from Sweden, as compared with only £118,560 in 1913.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Ironclad Switchgear.

THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., of Stafford Works, Rea Street South, Birmingham, are now specialising in the manufacture of ironclad switchgear. A number of patterns are being produced, including the Paragon and Camloc ironclad switches, the Memco ironclad change-over switch, the Kantark ironclad fuse, &c.

The Paragon switch has been designed to meet the want for a low-priced totally-enclosed ironclad double or triple-pole switch. The contacts are mounted on a mica insulated bar controlled by a side lever handle, and each pole is mounted on a separate porcelain base. The cover is interlocked with the handle, and the construction allows easy replacement of brushes or contacts; an earthing screw is provided, and the switch complies with H. O. regulations. A Paragon combined switch and fuse unit is also supplied, in which H. O. pattern bridge replacement fuses are contained in the switch case.

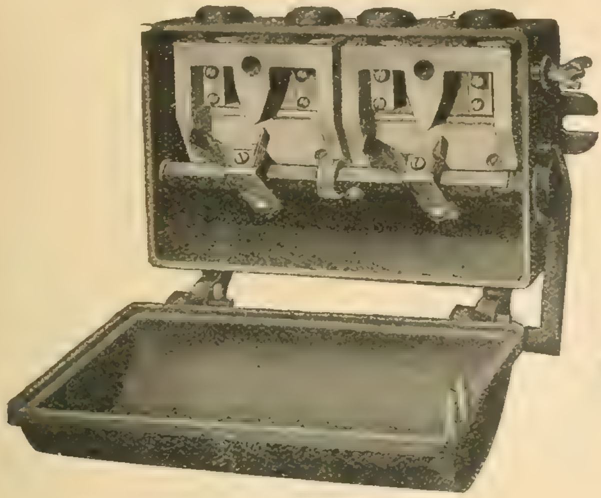


FIG. 1.—PARAGON D.P. SWITCH.

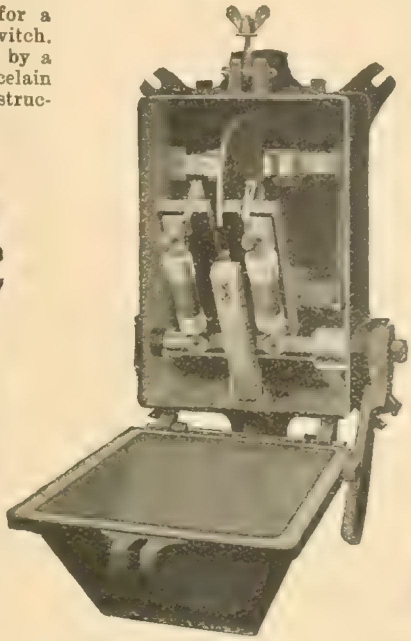


FIG. 2.—CAMLOC SWITCH-FUSE.

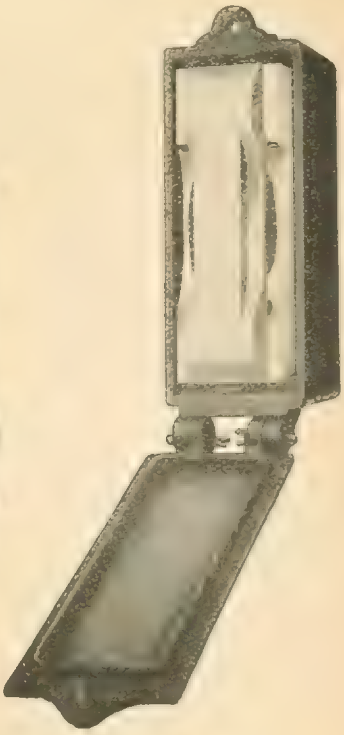


FIG. 3.—KANTARK FUSE.

The feature of the Camloc switch is its quick break; it is built on the mica and metal principle, double and triple-pole, with interlocking handle, and the mechanism gives a positive make which is effected independently of the spring. Every switch is guaranteed to withstand 2,300 volts A.C. between contacts and case. This switch is also supplied as a switch-fuse combined with the firm's standard pattern cartridge fuses.

The Memco change-over switch—double and triple-pole—is a completely enclosed ironclad switch suitable for all purposes.

The Kantark ironclad fuse is of the replacement bridge type, of improved design, with contacts well shielded and embedded in porcelain to conform to H. O. regulations. An arc chamber is provided with ventilation slots, to prevent damage to the fuse.

The Paragon and Camloc switches are fully protected, and the design of the Kantark fuse is registered.

Shop Window Reflectors.

MESSRS. SIMPLEX CONDUITS, LTD., of 116, Charing Cross Road, W.C., have just produced a range of reflectors, designed to illuminate objects displayed in shop windows in the most economical manner. These reflectors throw all the light upon the goods, and prevent the pavement in front of the shop being flooded with light, thus meeting the requirements of scientific illumination, and at the same time falling in with the new lighting regulations. All the reflectors are designed for easy wiring and fixing, and, at the same time, are easily adjustable.

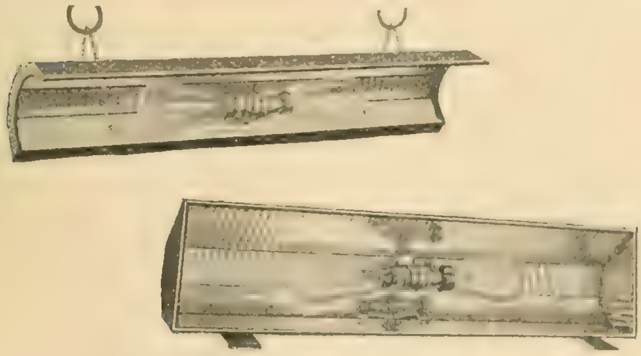


FIG. 4.—SIMPLEX SHOP WINDOW REFLECTORS.

Leaflet No. 583 describes this range fully, and a copy will be sent on application.

B.T.H. Half-watt Fittings.

The new provision department of Messrs. Selfridge & Co, Ltd., has been provided with an exceptionally efficient installation of electric lighting on the most up-to-date lines; the proprietor desired to employ half-watt lamps, and in order to obtain the best possible effect various systems were tried, with the result that the Eye-rest system was adopted. Messrs. Rashleigh Phipps & Co. were the contractors, and the fittings were supplied by the BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House, 77, Upper Thames Street, E.C. Fig. 5 shows the indirect lighting fitting as installed in the grocery department, on the first floor; each bowl is fitted with a B.T.H. X-ray reflector, in proper focal position with regard to the filament of the half-watt lamp, which directs the light on to the ceiling. Somewhat similar Eye-rest fittings are used in the provision department, on the ground floor. In the marble market in the basement semi-indirect lighting is employed, with the B.T.H. Lumina fitting, as shown in fig. 6. The intense intrinsic brilliancy of the half-watt lamp is thus shielded from direct vision, while ample ventilation is ensured, and the illumination obtained, it is claimed, is most agreeable—an important feature in shop lighting.

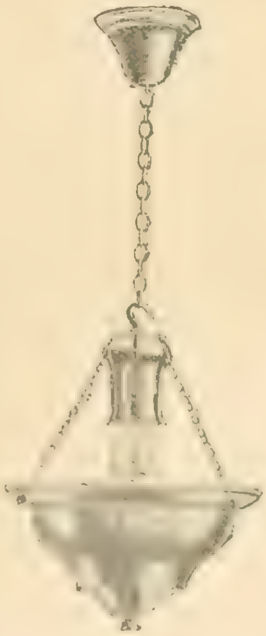


FIG. 5.—EYE-REST INDIRECT FITTING.

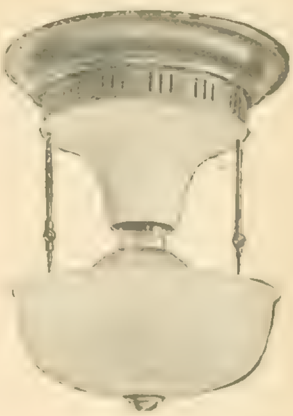


FIG. 6.—LUMINA SEMI-INDIRECT FITTING.

B.T.H. FITTINGS AT SELFRIDGE'S.

Benjamin Half-Watt Fitting.

The Benjamin Electric, Ltd., of 1a, Rosebery Avenue, E.C., have introduced the new vitreous enamelled steel reflector for half-watt lamps, illustrated in fig. 7. The contour of the reflector is such that the filament is hidden from the direct line of vision, the most efficient illumination being produced on the working plane. The skeleton neck ensures ample ventilation, while the Benjamin Goliath holder facilitates wiring and eliminates overheating of the terminals. The fitting is adapted for 300 to 500-watt lamps.

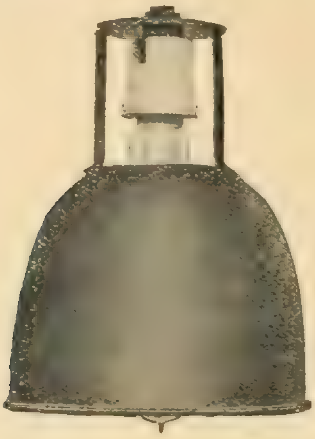


Fig. 7.—Benjamin Half-Watt Fitting.

LEGAL.

The Prize Court.—Seizure of Electric Fans.

In the Prize Court on Monday the President, Sir Samuel Evans, gave his reserved judgment in the suit by the Crown asking for the condemnation of five cases of electric fans seized on board the P. and O. steamship *Poona* in London on October 17th last. The goods were claimed by Isaria, Ltd., a company duly incorporated in England.

The President, giving judgment, said: The claimants to the goods seized and claimed in these proceedings (which consisted of five cases of electric fans) are a company named Isaria, Ltd., which was incorporated in May, 1912, and whose registered office at the time of the outbreak of war was 208, Tower Bridge Road, in the County of London. The company carried on business in this country and abroad. The goods (with others) had been sent out to Australia for sale, and were returned to the company in August, 1914. They were seized in the Port of London as prize in the Crown's rights to droits of Admiralty on October 17th, 1914. After investigation of the facts I was satisfied that the goods at the time of seizure belonged to the company. The question which remained for decision was whether, having regard to the constitution of the company, the goods were enemy property subject to seizure. At all material times the number of shares in Isaria, Ltd., issued were 1,250 shares of £1 each. Of these 1,244 were held by Isaria Zahlerwerke, of Munich, a German manufacturing company; one share was held by each of the four directors of Isaria, Ltd., who were German subjects and resident in Germany; one other share was held by one Schoenmann, the secretary of the company, also a German subject; the remaining share was held by one Vallée, who was said to have been a French subject, but who, for some time before the war, had resided at Munich, and been employed by the German company, the Isaria Zahlerwerke. Schoenmann left this country on August 3rd last for Germany, having purported to appoint one of the company's employés, Mr. Frank Morton, to be manager. Mr Morton represented the company in these proceedings. After the outbreak of war he was informed by the Board of Trade that they were advised that there was no objection to the sale from stock of the company of goods imported from Germany before the war, and that no licence was required for that purpose. Later on (in November last) he was informed by the Comptroller of the Companies' Department of the Board of Trade that as Isaria, Ltd., was a company incorporated in this country, there was nothing (having regard to Sec. 3 of the Trading with the Enemy Proclamation No. 2, dated September 9th) to prevent trading with the company, or the payment to it of money which might be owing to it. So Mr. Morton appears to have carried on the business of the company; and the books and papers of the business have been inspected, when required, by the official accountant appointed by the Board of Trade. For the claimants, it was contended that the goods belonged to an English company, not to alien enemies, and were not subject to seizure or confiscation. On the other hand, it was argued for the Crown that as all the directors were enemy subjects, and resident in Germany, and all the shareholders were also either enemy subjects, or resident in Germany, the goods were in reality the property of alien enemies, and ought to be condemned as such. I was referred to my decision in this Court in "The Roumanian" (1915, Probate, page 26); and, of course, to the judgments pronounced later by the Court of Appeal in "the Continental Tyre Co., Ltd., *v.* Daimler Co., Ltd., and *v.* Thomas Tilling, Ltd." (1915, I.K.B., page 893). I will only observe as to "The Roumanian" that it does not necessarily govern this case. The facts there were different in important and material respects; moreover, I think it will be found that in the course of the arguments in "the Roumanian," counsel for the claimants expressly admitted that the "Europaische Petroleum-Union Gesellschaft mit beschrankter Haftung" was a German company; and the case was dealt with accordingly. The judgments in the Court of Appeal in the Continental Tyre Co. cases, however, bear directly upon the point arising in the present case. What, therefore, ought I to do in this Court in view of those decisions? In matters relating to prize, the Court of Appeal does not bind this Court, for the reason that no appeal lies to the Court of Appeal from judgments given in the Prize Court. The only appellate court in such cases is the Judicial Committee of the Privy Council. If I were of opinion that different principles applied in the present proceedings in a Court of Prize; or if I held a strong opinion upon the legal aspects, even if the same principles were applicable, I conceive it would be my duty to give effect to such opinion even though it differed from that of the Court of Appeal. But I do not think, in the present case, different principles ought to be applied. The matter in controversy appears to me to be one which should be regarded from the point of view of municipal law; and no question of an overriding principle of international law arises. The claimants come forward as a company incorporated in accordance with the law of this country. The claim is not made by the individual shareholders—subjects of a foreign country, enemy or otherwise. The question turns upon the status of the company in this Kingdom. Accordingly, nothing in this case depends upon the bearing of the law of nations upon our municipal law. In these circumstances, I think it more respectful to the Court of Appeal to act in accordance with their judgment, however much I might feel inclined to sympathise with the dissentient views of Lord Justice Buckley. In the special facts of this case and of the Continental Tyre Co. cases, a decision in accordance with Lord Justice Buckley's judgment might be easy; but it is fairly obvious that with even a slight variation of facts as to the holding of the shares, the adoption of a definite general principle as a foundation for his judgment and its application would give rise to great difficulties. Without dealing with it any further, I may observe that even in Lord Justice Buckley's dissenting judgment this passage is to be found:—"The corporation, if it be a British corporation, stands in the same position for most purposes as a British subject. For instance, as regards rights of ownership of property and the right to protection and assistance by the law.' But while it stands for most purposes in the position of a British subject, it cannot be correctly described as a British subject." The question before me deals with "rights of ownership." For the reasons stated, I am content to accept respectfully the law as laid down by the Court of Appeal, and must leave the ultimate decision to a higher tribunal. If the judgment of the majority of the Court of Appeal is unsound, it must be so pronounced by the House of Lords on appeal from them; or by the Privy Council on appeal from this Court. If it is affirmed as good law, but is considered to require alteration as a matter of just policy, then the Legislature must act. I desire to add one word by way of reservation. The case of the ownership of vessels registered in this country is so special, having regard to our merchant shipping legislation, that I venture to repeat what I said in "The Tommi" and "The Rothersand" (1914, Probate, page 251), and to reserve expressly all questions which might arise if it were contended that a British vessel was the property of a company constituted like that of Isaria, Ltd. The judgment of the Court is that the goods seized are not enemy property, and I order their release. On their release they will be delivered over to Mr. Morton, the present manager of Isaria, Ltd.; and he, of course, will deal with them as belonging to the English company; and he will not be able to deliver them or their proceeds over to the alien enemy shareholders of the company or to use them or to apply their proceeds for the benefit of any such shareholders during the existence of the war.

Patent Revocation.

On the 29th ult. the Court of Appeal, composed of the Master of the Rolls, Lord Justice Phillimore and Mr. Justice Joyce, delivered judgment upon the appeal of Witcarbonizing, Ltd., from a judgment of Mr. Justice (now Lord Justice) Warrington dismissing their petition for revocation of letters patent No. 10,370 of 1912, granted to John E. Jameson, Oliver H. Valpy and Edmund A. Buckle, for "Improvements in the treatment of peat and the like." One of the claims of the patent was as follows:—"In a process for the extraction of water from peat and like substances passing an electric current through a pulp of the same heated to a temperature of 100° C. under a pressure such that no steam is produced substantially as described." Appellants applied for revocation of the patent on the grounds that it was invalid for want of utility and insufficiency of directions. It was proved that the water in peat was partly free and partly combined in the form of "hydro-cellulose," and that the combined water could not be got rid of by pressure as the free water could. Prior to the patent it had been suggested that the water could be removed by the use of a comparatively high temperature and pressure. The patentees (the respondents) alleged that the result could be attained by the use of an electric current the voltage of which might vary within wide limits, at a lower temperature, but the petitioners contended that the only result obtained by the use of the current was due to its heating effect. Mr. Justice Warrington held that the specification described a process in which the electric current was used to effect the decomposition of the "hydro-cellulose" without recourse for that purpose to heat, while the earlier process depended on the effect of heat alone; that the process was useful; and that the directions were not insufficient. He accordingly dismissed the petition with costs, and granted respondents a certificate of validity. From this decision the petitioners now appealed.

Mr. Walter, K.C., Mr. Colefax, K.C., and Mr. Frost appeared in support of the appeal, and Mr. Bousfield, K.C., and Mr. J. Hunter Gray for the respondents.

The Master of the Rolls, in the course of his judgment, said he did not consider the experiments which had been made by both sides were either satisfactory or conclusive, but, on the whole, he thought the petitioners had failed to prove that the respondents' patent was bad for want of utility. While feeling more difficulty upon the other point as to the directions in the respondents' specification being insufficient, as alleged by the petitioners, he was not, on the whole, prepared to differ from the conclusion arrived at by Mr. Justice Warrington upon that issue. The result was that in his opinion the appeal failed and should be dismissed with costs.

Lord Justice Phillimore and Mr. Justice Joyce delivered judgments to the same effect.

Piggott & Co., Ltd., *v.* Hicks & Co.

On Friday, before his Honour Sir W. Lucius Selfe, in the Marylebone County Court, Messrs. Thos. Piggott & Co., Ltd., engineers, Atlas Works, Springhill, Birmingham, claimed the return of £13, paid for an electric motor to Messrs. Hicks & Co., engineers, Portsdown Road, Maida Vale, W.

Mr. Rankin, counsel for the plaintiffs, explained that in February the defendants advertised a second-hand electric motor, as good as new, of 7½ H P., and the plaintiffs purchased it, paying a cheque for the amount in advance. When the machine arrived at Birmingham it was found that the coils had been fused up and that the motor was nothing like 7½ H.P. A new motor would have cost about £25, but at that date it would have taken a month to deliver it. In these circumstances, cash was paid for this motor. Counsel said that his clients had sustained considerable damage through want of this motor and having to substitute another. It cost in labour alone £7 to move one of their motors from one part of their works and install it where the additional power was needed. But for the fact that they had a spare motor, the damage would have been much heavier.

Mr. Dyson, manager of the plaintiffs' works, said that the motor was delivered on March 2nd. It was urgently wanted to complete a contract for steam pipes for the Admiralty, and the one supplied by the defendants not being what it was represented to be, caused delay in the work. It was wanted to drive a lathe. When it was discovered that the coils of the motor were defective and that the horse-power was much under 7½, they had to dismantle one of their fixed motors and place it to complete the pipe contract. The out-of-pocket cost of this work was £7 5s., and the work was delayed four weeks.

His Honour: Thus you have lost more than £7?—Witness: Considerably.

His Honour: There will be judgment for the plaintiffs for £26 9s. and costs, payable in 14 days. And about the rejected motor?

Counsel: It lies with my clients at the defendants' risk.

Workmen's Compensation.

At Preston County Court last week, Luke Riley, labourer, 21, Pollard Street, brought an unsuccessful claim under the Workmen's Compensation Act against the United Electric Car Co., Ltd., of Strand Road, Preston. It appeared that three years ago an accident occurred to the applicant, and his leg was injured. The respondents admitted liability for payment of compensation in respect of that accident until November 3rd last, when it was contended that applicant had fully recovered and was able to do the work they offered him. Applicant declared that ulcers on his leg rendered him unfit for work.

Judge Sturges gave judgment for the respondents, holding that the ulcers had no connection with the accident. Applicant was awarded costs up to the time of the payment into Court by respondents, and the latter were awarded subsequent costs.

PARLIAMENTARY.

Aberdare Tramways.

After several days' sitting the Select Committee of the House of Lords, presided over by Lord Newton, has passed the Aberdare U.D.C. Bill. The objects of the Bill are the construction of certain tramways, the provision of railless traction and motor-'bus routes, and certain street improvements. The principal opponents were the Great Western Railway Co. and the Taff Valley Railway Co.

Mr. Clode, for the promoters, said that the tramways of the Urban District Council, which were opened in 1913, had done fairly well, but the railless traction routes had not shown a profit. The tramway extensions proposed were from Trecynon to Hirwain, from Aberaman to Cwmaman, and to Abercwmboi. It was proposed to extend the existing railless traction routes from Abernant Road to Cwmbach and from Trecynon to Cwmbach. Sanction was asked to borrow £49,751 for the construction and equipment of the tramways and railless cars, and £8,500 for motor-'buses.

A great deal of local evidence was called, and Mr. S. Sellon and Mr. J. B. Hamilton also gave evidence in support of the proposals.

Mr. Balfour Browne, K.C., for the Taff Vale Railway Co., in asking the Committee to reject the Bill, contended that Parliament never intended tramways to run alongside existing railways to take traffic from them.

Mr. Lloyd, K.C., on behalf of the Great Western Railway Co., agreed that the proposed tramways were unnecessary and would be unremunerative.

The Committee passed the preamble except with regard to the proposed extension from Trecynon to Hirwain, which was struck out.

Yorkshire Electric Power Bill.

The Bill promoted by the Yorkshire Electric Power Co. came before the Select Committee of the House of Lords, presided over by Lord Hylton, on April 27th and subsequent days. The company, under the Bill, sought for power to supply electric current for lighting, and also provided for the division of the capital into £1 shares.

Mr. Freeman, K.C., appeared for the promoters, and said the area of the company comprised the greater part of the West Riding of Yorkshire, but the powers of the company only allowed them to supply electric power in bulk. The authorised capital of the company was £2,000 000, and £538,000 had been expended on capital account. In no fewer than 84 districts in the area there was no body authorised to supply electric light. The opponents of the Bill mainly consisted of county boroughs, and he contended that as the company could not go inside the areas of these boroughs, they were not affected.

After hearing evidence, the Committee struck out the main clauses of the Bill, and in consequence the promoters withdrew the whole Bill.

Second Readings.—In the House of Lords, on May 4th, the Metropolitan District Railway Bill and the Ascot District Gas and Electricity Bill, were read a second time.

OUR LEGAL QUERY COLUMN.

"Switch" writes:—"We should like the help of your Legal Column with regard to a question of trading with the enemy. The matter is probably one in which several readers find themselves, and we think is, therefore, of general interest. Should you mention the matter in your paper, we must ask you, for obvious reasons, not to mention our name in any way. The position is that in the past we had various apparatus made for us in Germany; the actual orders were placed with the agent of the German firm in this country, who is either an Englishman or a neutral. The orders were made out to him; the invoices we received were on the German manufacturers' paper, with a note on the bottom: 'Payable to our agent, Mr. . . . . in London.' The cheques were paid by us to this agent. Since the outbreak of war we have made arrangements to have the apparatus made in this country, and for various reasons have had to place contracts for some time ahead. We wish to know how we can take steps to have the remainder of the outstanding orders with the German manufacturers legally cancelled. We might say that the orders given to the agent in London mentioned a definite number of pieces but generally stated 'Delivery as required.' Thanking you in anticipation for any assistance you can give us."

⁂ An executory contract concluded with an alien enemy before the outbreak of war is merely suspended during the war as regards the right to performance and the right of action. But such a contract is either avoided or dissolved by the outbreak of war (1) if it enures to the aid of the enemy, or (2) if it is in its nature incapable of suspension. A contract will in its nature be incapable of suspension if (*inter alia*) its proper performance necessitates intercourse with the enemy during the war. The above are the principles of law (apart from the law as defined by various proclamations) which govern the question propounded. It would seem that if any payment made to the English agent were to have been by him transmitted to his German principals, it would be illegal. By the Trading with the Enemy Proclamation (No. 2), Art. 5, any person resident, carrying on business, or being in the British Dominions is warned—(1) Not to pay any sum of money to or for the benefit of an enemy. It is true that if an enemy has an agent in this country duly appointed before the war, payment to such agent is not a crime, although the money must not be transmitted by him to his principal (see Kershaw *v.* Kelsey (1868) 100 Mass. 561). In these circumstances inasmuch as our correspondent will probably have no means of knowing whether money is being transmitted to Germany or not, to continue to trade with the agent will be a very dangerous proceeding, and it is difficult to understand why he need take steps to have the orders legally cancelled. All that is necessary for him is to serve a notice saying that he does not propose to accept any more goods under the contract. He would do well, however, to consult a solicitor.

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Engineering Industry and the War.

Many will read with great interest your valuable article entitled "The Engineering Industry and the War," and I should like the favour of a portion of your space to make a few remarks thereon.

I believe that zeal without knowledge is frenzy, and I believe that the basis of the genius of our high national civilisation exists in the preventative, constructive and aggressive resources of which our professional engineers are the masters and national custodians.

I have asked a friend to put down a question in Parliament upon this subject, because I find, upon discussing the matter with a number of Members of Parliament, and in other obvious patent ways, that the nation knows little or nothing of the vital asset represented by some 12,000 professional engineers appearing in the published lists of the Institutions of Civil, Electrical, and Mechanical Engineers.

I know the medical profession in many countries, and having met them in consultations, can testify in many ways that they have little or no knowledge of the important subject of the industrial performance capacity of male or female individuals. Try any medical man you like, and he does not know that the average female heart pumps blood as 3 is to 5 of the average male; it seems incredible, but they do not know this simple fact in their line, and yet the blood pumped by the heart is the measure of industrial performance.

In the area of the sacrum it is the same, and these are the biological laws governing weight-lifting and carrying capacity as well as reserve power for overtime and special sustained mental or physical efforts.

Engineers are the only professional men who graduate in actual labour experience and know how to get those results from individual output which are so essentially a part of the uniform national effort in every part just now, without the absurd long hours and overstrain which are doing great general injury unnecessarily.

In a letter it is impossible to do justice to the capacity and responsibility of the trained engineer, but we have, whatever one may say, to thank Parliament for the information given last week, that the Admiralty retains eight medical men at £5,000 per annum.

But where are the engineers? How many engineers are retained by the whole Empire at £5,000 per annum? Germany is fighting us with engineers, not with doctors. The greatest preventative and aggressive *medicine* is engineering, not physics and surgery, and the great Dr. Erlich has lowered himself when he declares "this is a doctors' war."

If the Germans will withdraw their engineers out of the war we will withdraw our doctors, and in that case in three weeks we should be in Berlin.

One is glad to see professional men retained at £5,000 a year, which a good man is honestly worth to sustain the burden of his position. But, may we not see, since war always has been an engineering job, our prominent engineers placed in prominent positions and paid like doctors and lawyers in the interests of the State? Why have we an Engineering Committee on the production of munitions of war presided over by a lawyer, and no professional engineer listed by the great British engineering institutions, not one, upon that Committee?

J. Sutherland Warner, A.M.I.Mech.E.

London, W., *April 30th*, 1915.

Mathematical Notation.

With reference to my proposal which you published in last week's issue, I had sent to Prof. A. E. Kennelly, of Harvard University, a fore copy of the same, and in an appreciative answer, he thinks the suggestion a very good one, and "hopes it will be earnestly advanced with a view of winning its ultimate adoption." This though, he says, he believes he was the first to introduce, about 1893, the self explanatory form of notation $r/\underline{\theta}$; but I deem it would not take long for any interested in the subject to accept the dagger with its simple *memoria technica* for positive and negative angles.

F. Jacob.

London, S.E., *May 3rd*, 1915.

Batteries for Submarines.—Hitherto, we learn from American sources, only lead batteries have been used on board submarines. It is reported, however, that an Edison nickel-iron battery is to be installed in a U.S. submarine which is now under construction.

British Industries Fair.—Buyers who have not received invitation cards for this Fair, which opens on May 10th, at the Agricultural Hall, Islington, should communicate at once with the Board of Trade at 32, Cheapside, E.C.

WAR ITEMS.

Municipal Employés and the Manufacture of Munitions.—A census of municipal electricity and tramways employés who can be spared for the making of war munitions has just been taken in Bolton, Wigan, Bury, Salford and other areas of central and south-east Lancashire. It is understood that a considerable number of such employés are available. The Northampton Tramways Committee has reported to the Town Council that if a 10 minutes' service is adopted, 43 men could be released in order that they may be engaged in the manufacture of war munitions. The most suitable men are to be selected by the Committee. The Lighting Committee of the Leyton District Council has approved a scheme whereby the mechanics at the works will be enabled, in their own time, to assist in the manufacture of spare parts for transport motors for war purposes, the material being supplied by the Associated Equipment Co., who will pay the men for work done.

After the War.—The Fulham Electricity Committee recommends that the Council undertakes that, when engaging new hands after the war, preference shall, as far as possible, be given to those who have served their country under arms or in making munitions of war.

War Bonus.—In view of the greatly increased prices of household necessities caused by the war, Messrs. J. & W. B. Smith have decided, quite voluntarily, to pay from April 24th a special war bonus to all their employés for the duration of the war.

Siemens's Employés with the Forces.—We have received a copy of a booklet of 46 pp., issued in April, giving the names of employés of the Siemens Companies who are now serving in H.M. Forces. These are set out alphabetically, with particulars of the department in which employed (offices, branches or works), and the unit and rank now held. Copies of the booklet are being distributed among all the men—who now number well over 1,000. Still more have enlisted since the booklet was printed.

Blackpool Electrical Employés.—Of the men who were recently engaged in the Blackpool Corporation electricity department, 31 are on military service and six are engaged in the making of munitions. The tramways department has a staff of 190 men. There are only seven single men in the office and engineering departments, and four have dependents. On the traffic side there are eleven single men of military age, but eight have been pronounced medically unfit for service, and two of the remaining three have dependents. There are 49 tramway employés serving in the Forces.

Board of Trade Assistance.—The Board of Trade Commercial Intelligence Branch has issued list No. 18 of inquiries received during the week ending April 24th for names of suppliers of goods.

Government Cable Contracts.—Replying in the Parliamentary papers to Mr. Booth, Mr. Beck, as representing the First Commissioner of Works, said that his department had recently given a contract to the Union Cable Co., Ltd. The principal holding was in German hands, and while the managing director, Mr. Blackwood, was an Englishman, the other four directors were German. The works were at Essex and a number of English people were employed, and not a penny of profit of any kind went to the German people. The action of the Office of Works in the matter was in accordance with the policy laid down for them, in common with other departments, by the Government in the Trading with the Enemy Act.

The Position in Brussels.—M. E. Janssens, writing from 24, Budge Row, E.C., gives the following report of the situation of the electrical trade in Brussels, which has been handed to him by a neutral subject who has just returned from that town:—"All things are very quiet. The tramway companies are running a few cars on each of their services; this, with the consent of the German authorities, who have taxed their receipts heavily. A number of factories are considering—now that no orders are in hand—the manufacture of a lot of articles quite out of their lines, thus increasing their output to a maximum. 'Energie and Lumiére' employ actually 15 per cent. of their personnel to make new types of electrical apparatus, and although engaged solely in that line before the war, have now started, as a side line, the manufacture of sanitary appliances! The Belgian manufacturers are busy in studying new devices, in improving the existing types on the market, and in increasing the output of their works, while their representatives are in England searching for sound connections."

Newcastle Electrical Manufacturers and War Munitions.—At a special meeting of the electrical section of the Newcastle-on-Tyne Chamber of Commerce, held on Friday last, to take into consideration the question of expediting the production of munitions of war, it was unanimously resolved that the members of the section should offer their individual help in their spare time to the Munitions of War Committee in any capacity. It was further agreed that all firms represented in the electrical section should state to the Munitions of War Committee what special work they were able and willing to do for the Admiralty or War Office. The opinion of the Committee is also to be sought as to whether the section should approach similar bodies and ask for promises of individual help, should it be required.

Kieff Electrical War Tax.—The Governor of Kieff has notified the Electrical Company of the town that the local Duma has decided to levy a war tax of 5 per cent. on the sums paid for electric light, and asks the company to recover from the users. On the request from the company for instructions how to act in the event of the subscribers refusing to pay the tax, the Governor has admitted its inability to sue, and it has to refer cases of recalcitrancy to the town authorities.

Russia: Catalogues Wanted.—Catalogues and price lists are wanted by Bracia Borkowscy, electrotechnical depôt, Warsaw, Al. Jerozolimska 56.

Russia.—Several agents in Warsaw are anxious to secure representation there for British manufacturers of electrical goods and fittings and high-voltage goods. Application should be made to the Board of Trade Commercial Intelligence Branch in London.

German Exports to U.S.A.—The President of the Board of Trade states (says the "Times") that the imports into the United States from Germany were valued at £12,222,000 in the seven months ended February, a decrease of 48 per cent. Imports from the United Kingdom, however, were valued at £29,824,000, as compared with £34,413,000 in the earlier period, a decrease of only 13 per cent. Imports from Germany, though higher in January, 1915, than in preceding months, owing mainly to large imports of dye stuff and fine chemicals, were lower than in the corresponding month of 1914, and showed a heavy decline in February.

Engineers' War Wages.—The Amalgamated Engineers in Ashton-under-Lyne, Stalybridge, Dukinfield and Hyde have had their wages advanced 3s. per week on time rates and 7½ per cent. on piece rates, to be recognised as war wages, and as due to and dependent upon the existence of the abnormal conditions now prevailing in consequence of the war.—"Financial Times."

The Future of British Engineering Trade.—In the course of an editorial on "War Engineering Organisation and Future Trade," the "Engineer" writes:—That an idea of utilising the present war organisation for peace requirements is taking root in the minds of manufacturers may be gathered from the suggestion put forward by Mr. Arthur Balfour at a recent meeting of the British Foundrymen's Association at Sheffield. Mr. Balfour, who is a well-known Sheffield manufacturer, is clearly one of those who recognise that an opportunity has arisen for shaping the destinies of the British engineering industry, and for striking out on new lines. If his advice be followed, then the war, however heavy the price to be paid, will not have been wholly valueless. The opinion is put forward that Sheffield firms, and the criticism applies with equal force to other centres of production, are at present handicapped in their organisation by having too many articles to make in a single works, and it is recommended that the existing close co-operation between different works should be continued after the war, and that groups of manufacturers should work together, the production of different commodities being allocated by arrangement among the various establishments. Such a proposal is not, of course, entirely novel, but it ought to make a special appeal at this juncture, when the future of British engineering is to a certain extent in the melting-pot, and the industry will shortly be face to face with new conditions. There can be no question that when Germany realises that her attempt to dominate the world by force of arms has resulted in failure, she will seek by a fresh and more aggressive campaign than in the past to retrieve her fallen fortunes in the commercial arena. She will, however, start under material disadvantages, for by her conduct of the war she has antagonised the whole world and squandered the goodwill in overseas markets created by years of patient effort. It will be a long time before her manufacturers can hope to live down the obloquy her soldiers have brought upon themselves in the field. The interregnum in German commerce thus created should be the opportunity of a home industry, which, without any slavish imitation of German methods, should by then possess many of the advantages of scientific organisation, and be prepared for the adaptation of the new machinery of commerce to the needs of consumers."

No War Bonuses for Single Men.—A special joint committee of the Stoke-on-Trent Federated Council recommended that a war bonus of 2s. a week be paid to all employés of the Corporation receiving 30s. a week or less, and 1s. to employés receiving between 30s. and 40s., the recommendation not applying to employés under 21 years of age. When the matter was before the Stoke-on-Trent Council last week, an amendment was put that the bonus should not be given to unmarried men eligible for military service, but this was lost, it being stated that many single men were compelled to remain at their work with the Corporation and others had mothers to support. Another amendment was moved that all single men be excluded from bonus benefits, but eventually it was resolved that the bonus should not be given to single men except in cases where they were the sole support of one or both parents.

Labour at War Factories.—The following new regulation has been added under the Defence of the Realm Act in relation to labour employed at works where war munitions are manufactured:—"8b. The occupier of a factory or workshop the business carried on in which consists wholly or mainly in engineering, shipbuilding, or the production of arms, ammunition or explosives, or of substances required for the production thereof, shall not, nor shall any person on behalf of the occupier of such factory or workshop, either directly or indirectly, by canvassing, advertisement or otherwise, take any steps with a view to inducing—(a) any person employed in any other factory or workshop, being a person engaged on work for any Government Department or otherwise serving war purposes, to leave his employment; or (b) any person resident in the United Kingdom at a distance of more than ten miles from the occupier's factory or workshop, to accept employment therein, otherwise than by notifying vacancies to a Board of Trade Labour Exchange; and in the event of any person contravening the provisions of this regulation he shall be guilty of an offence against these regulations."

Switchboard Service in Wartime.—We are informed that many men have already been enrolled as full-time or part-time switchboard attendants to release younger men for service in the Army. Electrical engineers willing to assist for half-night shifts on alternate nights are wanted in the following districts:—Hammersmith, Wandsworth, Tooting, Streatham, Clapham, Stockwell, Battersea, Camberwell, Holborn, Camden Town, Islington, Mildmay Park, Clapton, Hackney, Limehouse, Barking, Poplar, Woolwich, Lewisham, and Forest Hill. Further particulars can be obtained at the offices of "Electrical Engineering."

Roll of Honour.—Private Whiteside, of the 5th King's Own Royal Lancaster Regiment, who has been killed at the front, was formerly employed at the Lancaster Electricity Works.

Private Alfred Jones, aged 34 years, of Crewe, who has died at the Cambridge Military Hospital from meningitis, served for a time at the Salford Electrical Engineering Works, under Mr. Donal Fraser. More recently he had been an assistant examiner in the Patent Office.

We regret to learn that Second Lieutenant John Chamberlain, of the South Wales Borderers, is reported wounded. Lieut. Chamberlain is well known to many of our readers by reason of his connection with Messrs. Chamberlain and Hookham, Tubes, Ltd., and various other businesses. We are glad to be able to state that up to the time of writing he is making favourable progress.

Engineering readers will, we are sure, join us in expressing sympathy with Professor Archibald Barr, of Glasgow, whose second son, Lieut. J. Y. Barr (B.A., Oxford) was killed in action on April 25th at the age of 23 years.

Private J. Burns, formerly employed by the St. Helens Cable Co., has been at the Base Camp, Havre, for some considerable time, suffering from a frost-bitten and septic foot.

Personal.—Last Tuesday's "London Gazette" contained the following appointment:—Territorial Force—No. 4 Electric Lights Company, Devonshire (Fortress) Engineers: George Owen Tipping to be Second Lieutenant. May 5th.

BUSINESS NOTES.

Book Notices.—*Model Power Boats.* By E. W. Hobbs. London: Percival Marshall & Co. Price 5s. net.—So far as we are aware, this volume is unique in scope, and certainly its excellence entitles it to become the standard treatise on a subject which is as important from the scientific and technical standpoint as from its social and sporting interest. The building of model boats of every description and the determination of their excellence of design by speed trials constitutes a useful method of naval architecture and research.

This the author clearly recognises, and emphasises it by devoting great attention to the naval architecture of small craft, and the treatment he gives to the subject is such that those who wish to build and run their vessels on thoroughly scientific lines will find all the necessary information herein. Those who do not feel disposed to take their sport so seriously will yet find the "theoretical" sections of the book helpful in explaining facts which could only be learned otherwise by costly experience, while the exclusively practical chapters will be of interest to every reader engaged in model boat work or contemplating its performance—whether professionally or as a hobby. After a brief historical survey of model power boating and a review of the sporting and social aspects of the pastime, the author illustrates and describes over 30 different classes of models and explains the merits of each. Chapter III, explaining how and why a boat floats upright and how this result may be secured, should save many painful experiences of certain phases of application of Archimedes' principle. The next chapter deals with resistance and propulsion in sufficient detail to enable the reader to design his boat on rational lines, the precise steps to be taken being set out in the next chapter. Alternative methods of hull construction are then discussed; the reader is left free to adopt whatever type and size of vessel he desires, and is given all the information necessary to enable him to carry his ideas to a successful issue. The next five chapters deal with the power equipment of the vessel. The general construction, method of working, merits and selection of steam engines, boilers, burners, petrol engines and electric motors are described and liberally illustrated. It is interesting to note that small steam engines are rated by watts, and this convenient power unit is adopted in many other parts of the book. The treatment of electric motors for propelling purposes is very elementary, but possibly sufficient; the possibilities of nickel accumulators should surely be mentioned. Deck fittings and the fitting-out of models, on which appearance and success so much depend, form the subjects of two chapters, and the work is terminated by an excellent chapter on power boat racing and a glossary of technical terms.

Improved Four-Figure Logarithm Table. By G. C. McLaren London: Cambridge University Press. Price 1s. 6d. net.—The arrangement of the tables in this work is excellent; with the aid of a thumb-index, and well-chosen spacing of the lines, the log of any number can be found in a few seconds. The printing and paper are equally satisfactory. Difference columns, which form an essential feature of some so-called "four-figure" tables, and which are an unmitigated nuisance in use, are here dispensed with, three figures being in the first column and the fourth at the top of the page. The author has introduced an improvement to surmount the difficulty due to approximation in the fourth figure; the log of 5024, for instance, to six places is 701050; in a four-figure table, shall it be entered as 7010 or 7011? The author writes 7010. in this case, and for the log of 5023 (700963) he writes 7009 :, the single dot representing "about one-third" and the double dot "about two-thirds," and being taken into account accordingly in the use of the tables. He claims that this reduces the possible error in the fourth figure from 5 to 1, as compared with ordinary four-figure tables.

This may be true; time does not permit of our working out the large number of examples necessary to verify the statement, but it is clear that a closer approximation can be obtained in this way. Another innovation seems to us somewhat risky. In order to facilitate the use of logs by those whose mathematical knowledge is of the scantiest, Mr. McLaren dispenses almost entirely with the use of the index, and works only with the mantissa, the position of the decimal point being found by inspection. Up to a point this is quite feasible, but it limits the range of operations to multiplication and division—the user would be at sea in finding the root of a fraction, and even in multiplying or dividing decimal fractions it is easy to fall into error.

Reid's Handy Colliery Guide. Newcastle-on-Tyne: Andrew Reid & Co., Ltd. Price 2s. 6d.—This is a new edition of a guide and directory to the coal industries of the North of England (Northumberland, Durham and Yorkshire). It contains a map showing the collieries, railways and stations in these three counties, also a copy of the Coal Mines Act, 1911, with various statutory rules and orders issued since that Act came into force. The collieries are particularised, in tabular form, as to company, colliery, situation and station, agent, manager, and engineer, and in other sections alphabetical lists appear of agents, managers, and fitters. The special rules relating to the use of electricity in mines are given in full. Some pages of miscellaneous information, formulæ, &c., by T. R. Blackett, occupy the closing pages.

"*Journal* of the Institution of Electrical Engineers." Vol. LIII, No. 247. May 1st, 1915. Price 3s. 6d.—This issue contains papers on "The Power Supply of the Central Mining-Rand Mines Group," by J. H. Rider, and "Methods of Testing the Scherbius Compensator," by A. A. Ahmed.

"*Bulletin* de la Société Internationale des Electriciens." Vol. V, No. 41. April, 1915. Paris: Gauthier-Villars. Price 3 fr.

"*Journal of the Tramways and Light Railways Association.*" London: Caxton House.—The April number contains a full report of the House of Lords' Judgment in the case of The L.C.C. *v.* Islington Assessment Committee.

"The Year-Book of Wireless Telegraphy and Telephony." 1915. London: The Wireless Press, Ltd. Price 3s. 6d. net.

Messrs. William Hodge & Co. announce the early publication of a Supplement to "The Law of Contract during War," by Prof. W. F. Trotter, bringing the law up-to-date.

A Minister of Commerce.—At the annual meeting of the Association of Trade Protection Societies of the United Kingdom, which is to take place in London on Tuesday and Wednesday next, several resolutions will be submitted, agitating either for a Minister of Commerce, or for a special Government department charged with trade, industry and commerce only. It is proposed to forward to the Prime Minister and the President of the Board of Trade the expressed hope of the Association that even while the war is proceeding such a department may be organised. The Association asks that a Minister of Commerce shall be appointed to maintain relations with British Consuls abroad, with a view to increasing the export of British manufactures, and that British Consuls in all important countries should be British subjects, with instructions to make frequent reports on trading requirements to the said Minister.

American Foreign Trade.—Reuter's agent in Washington states (according to the *Financial Times*) that commercial experts in New York and Washington are at present deeply engrossed in the question of the possibility of domestic manufacturers forming combinations of selling agencies abroad for the promotion of foreign trade. It is believed that such a selling agency plan, a detailed arrangement of which has recently been drawn up and recommended by the Advisory Committee of the United States Chamber of Commerce, is indispensable to the growth of American commerce on an international basis.

Private Arrangements.—Allen & Grosse, Ltd., electrical engineers, Queen Street, Belfast.—A meeting of the creditors was held on April 27th, in Belfast, when a statement of affairs was submitted, showing liabilities £1,763, and assets estimated to produce £712. After allowing £25 for the claims of preferential creditors, the net assets amounted to £687, an apparent deficiency being disclosed of £1,077. It was reported that the company was formed about three and a half years ago, but had only traded with success during the first 12 months, and for the past two and a half years it had been working at a serious loss. A lengthy discussion ensued, and no resolution was passed, but it was suggested and arranged that three of the creditors present should look into the assets and report to an adjourned meeting. The following are creditors:—

Albion Electric Stores	£14	Newtons, Ltd.	£29
Brotherton Tubes & Conduits, Ltd.	33	Pritchetts & Gold, Ltd.	135
W. T. Glover & Co., Ltd.	94	Veritys, Ltd.	38
N. C. C. Electrical Co.	30	Fielding & Platt, Ltd.	149

Fardon & Carpenter, Ltd., electrical engineers, 4, Maidenhead Court, London, E.C.—The following are among the creditors herein:—

Lydall & Son	£15	Pfeil & Co.	£19
Allan Bros.	17	Rollett, H., & Co.	23
Elika Brgmlampa. Nuremberg	18	Sterling Telephone Co.	12
Grevener, J. and H.	22	Schwafe, F., & Co.	30
General Accessories Co., Ltd.	13	Directors' fees	153
Grothe Sohn, A.	22	Solicitors' costs	29
Oldham & Willy	34	Rent	16
Holloway Foundry	17	Electric light	19
Odhams, J. and G.	23	Salaries	13

Electrical Wholesalers' Federation.—An interesting registration notice appears in our "New Companies Registered" section to-day. The Electrical Wholesalers' Federation, Ltd., has been formed for a number of purposes there set forth, with offices at Amberley House, Norfolk Street, Strand, W.C. The number of members is declared not to exceed 100, but the Committee may register an increase. The subscribers who constitute the provisional Committee are:—Messrs. M. Beales, F. Pooley, R. W. Smith, F. S. Smith, and A. G. Beaver, all of London; P. L. Davies, of Liverpool; and G. O. Donovan, of Birmingham.

Bankruptcy Proceedings.—G. Burgess (Granville Burgess & Co.), electrical engineer, 27, Museum Chambers, Bury Street, W.C.—A first and final dividend of 11½d. in the £ is payable on May 7th, at Bankruptcy Buildings, W.C.

Patent Restoration.—An order has been made for the restoration of Patent No. 26,034 of 1909, for "Improvements in means for imparting stability to unstable bodies," granted to Louis Brennan.

Cheltenham Electricity Department.—The address of this department is now:—Municipal Offices, Promenade, Cheltenham. The telephone number of the offices will be 1001, and for the works, as before, 106.

Catalogues and Lists.—The Langdon-Davies Motor Co., Ltd., of 110, Cannon Street, London, E.C., has issued a handy pocket memoranda book, containing insurance coupon, and a number of useful tables. Standard sizes and types of the firm's motors are particularised also in tabular form.

"K. & W." Soap Fountain Co., 8, Bream's Buildings, London, E.C.—Particulars of their liquid soap fountains, which are used in many workshops with economical results—the soap cannot be left in the water or stolen.

Cameron Sales Organisation, 9-10, Southampton Street, London, W.C.—Eight-page illustrated and descriptive price list of "White Cross" electric vibrators.

Messrs. Benjamin Electric, Ltd., 1a, Rosebery Avenue, London, E.C.—Illustrated leaflet describing a new Benjamin half-watt reflector for lamps up to 500 watts. The company announces an advance of 10 per cent. in the prices appearing in this circular, also in those appearing in their L5 catalogue (excepting Section 4).

Messrs. E. S. Hindley & Sons, Bourton, Dorset.—Illustrated leaflet describing their vertical oil engines for electric lighting, and their two-crank compound enclosed steam engine.

Messrs. Fielding & Platt, Ltd., Gloucester.—Eight-page illustrated pamphlet describing the Fielding semi-Diesel crude oil engine. The firm makes engines ranging from 11 b.h.p. to 300 b.h.p.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—Eight-page pamphlet, setting out prices of a large variety of electrical accessories, fittings, bells, batteries, cables, starters, &c.

L.C.C. Contract Prices.—This week's agenda of the L.C.C. contains the following:—"Regulation No. 662 provides that, in cases in which the publication of the estimated value of a contract for stores, &c., may lead to the disclosure of the individual price or prices quoted, the particulars, instead of being included in the report of the Stores and Contracts Committee, shall be laid on the table for the information of members. The considerations which led the Council to make this regulation appear to apply equally to the stores, &c., purchased through the Highways Committee, and we recommend:—'That Regulation No. 662 be amended by the insertion before the word 'Stores' of the words 'Highways Committee or the'; and that the regulation, as so amended, be approved."

Liquidations. — Harrow Road and Paddington Tramways Co., Ltd. – A meeting will be held on May 31st at 2 and 3, Norfolk Street, W.C., to hear an account of the winding up from the liquidator, Mr. A. R. Abbott.

Rapid Light Controlling Syndicate, Ltd. – A meeting will be held on May 31st at 7, Victoria Street, S.W., to hear an account of the winding up from the liquidator, Mr. R. H. Pritchard.

Electric Railway Signalling Syndicate, Ltd.—This company is winding up voluntarily, with Mr. C. F. Palmer, of 1, Broad Street Avenue, E.C., as liquidator.

Trade Announcements.—Mr. G. Braulik, 8, Lambeth Hill, London, E.C., has been appointed sole selling agent for the United Kingdom and British export of a quick water heater for washstands patented by H. Löfquist, of Stockholm. We have received an illustrated leaflet describing the apparatus.

Messrs. Field & Co., electricians, have opened premises in Station Street, Burton-on-Trent.

Premises at 38, Southport Street, Barnstaple, have been taken by Mr. F. Bickford, electrical engineer.

Mr. Hanson Perry, electrical engineer, of Douglas, Isle of Man, has removed his offices to Cronkbourne Road. His stores remain at 28, North Quay.

Prices Advance. — Messrs. G. St. John Day (Patents), Ltd., of Oldham, announce that owing to material and labour costs having advanced, their prices are increased by 10 per cent. from May 2nd.

LIGHTING and POWER NOTES.

Aberdeen.—According to a statement by the city electrical engineer, 34 men of the department have enlisted, and to prepare for next winter, and to keep the works running it has been necessary to train the clerical staff as switchboard attendants. The number of power consumers since the opening of the war has increased by 17, and over half a million more units were generated during the first seven months of the war as compared with the returns of the corresponding period in the previous year.

Acton.—Price Increase.—The Chamber of Commerce has lodged with the U.D.C. a protest against a proposed 10 per cent. increase in the charges for current by the Metropolitan Electric Supply Co., it being pointed out that the legal maximum charges were already being paid. The Council has decided to point out to the company that an increase of 10 per cent. would press somewhat hardly on consumers, and suggest that any increase should not exceed 5 per cent.

Australia.—The Electricity Committee of the Sydney Municipal Council recommends that, as the replacement parts for the steam turbine, which broke down in June, 1914, are being fixed in place, the order on the British Westinghouse Co. for a complete turbine be cancelled, and the company compensated for the loss.

The ratepayers of Warragul, Vic., are to consider the advisability of installing electric light and the extension of the Gas Co.'s contract has been deferred pending the result; in the meantime the engineer has been instructed to secure the site for a power house.—*Tenders.*

The Poowong and Jeetho (Vic.) Shire Council has appointed Mr. V. J. Crowley, of Melbourne, to report upon the electric lighting scheme of Korumburra and to supervise the complete overhaul of the plant.—*A. M. Standard.*

Barking. — Proposed Loan. — The U.D.C. having applied for a loan of £18,000 for electricity purposes, the L.G.B. has intimated that unless the expenditure is necessary for military purposes, it would be unable to sanction a loan at the present time. The Council has requested the L.G.B. to hold a local inquiry with regard to the loan.

Basingstoke. — Loan Sanction. — The L.G.B. has sanctioned a loan of £4,100 to enable the T.C. to extend the mains to the works of Messrs. Thornycroft. The cables are also to be extended to the works of Messrs. Mussellwhite, at Eastrop.

Blackburn.—Year's Working.—The surplus profit on the year's working of the electricity department, amounts to £2,348, compared with £5,037 last year. Sales of energy realised £43,334, or £1,103 less than last year. Generation of electricity cost £13,798, or £376 less than last year; distribution £2,938, being £270 more; lamps, fittings and motors £2,831, £406 more; rates and taxes £2,481, £56 more; and management expenses £2,437, or £62 more.

The Corporation has given formal notice that application has been made to the B. of T. for consent to erect a generating station at Rishton.

Black Rock (Co. Dublin).—E.L. Scheme.—The U.D.C. has received the Local Government Board's sanction to its electric lighting scheme, and will proceed with it on securing Treasury sanction for borrowing the necessary funds.

Bootle.—Bulk Supply.—The T.C. has applied to the B. of T. for consent to supply current in bulk to the Liverpool District Lighting Co., Ltd., and the B. of T. has intimated its intention to make the necessary order.

Bridlington.—Refuse Destructor.—The T.C. has decided to renew its application to the L.G.B. for an inquiry to be held relative to the provision of a refuse destructor for the town.

Chelmsford.—Suggested E.L. Purchase, &c.—The T.C. has accepted a rebate of £200 on the public lighting contract from the Electric Supply Corporation in respect of restricted lighting, and has referred the question of any further reduction to a Sub-Committee. The Lighting Committee is to consider the question of exercising the option of purchasing the undertaking of the Electric Supply Corporation, for which formal notice has to be served before January 20th next.

Colne.—For the year ended March 31st, there was an increase of 95,679 units in the quantity of electricity sold as compared with the previous year.

Connah's Quay.—Prov. Order.—The U.D.C. has been informed that the B. of T. will not extend the area of supply under the prov. order for E.L. beyond the Council's district, and that the order was being made upon that condition.

Continental.—Russia.—Messrs. Siemens & Halske hold the contract for electrically lighting the town of Voronezh. The town is going to use its option of buying the company out on November 23rd this year, and will build its own electric station for lighting and traction, and raise a loan of 1,025,000 roubles for this and other purposes. It intends to reconstruct the old electrical station.

Coventry.—Year's Working.—The annual report of the electricity department shows that the revenue for the past year amounted to £77,913, as compared with £71,207 in the previous year. The net profit on the year's working was £22,829, as against £21,749 in the previous year. The Committee recommends that £6,000 be transferred for the relief of rates. The total number of units sold increased from 16,508,338 to 20,249,018, an increase of 3,740,680.—*Birmingham Daily Post.*

Derby.—Proposed Loans.—The E.L. Committee of the T.C. recommends application to the L.G.B. for sanction to loans of £3,488 for mains, and £569 for motors, already expended; and for £1,000 additional for mains and motors for supplies for war purposes only.

Dublin.—Basing its calculations on the probable prices, the Corporation Improvements Committee has reported that £2,700 will be required during the ensuing year for coal, and £5,000 for electricity—a total of £7,700 against the Corporation provision of £6,000.

Eccles.—The Watch Committee has asked the Town Clerk and the borough electrical engineer to report on the suggestion by H.M. Inspector of Factories respecting the desirability of electric wiring and fittings, installed in factories by private electricians, being inspected and approved by the borough electrical engineer or other responsible official.

Edinburgh.—Year's Estimates.—The estimated expenditure by the Corporation lighting department for the ensuing year is £39,745, a decrease of £3,595 as compared with the net expenditure last year. The decrease is due mainly to the expected saving in respect of the restricted lighting of the city streets—the sums estimated with respect to electric and gas lamps being in each case £1,440 less than last year.

It was reported to the Electric Lighting Committee of the Corporation that the draft provisional estimates for the coming year showed a deficit of over £5,000. This was more than accounted for by the increased coal bill, which had gone up by £10,000. The Committee at its next meeting will consider whether the estimated deficit is to be made up by increasing the charges or otherwise.

According to a Glasgow paper, the Electric Lighting Committee has received inquiries as to the cost of energy for charging electric vehicles, and has decided to recommend that the charge be 1d. per unit, as the accumulators would be charged during the night.

Erith.—Bulk Supply, &c.—The West Kent Electric Co. has applied to the U.D.C. for terms for a bulk supply of current for lighting 200 cottages to be erected in Colyer's Lane. The Council has referred the matter to the chairman, clerk, and engineer to take such steps as they may deem necessary. The engineer having reported that the question of extending the generating plant was becoming a matter of some urgency, has been instructed to submit a report, including a comparative statement showing the consumption by power consumers during the past four or five years, and his observations in connection with the probability of bulk supplies in the district.

Haslingden.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £4,600 for mains and special trench work, and £2,770 for services, switchgear and transformers.

Heywood.—Increased Prices.—An advance of 10 per cent. in charges for electricity came into operation last week, the increase being necessary in consequence of the high price of fuel.

Ilford.—Electric Coal Wagon.—The electrical engineer in a report favours the purchase of an electric vehicle for the cartage of coal, but before making a recommendation on the subject, the Lighting Committee has arranged for an inspection. The Committee has adjourned consideration of certain new tariffs. The department's showroom in High Road has been closed, and since adapted for use as a sub-office for inquiries.

Keighley.—At a meeting of the T.C. last week, reference was made to the economies being adopted with regard to expenditure on municipal undertakings. In regard to the electricity department it was stated that threequarters of the consumers on the mains were engaged on Government work, and owing to this fact and the constantly increasing demands upon the supply, the month of March showed an increase in revenue of £500, as compared with the corresponding period of 1914.

Kingston-on-Thames.—Increased Prices.—The town clerk reports that in view of the recent decision of the Council not to accept a recommendation of the Lighting Committee that no alteration should be made in the rate of charge for current supplied for heating, cooking and fixed motors, the rate for such purposes would now be 1⅜d. per unit. The L.G.B. has requested to be furnished with particulars of the excess expenditure amounting to £5,792 on loans already sanctioned for purposes of electric lighting.

Kingstown.—The electrical engineer, Mr. J. P. Tierney, has been directed by the Council to submit alternative schemes for a generating station in connection with the electricity supply scheme.

London.—Bermondsey.—The Electricity Committee, on the report of the engineer, recommends that the stokers of the three Howden boilers at the electricity works be replaced by chain-grate stokers, and that the offer of Messrs. Bennis & Co. for the supply of such grates be accepted. The engineer considers that with the increased boiler power the question of obtaining a bulk supply can be postponed for another year.

L.C.C.—The Finance Committee recommends that the Council sanction the borrowing by the Battersea B.C. of £9,000 for the electricity undertaking, viz., £6,050 for mains, £1,176 for house services, and £1,774 for meters; also £15,000 for electricity mains by the Stepney B.C.

Sanction is also recommended to the borrowing by the Woolwich B.C. of £35,000, being £9,000 for buildings and £26,000 for electrical plant, providing the B.C. agrees that the balance remaining at April 1st, 1920, in respect of loans originally granted for 42 years for the old plant, should be repaid in half the period unexpired at that date.

The London Education Committee proposes to install electric power at the Aristotle Road (Clapham) metal work centre for driving the machinery.

The Holborn B.C. Works Committee has decided in connection with the reduced street lighting that no further steps can be taken to modify the street lighting charges by the Metropolitan E.S. Co., which has expressed its disinclination, for certain reasons, to interfere with the terms of the contract, which is a 10 years' one.

Malvern.—Increased Prices.—In view of the increased cost of production, the U.D.C. has advanced the price of current by 1d. per unit.

Manchester.—Increased Prices.—Ordinary consumers of electricity, as distinct from large consumers whose payments for current are regulated by a sliding scale, are to be charged an increase of 10 per cent. for light, and users of power an increase of 15 per cent. Consumers who are under the Norwich system and are charged 12½ per cent. on the assessable value of their houses, with the price of the unit in addition, will pay 15 per cent. in future. It will be remembered that a hint was dropped recently that increased charges would be necessary owing to the increased cost of coal and labour.

Merthyr Tydfil.—The Electric Traction and Lighting Co., Ltd., has applied to the B. of T. for consent to the use of overhead lines in the district for the transmission of energy at a pressure of 11,000 volts.

Mirfield.—Increased Prices.—Owing to the increased cost, the U.D.C. has advanced the price of energy for power and street lighting by 10 per cent.

Nelson.—Year's Working.—The electricity department has made a net profit during the past year of £1,138, as against an estimated profit of £1,420. In view of the circumstances, the result is regarded as most gratifying, and constitutes a record for the department, excepting only the returns for 1913-14.

Northampton.—Proposed Power Station.—The Northampton Electric Light and Power Co., Ltd., has made an application to the B. of T. for consent to the construction of a generating station at Far Cotton, one of the growing suburbs of the town. The site is on the river and near two railways. The disadvantage of the present station is that it is in such a position that a railway siding cannot be constructed.

Nuneaton.—Rate Relief.—The T.C. has decided to contribute £500 out of the past year's profits on the electricity undertaking towards relief of rates.

Rugby.—The U.D.C. has sanctioned the laying of E.L. cable in new streets off the Lodge Estate, at an estimated cost of £300.

Salford.—Proposed Loans.—The Electricity Committee has directed application to be made to the L.G.B. for a further sanction to borrow £5,466 to cover capital expenditure incurred in connection with the undertaking since March 12th last, in respect of loans sanctioned by the Board prior to that date.

Southampton.—The price for charging electric vehicle batteries has been fixed at 1½d. per unit. It has become necessary to increase the mains in the northern district at a cost of approximately £500, and the purchase of the necessary cable has been left in the hands of the engineer and chairman of the Electricity Committee.

Stoke-on-Trent.—Increased Prices.—An advance of 10 per cent. in the charges for current has been made by the T.C.

Waterford.—L.G.B. Inquiry.—An inquiry into an application by the Corporation for a loan of £30,000 for the purpose of carrying out the electric lighting project, was held at the City Hall last week.—*Freeman's Journal.*

Wharfedale.—At the last meeting of the Guiseley District Council, in view of the withdrawal of the Yorkshire Electric Power Bill, it was suggested that the time was now opportune to make some arrangements for the supply of electricity from a municipality at present owning electricity works, or a privately-owned power company, or for the combined District Councils to manufacture current themselves. It was agreed that the Guiseley Council should convene a conference of adjacent District Councils to ascertain the position occupied by them with respect to any lighting order that might be in existence.

TRAMWAY and RAILWAY NOTES.

Blackburn.—Year's Working.—In the tramways department the surplus profit for the year just closed is £1,572, against £4,011 in the previous year. Traffic revenue amounted to £65,158, a decrease of £3,034. Excluding Accrington borough, the mileage was 1,121,769, or 27,693 miles fewer than in the previous year, and the mileage run in Accrington was 65,014. The passengers carried numbered 12,223,569, against 12,731,532 in the previous year.

Bournemouth.—Year's Working.—The annual report of the Corporation tramways shows a net profit for the year of £9,350. The total traffic receipts for the year ended March 31st were £102 346, being a decrease of £2,623 on the previous year. Up to the declaration of war in August, the receipts were above the average, and a profit of £20,000 was fully anticipated. The year's net profit would have been much larger but for the fact that from August to March 31st £2,352 was paid as contributions towards the members of the staff who joined the forces.—*Daily Telegraph.*

Bury.—Carriage of Goods.—At the recent meeting of the Associated Chambers of Commerce a resolution was brought forward by the Bury Chamber expressing the view that considerable commercial advantage would accrue through the ultisation of municipal tramways for the carriage of goods, and recommending individual chambers to further their use. It is now announced that the Bury tramways manager has favourably considered the proposal, and is prepared to give information to persons wishing to use the tramways in the way suggested.

Chester.—Tramway Traffics.—For the year ended March 25th there was an increase in the receipts from the tramways of £141, the increase in the number of passengers being 58,045.

The Tramways Committee has decided that no more men of serviceable age shall be engaged as conductors unless it be proved that they have been rejected or incapacitated for service in H.M. Forces.

For the time being, at any rate, the Tramways Committee has decided not to appoint women as tram conductors.

Colne.—Year's Working.—The total revenue of the tramways for the year just ended amounted to £13,188, or 10·6d. per car-mile. The receipts amounted to £13,082, a decrease of £1,606, compared with the previous year; the passengers carried numbered 2,363,113, and the cars ran 296,021 miles. The greater portion of the decrease in receipts is attributed to the war.

Dundee.—At a meeting of the Corporation Tramway Committee it was stated that the revenue would be £1,500 less than last year, and that, due to the war bonus and payments to the dependents and enlisted men, the expenditure would be increased by that amount.

Eccles.—The T.C. has entered into an arrangement with the Salford Corporation, under which the latter, for the sum of £800, will repair the whole of the tramway overhead electrical equipment in the borough, and for a payment of £35 per mile of single trolley wire per annum, in addition to cost of new material provided, less value of scrap received, maintain the overhead equipment for a period of 10 years from April 1st, 1915.

Haslingden.—Year's Working.—The traffic receipts of the tramways during the year ended March 31st amounted to £7,965, compared with £8,489 for the previous year, a decrease of £524. The mileage run was reduced by 5,625 miles.

The chairman and vice-chairman of the Tramways Committee are to consider and report upon the purchase of a new motor tower wagon or a vehicle suitable for conversion.

Leeds.—War Bonuses.—The General Purposes Committee, on Monday, considered an application from members of the Tramwaymen's Union in the service of the Corporation for an increase of war bonuses now being paid under the Corporation scheme. The Committee declined to accede to the request, and took the view that the present scale of allowances is adequate.

London (L.C.C.).—According to the *Evening News*, dissatisfaction is reported amongst the men working on the L.C.C. tramways, and a mass meeting is being called for May 15th. The wages agreement under which the men are working expires on June 26th. Very few of the drivers and conductors benefit from the war bonus given to L.C.C. employés earning less than 30s. a week.

Nelson.—Year's Working.—During the past year the net profit yielded by the light railways was £314, as against an estimated profit of £828. In his annual report, Mr. Naylor (manager) states that, in view of the outlook, the proposed venture with regard to railless traction has been left in abeyance.

Salford.—Female Labour.—The Tramways Committee has decided to employ 16 women as car conductors as an experiment. They will work six hours a day, and will be paid the standard rate of wages. Women washers are to be employed for day work at the depôt, so as to liberate men for night work.

The local branch of the Tramway Workers' Union has adopted a resolution to the effect that the members will not entertain the question of female labour in Salford, and that they will refuse to work with women. The matter was to be considered on Tuesday at a meeting of the Tramways Committee.

TELEGRAPH and TELEPHONE NOTES.

Austro-Spanish Wireless.—Since March 22nd a radio-telegraphic service has been established between the Austrian wireless station at Trieste and the Spanish station at Barcelona. The tariff is 29 centimes per word.

Russia.—The Minister of the Interior has prepared an instruction on the order for levying a single tax on telephones in Russia, except on such apparatus as have been installed for free use, and also excepting Finland. The tax amounts to 10 roubles for each apparatus. For supplementary apparatus, no matter how many, the same rate must be paid. In case of transfer of apparatus the most recent user becomes responsible for the tax.

Spain.—The Spanish National Submarine Telegraph Co., owing to the expiration of its concessions for submarine cables, is in liquidation.—*Journal Télégraphique.*

Wireless Telegraphy. It is reported from New York that plans are being prepared by experts of the U.S. Navy Department for the establishment of a wireless telegraph station at Cape Cod, which will be equipped with an apparatus specially designed to give assistance to ships groping their way up and down the Atlantic during dense fogs. The apparatus, although of foreign origin, has been perfected by an American naval officer in such a way that it will, it is claimed, be possible to locate a calling ship by the measurement of the radio waves and the assistance of a compass.

The Australian Government is making arrangements to equip the trans-Continental railway works with four wireless plants, so as to enable the working parties to keep in touch with each other, and thus avoid delays. The sets have been designed by the Commonwealth engineer for radiotelegraphy (Mr. Balsillie). Each will have a range of about 150 miles, but will rarely be required to work over more than 20 to 30 miles.—*T. and T. Age.*

Wireless Telephony.—Some time ago the Japanese Department of Communications established a system of wireless telephonic communication between Toba, in the Province of Shima, and the Island of Ishijima. The service having proved extremely useful to shipping, it is reported that the Department has decided to establish wireless telephone stations at five other ports, the range of communication in each case being between 40 and 50 miles.

CONTRACTS OPEN and CLOSED.

OPEN.

Argentina.—For the first section of the National College at Salta (cost £34,300) an electrical installation and telephones will be required, and public tenders are to be invited by the Direccion General for carrying out the works.

Australia.—Melbourne.—May 18th. Four 250-k.v.a. three-phase transformers; 9,680 yards ·05 sq. in., three-core, lead-covered cable, for the City Council. See "Official Notices" April 30th.

May 19th. Victorian Railways. Meters, coasting recorders or other energy-checking devices for train operation on the multiple-unit system, d.c., 1,500 volts. See "Official Notices" April 30th.

June 15th. City Council. Four mechanically-fired boilers, one turbine-driven boiler-feed pump, two fuel economisers, circulating water pumps. City Electrical Engineer. Specifications from Messrs. McIlwraith, McEacharn & Co., Ltd., London, E.C.

Sydney.—June 16th. Deputy P.M.G. 400 Morse sounders, American pony pattern. (Schedule No. 449.)*

July 19th. Municipal Council. One or two 12,000-kw. turbo-alternators (Contract No. 363).* A copy of the specification can be obtained from the City Electrical Engineer, Sydney.

July 19th. Steel towers for 33,000-volt transmission line. Specification (10s. 6d.) at E.L. Department, Town Hall.

Toowoomba.—June 7th. 480-volt d.c. electrically-driven centrifugal well-sinking pump, 30,000 gallons per hour, against a head of 200 ft. max. Deposit 2½ per cent. City Engineer.

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

China.—Shanghai.—May 20th. 2,600 yards of three-core e.h.t. armoured cable, and 79 three-phase induction motors, for the Municipal Council. See "Official Notices" to-day.

Darlington.—May 20th. Corporation. Cast-iron condenser water pipes. See "Official Notices" to-day.

Dover.—May 18th. Six electric vehicles, for the T.C. See "Official Notices" to-day.

Finchley.—May 31st. U.D.C. Wiring, for light, 100 workmen's dwellings. See "Official Notices" to-day.

France.—The Administration des Chemins de fer de l'Etat, Paris, wants 46 a.c. motors of 10, 15 and 20 kw., for the new workshops of Sotteville; particulars from the Bureaux du Service Electrique (1re division), 43, Rue de Rome, on Tuesdays and Fridays, 3 to 5 p.m., up to May 14th. The Administration also wants motor-compressors for railway automobiles; particulars from the Bureaux du Service Electrique (3e division), 72, Rue de Rome, between the same hours, up to May 17th.—*La Lumière Electrique.*

Leeds.—May 26th. Corporation. Steam, feed and water pipes. See "Official Notices" to-day.

Leigh (Lancs.).—May 21st. One vertical tube boiler, one 250-kw. rotary converter or motor converter, one switch panel, for the Borough Electricity Committee. See "Official Notices" April 30th.

London.—May 12th. L.C.C. Installation, about 210 wiring and 250 lighting points, at Sebbon Street Elementary School, Islington, N. See "Official Notices" April 30th.

The Highways Committee recommends that tenders be invited from selected firms for the supply of foundry plant for the central car-repair depôt.

Manchester.—June 2nd. Corporation. Coal-unloading crane, conveying plants, &c. See "Official Notices" to-day.

Norwich.—May 11th. 5,000 tons of coal, peas or slack, for the Electricity Department. Forms of tender from Mr. F. C. M. Long, City Electrical Engineer.

Sheffield.—May 28th. Two natural draught cooling towers complete. For the Electric Supply Department. See "Official Notices" to-day.

South Africa.—Johannesburg.—June 1st. Municipal Council. 24 double-pole, automatic, oil-immersed circuit breakers of a continuous carrying capacity of 200 amperes (Contract No. 971). Specifications, &c., from the Controller of Stores, Municipal Offices, Plein Square, Johannesburg. Tenders to Town Clerk.—*Board of Trade Journal.*

Spain.—May 18th. Plant and material for a hydro-electric station in connection with the Principe Alfonso drainage works, Province of Palencia. Tenders, description and deposit (£41) to Negociado de Aguas del Ministerio de Fomento, Madrid. Local representation.

June (end). Director-General de Correos y Telégrafos, Calle de Carretas 10, Madrid. Laying a submarine cable from Cadiz to Laraiche, and repair of certain cables. Further particulars at Board of Trade Commercial Intelligence Branch in London.

Tasmania.—Launceston.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Winchester.—May 11th. Corporation. Twelve months' supply of steam coal, for the Electricity Department. See "Official Notices" April 30th.

CLOSED.

Brighton.—The T.C. has accepted the tender of Richardsons, Westgarth & Co., Ltd., for a surface condenser for the Southwick power station, at £1,925.

Condensing Plant Contracts.—The Mirrlees Watson Co. has recently received orders for condensing plant as follows:—

Torquay Corporation.—Third set.
South Leicestershire Colliery Co.—Two sets.
Millom & Askam Hematite Co., Ltd., per Messrs. Fraser & Chalmers.—Fifth set.
Compagnie Française Thomson Houston, Paris, for Tulliere power station.—Fourth set; also for Athens power station.—Third set.
Tharsis Sulphur and Copper Co., Ltd.—Three sets.
Also plant for Bourges (France), Senegal, Russia, Japan, Straits Settlements and West Indies.

Derby.—The T.C. has accepted a tender from Messrs. Edgar Allen & Co., Ltd., for tramway rails.

Grimsby.—The T.C. Lighting Committee has directed that half the quantity of meters required for a period of two years be purchased from the British Thomson-Houston Co., and the remainder from Messrs. Chamberlain & Hookham, and Messrs. Ferranti, Ltd., in equal quantities.

Halifax.—The Tramways Committee has accepted the tender of the General Electric Co., Ltd., at £2,563, for three rotary converters, transformers, and switchgear required in connection with conversion of the Hipperholme and Hebden Bridge sub-stations plant to three-phase 50-cycle alternating current supply.

Hendon.—The tender of the Hendon Electric Supply Co., at £198, has been accepted by the Education Committee for wiring the Wessex Garden School. Four tenders were received. A similar number of tenders were also received for wiring the Bell Lane School; consideration of these has been deferred.

Liverpool.—The City Council is recommended to accept the tender of Messrs. Ferranti, Ltd., for a 12 months' supply of electric meters.

London.—Hammersmith.—The Electricity Committee reports that Messrs. Johnson & Phillips, Ltd., the contractors for the supply of box frames, covers, boxes, &c., during the current financial year have written stating that since the acceptance of their tender they have received a number of Government orders, and that in consequence of a considerable number of men being specially allocated for Government work, the deliveries of the Council's order would be impeded. Under the circumstances the firm ask to be allowed to withdraw the tender. The Committee recommends the Council to agree with the request, and has directed the engineer to communicate with Messrs. W. Lucy & Co., Ltd., the next lowest tenderers, to ascertain if they are prepared to enter into a contract with the Council.

Shoreditch.—The Lighting Committee has accepted the tender of the Stirling Boiler Co. to supply and fix one pair of chain grate stokers for £415, including 250 spare links of the double lap type.

The following tenders have been received by the London Education Committee for installing electric lighting in the Derinton Road School, Wandsworth:—

Alpha Manufacturing Co.	(accepted)	£358
Johnson, O'Sullivan & Co.		394
Napier, Kimber, Ltd.		414
Lund Bros. & Co.		428
C. H. Cathcart & Co.		585
M. Mackie & Co.		587
Holland & Sons		804

Bermondsey.—The Electricity Committee has recommended the acceptance of the tenders of Messrs. Hy. Clark & Sons, Ltd., W. B. Dick & Co., Ltd., and the Silvertown Lubricants, Ltd., for engine oils during the ensuing 12 months.

L.C.C.—The Asylums and Mental Deficiency Committee has accepted the tender of Messrs. Tyler & Freeman, at £271, for installation of telephones, fire alarms and call-bells at the Maudsley Hospital.

Manchester.—The Electricity Committee has accepted the following tenders:—

Three three-wire balancers.—Lancashire Dynamo & Motor Co., Ltd.
Cable.—B.I. & Helsby Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Johnson & Philips, Ltd.; Western Electric Co., Ltd.; Union Cable Co., Ltd.; W. T. Glover & Co.
Three 1,250-K.V.A. static transformers.—British Westinghouse Co.
One 250-K.V.A. transformer.—British Electric Transformer Co., Ltd.
Three 1,000-K.V.A. three-phase static transformers.—Ferranti, Ltd.
One 650-KW. rotary converter.—British Westinghouse Co.
High-pressure steam valves.—Dewrance & Co. and J. Hopkinson & Co., Ltd.

The Corporation Sanitary Committee has accepted the tender of Messrs. Waygood Otis, Ltd., for repairs to the lift at the Civic Buildings.

The following tenders have been accepted by the Tramways Committee:

Furnace coal.—Kelsall Bros., and J. Smith & Co.
Block tin.—John Mackie & Sons (agents for Cornish Tin Smelting Co., Ltd.).
Fishplates.—Bolckow, Vaughan & Co., Ltd.

The resolution of the Tramways Committee accepting the tender of Messrs. John Brown & Co., Ltd., for a portion of the Committee's requirements of steel car tires has been rescinded, and an amended tender of Messrs. Cammell, Laird & Co., Ltd., for the whole of the Committee's requirements of such tires has been accepted.

Meter Contracts.—Messrs. Chamberlain & Hookham, Ltd., have received the following contracts for meters for 12 months:—

Maidenhead.—D.C. meters.
South Shields.—A.C. meters.
Bradford.—A.C. and D.C. meters.

Messrs. Ferranti, Ltd., have received the following contracts. In all cases they are for the year ending March, 1916, excepting Alloa and Bradford, and these run to May, 1916:—

Belfast Corporation.—C.C. house service meters, 250/500-ampere sizes only.
Halifax Corporation.—C.C. house service meters.
Heston and Isleworth U.D.C.—C.C. house service meters.
Swindon Corporation.—C.C. house service meters.
Wimbledon Corporation.—A.C. house service meters.
Grays U.D.C.—C.C. house service meters.
Grimsby Corporation.—Portion C.C. house service meters.
Birkenhead Corporation.—C.C. house service meters.
Alloa T.C.—C.C. house service meters, 10-100 amperes inclusive.
Liverpool Corporation.—C.C. house service meters.
Borough of Kilmarnock.—C.C. house service meters.
Bradford Corporation.—C.C. and A.C. house service meters.

Nuneaton.—The T.C. has sealed a contract with Callender's Cable and Construction Co., Ltd., for the supply of cable.

Preston.—The Electrical Apparatus Co., Ltd., has obtained a renewal of the present contract from the National Electric Supply Co. for the sole supply of motor starters for a further period of 12 months.

Southampton.—The following tenders have been received for the supply of steel tramcar tires:—

J. Baker & Co.	£17
J. Brown & Co., Ltd.	20
Cammell, Laird & Co.	25

The acceptance of a tender has been left with the manager and chairman of the Tramways Committee.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, May 7th. At 8 p.m. At 39, Victoria Street, S.W. Informal discussion.

Association of Mining Electrical Engineers (Notts. and Derbyshire Branch).—Joint Meeting with National Association of Colliery Managers. Saturday, May 8th. At 3.30 p.m. At University College, Nottingham. Paper on "Protective Devices," by Messrs. E. Kilburn Scott and L. F. Fogarty.

Institute of Metals.—Wednesday, May 12th. At 8.30 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "The Passage of Electricity through Metals," by Sir J. J. Thomson, F.R.S.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, May 12th. At 7.30 p.m. At the University, Edmund Street. Annual General Meeting.

(Yorkshire Local Section).—Wednesday, May 12th. At 7 p.m. At Philosophical Hall, Leeds. Annual General Meeting. Paper on "The Power Supply of the Central Mining—Rand Mines Group," by Mr. J. H. Rider.

Royal Society of Arts.—Wednesday, May 12th. At 8 p.m. At John Street, Adelphi, W.C. Paper on "Recent Progress in Pyrometry," by Mr. C. R. Darling.

Institution of Mechanical Engineers.—Friday, May 14th. At 8 p.m. At Institution of Civil Engineers, Great George Street, Westminster. Paper on "The Distribution of Heat in the Cylinder of a Gas Engine," by Prof. A. H. Gibson and Mr. W. J. Walker.

Royal Institution of Great Britain.—Saturday, May 15th. At 3 p.m. At Albemarle Street, W. Lecture on "Advances in the Study of Radio-Active Bodies," by Prof. F. Soddy.

Generous Gift to Leigh Infirmary.—In memory of his father, the late Alderman Thos. Greenough, Mr. Thos. R. Greenough, on behalf of his mother and himself, on Thursday last week handed over to the Leigh Infirmary a complete electrical and radiographical department in three divisions, at a cost of about £5,000.

Fatalities.—Stirling.—William McClumpha, electrical engineer, who resided at Millhall Cottages, near Stirling, was killed instantaneously in No. 1 Pit, Polmaise Colliery. He was repairing a coal-cutting machine, when it was accidentally set in motion.

Manchester.—At Manchester on Monday an inquest was held on William Dyson, aged 57. It appeared from the evidence that on April 16th the deceased, who was employed by the Calico Printers' Association, was instructed to repair an electric bell in connection with the hoist at the Oxford Street premises of the firm. He had to get to the top of the lift, and while he was carrying out the work his arm caught one of the control wheels, and the lift was set in motion. It ascended to the top and jammed Dyson's leg, the injury subsequently proving fatal. "Accidental death" was the verdict.

THE BOMBAY HYDRO-ELECTRIC SCHEME.*

By A. DICKINSON, M.I.E E.

It is proposed in this paper to give particulars of a large hydro-electric scheme known as the Tata Hydro-Electric Power Supply Co., Ltd., Bombay. The main object of this company is to supply electrical energy for use in Bombay, principally for power in cotton mills.

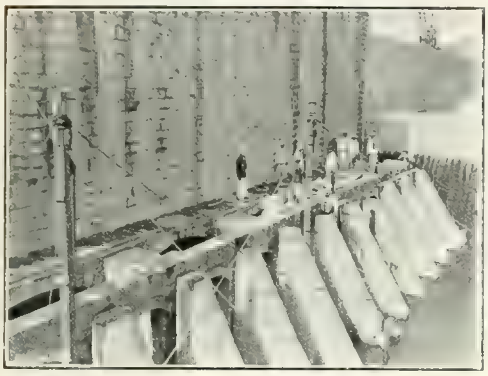


Fig. 1.—Dam and Sluices.

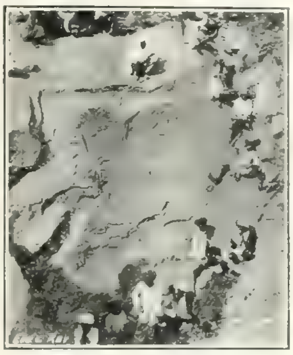


Fig. 2.—Natives Preparing Foundations of Dam.

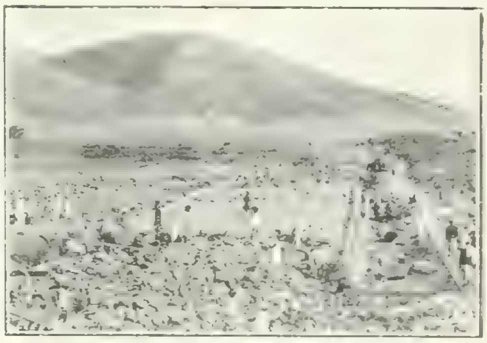


Fig. 3.—Dam under construction.

The hydraulic section of the scheme is exceptional, inasmuch as special lakes have been created, and the whole of the water for supplying the power is collected from the rain falling during the monsoon. Three reservoirs are being formed by constructing dams across valleys known as Lonawla, Walwhan, and Shirawta. From the reservoirs the water is conveyed in an open duct to the forebay, and thence through pipe lines to the power house, a distance of 13,000 ft., in which length there is a fall of 1,725 ft. The power house is situated at Khopoli, 43 miles from the receiving station on the Island of Bombay. (See map on p. 661.)

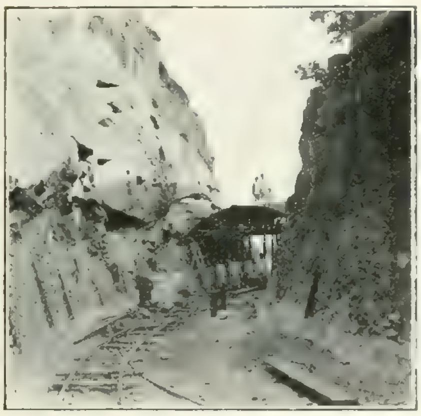


Fig. 4.—Duct in Deep Cutting.

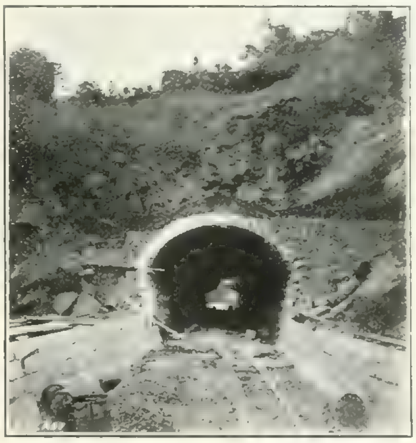


Fig. 5.—Duct in Tunnel.

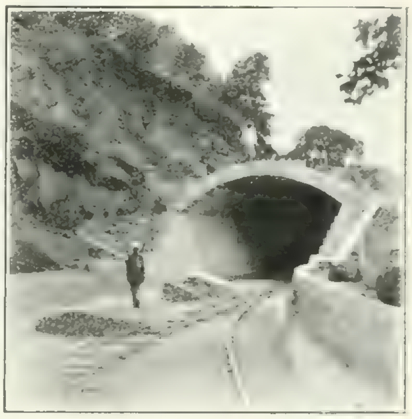


Fig. 6.—Duct on Hillside.

The present scheme is to install in the power house eight sets, each 11,000 B.H.P., and in the receiving station the plant necessary to deal with the power-house output. Five sets only are now installed in the power house, and the remaining three sets will be put down as water becomes available.

Generation is at 5,000 volts, 3-phase, 50 periods, the energy being transformed up to a line pressure of 100,000 volts.

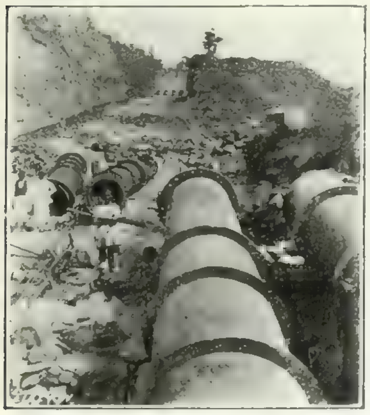


Fig. 7.—Pipe-line under Construction.

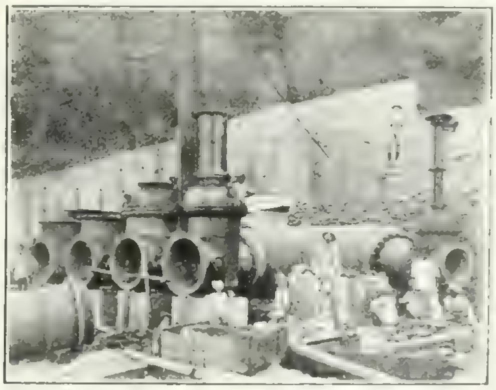


Fig. 8.—Valves on Pipeline.

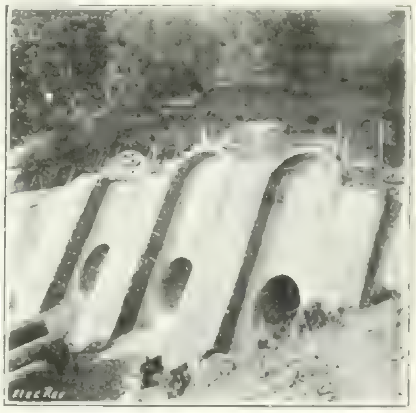


Fig. 9.—Forebay under Construction.

Lonawla is a storage lake intended principally for use during the monsoon period and, when this lake is empty, water is drawn from the lakes of Walwhan and Shirawta.

The lakes are formed by constructing across the three valleys dams with coursed rubble masonry faces and with heart of uncoursed rubble masonry.

Name of lake.	Height of dams in feet.	Length of dams in feet.	Surface acreage of lakes.	Water stored, millions of cubic feet.
Lonawla ...	19	5,500	986	361
Walwhan...	54	4,500	1,535	2,560
Shirawta ...	74	8,000	3,174	6,963

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* Abstract of paper read before the Institution of Electrical Engineers, April, 1915. A preliminary description appeared in the Electrical Review of January 16th, 1914, p. 93. For the accompanying views (reproduced from lantern slides) we are indebted to the courtesy of the Author.—Eds.

Two dams form Lonavla Lake, a main dam 3,600 ft. long across the valley and a smaller dam in which the sluices are built, 1,900 ft. long, the former being about 40 ft. high to the bottom of the foundation and 26 ft. above the lowest level of the valley, across the head waters of the Indrayani River.

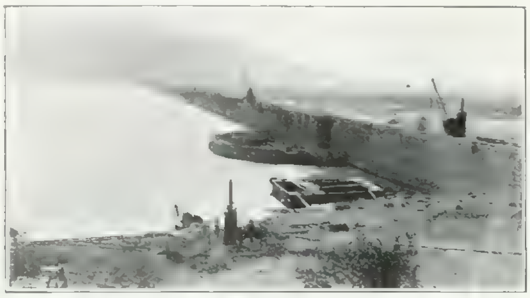


Fig. 10.—One of the Dams approaching Completion, Lake [illegible]

Walwhan dam is 4,500 ft. long and 75 ft. high to the bottom of the foundations, and 68 ft. above the lowest level of the valley.

Shirawta dam is 8,000 ft. long and 100 ft. high to the bottom of the foundations, and 92 ft. above the lowest level of the valley.

The total quantity of rubble masonry in the three dams is 926,000 cubic yards. The outlet of Shirawta Lake is connected to Walwhan Lake by a tunnel 5,000 ft. long through the hills, the formation being hard trap rock. At the inlet of this tunnel there is a head wall containing ample sluices to allow Shirawta Lake to be discharged into Walwhan Lake as desired to meet the required conditions of draw off.

Figs. 11 and 12.—Exterior of Power House, Khopoli.

The ducts have a water capacity of 120,000 h.p., the maximum velocity of the water being approximately 5 ft. per second.

The country through which the ducts pass is very difficult, necessitating the construction of 22 aqueducts. There are three tunnels cut through rock, one being 750 ft. in length, one 280 ft., and another 130 ft., making in all a length of 1,160 ft. In addition there are 10 cut and cover tunnels having a combined length of 2,630 ft.

The forebay has a storage capacity of 1½ hours with the whole of the eight sets working. Openings are proved in the dam for three 82-in. pipes.

The gates are operated by racks, either by hand or by an electric motor of 12 h.p. at 600 r.p.m. This gives to the gates a lifting speed of about 13½ inches per minute, so that fully to open the gates takes about 8 minutes.

Special provision has been made for speedily closing the gates from the power house in case of a burst pipe, or due to any other necessity. This is accomplished by a solenoid releasing the ratchet wheels so that the gates close by their own weight. On the gates is a device which automatically disconnects the electric motor before the gates reach the highest or the lowest positions. The gates are also fitted with automatic brakes so that when operating the gates from the power house they cannot be damaged by falling too quickly.

The inlets are protected by screens so constructed that one screen slides over the other, the object being to free the screens from grass or other debris collected thereon.

From the forebay the pipe line, which is one of the largest (as regards the horse-power transmitted) ever built for a water-power plant, conveys the water down the cliffs and steep slopes to the power house at Khopoli in the plains below. The scheme has been designed in two sections, two upper and eight lower pipe lines. The present installation (half the scheme) comprises one upper pipe line, a distributing pipe, and four lower pipe lines, the total length being about 13,000 ft., 8,200 ft. of upper and 4,800 ft. of lower pipe line.

The upper pipe line is built in three sections, decreasing from 82½ in. diameter and ⅜ in. thick to 72 in. diameter and 13/16 in. thick. The distributing pipe is 72 in. in internal diameter, 15/16 in. thick, and about 46 ft. long, with four 42-in. branches and one spare branch. The lower pipe line, starting from the distributing pipe, is of lap-welded steel tube 42 in. to 38 in. in internal diameter and ½ to 1¼-in. thick. Near the power house, three exciter-turbine pipe-line connections are provided. The pipe lines are designed for a factor of safety of 4.5, calculated on the minimum tensile strengths and static heads.

The whole pipe line is laid above ground, provision being made for variations of temperature from 50° F. to 127° F. by expansion joints.

The waste-weir level at the forebay is 2,032 ft. and the power house floor level 309 ft. above the mean sea-level, giving a static head of 1,725 ft. to the centre of the turbine gate, with a pipe pressure of 743 lb. per square inch. With four turbines, each running at 11,000 b.h.p., the total loss of head is 66 ft.

The scheme has been designed for a normal plant capacity of 88,000 h.p. in eight main 11,000-h.p. sets, two 850-h.p. exciter sets, and eight step-up 3-phase 10,000 k.v.a. transformer banks, with the necessary switchgear, station auxiliary apparatus, and four outgoing lines.

The present building will take five main and two exciter sets, five transformer banks, switchgear, and auxiliaries, and two outgoing lines. The building consists of a turbine and generator room spanned by a 67-ton electric travelling crane, 5,000-volt bus-bar and oil-switch rooms, transformer compartments with a tramway passage and turntable for handling the transformers by means of trucks, and a repair shop, all these being on the ground floor, together with a 100,000-volt bus-bar and oil-switch room and transmission-line outlet tower located on the floors above.

The main sets consist of Escher-Wyss hydraulic impulse turbines of the horizontal type running at 300 revs. per minute and direct-coupled to Siemens Brothers three-phase generators. The exciter sets consist of Escher-Wyss tangential wheels, running at 600 revs. per minute and direct-coupled to Siemens Brothers compound-wound generators.

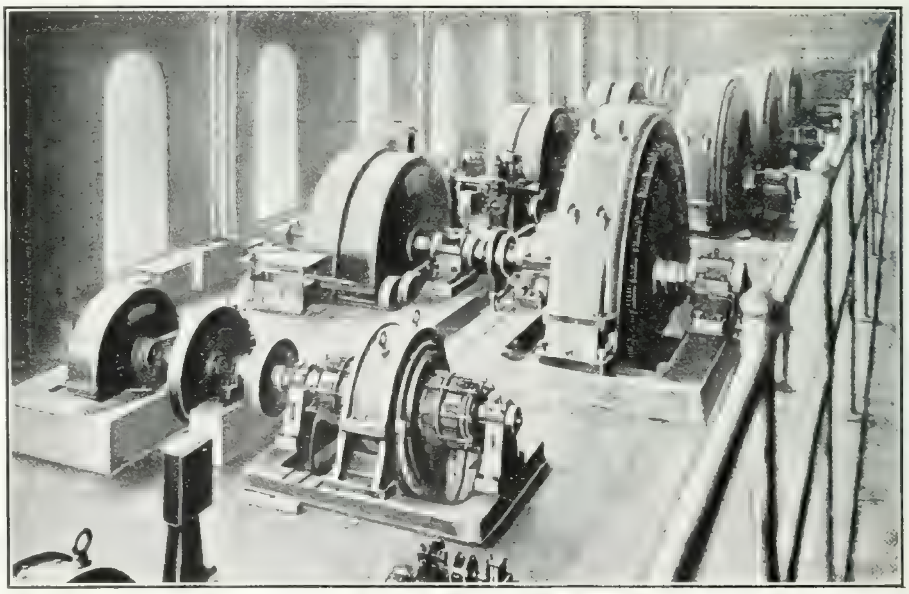


Fig. 13.—Generating Plant and Exciter in Power House.

The turbine wheels consist of cast-steel disks and buckets carried by Siemens-Martin steel shafts, with two ring-lubrieating bearings provided with water cooling. The nozzles are of the cast-steel deflecting type, and the governors are of the oil-pressure type fitted with hydraulic automatic servomotors, guaranteed to limit the speed variation to 2½, 5, and 12 per cent. when 25, 50, and 100 per cent. of the load is suddenly thrown off. A dash-pot connects the deflecting nozzle and the automatic speed governor, only the needle being connected rigidly to the governor.

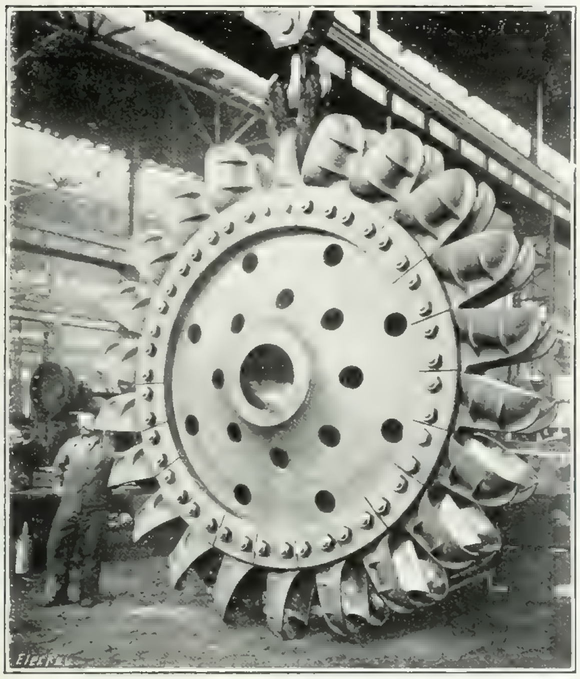


Fig. 14.—Pelton Wheel of 11,000 b.h.p.

In the event of a sudden closing movement, the servomotor diverts the jet from the runner-wheel, the levers being so arranged that during this operation there is no movement of the needle to close the nozzle, thus guarding against an increase of pressure in the pipe line. The nozzle then begins to return to its normal position, the needle at the same time decreasing and closing the jet outlet. This movement is followed automatically by the action of the dash-pot, the piston slowly sinking and the deflecting nozzle being returned to its normal position. With a slow closing movement of the regulator the nozzle is not deflected, owing to the slow movement of the dash-pot piston, the needle being slowly operated directly from the regulator.

The exciter turbines have separately-fitted cast-steel buckets, with similar governors guaranteed to limit the speed to 3, 6, and 16 per cent. when 25, 50 and 100 per cent. of the load is suddenly thrown off. The guaranteed full-load efficiency is 82 per cent. for the main, and 77 per cent. for the exciter turbines.

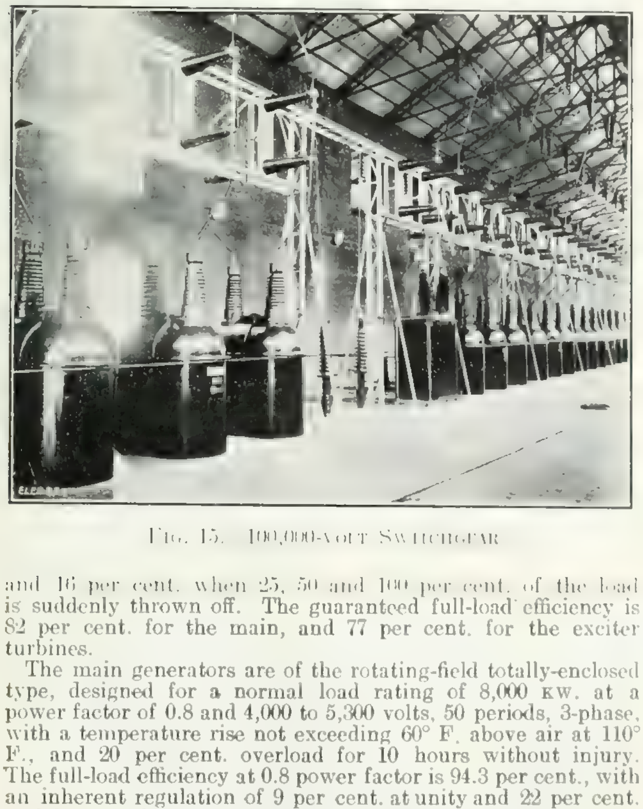


Fig. 15.—100,000-volt Switchgear.

The main generators are of the rotating-field totally-enclosed type, designed for a normal load rating of 8,000 kw. at a power factor of 0.8 and 4,000 to 5,300 volts, 50 periods, 3-phase, with a temperature rise not exceeding 60° F. above air at 110° F., and 20 per cent. overload for 10 hours without injury. The full-load efficiency at 0.8 power factor is 94.3 per cent., with an inherent regulation of 9 per cent. at unity and 22 per cent. at 0.8 power factor. Induced ventilation is provided by means of fans on the rotor shafts, each machine being connected to the main inlet air-duct by a shutter and to the outlet air-duct to the atmosphere. These shutters are motor-operated with automatic control, so arranged that when the field switches are closed the shutters are open, and *vice versa*. The bearings are supplied with oil under pressure and are provided with water cooling.

The exciters are compound-wound machines designed for a full-load rating of 600 kw. at 250 volts, and 20 per cent. overload, the full-load efficiency being 93 per cent. The energy required for excitation at full-load and unity power factor is 25 kw. and at 0.8 power factor is 38 kw.

Each 3-phase transformer bank consists of three single-phase General Electric (U.S.A.), oil-immersed, water-cooled, static transformers, delta-delta connected and designed for a full-load output of 3,333 k.v.a. at 0.8 power factor when stepping up from 5,000 to 100,000 volts, 50 periods, the temperature rise not exceeding 70° F. above cooling water at 75° F., with a water circulation of 950 gallons per hour. These sets are capable of 20 per cent. overload for 10 hours with a water circulation of 1,200 gallons per hour without injurious heating.

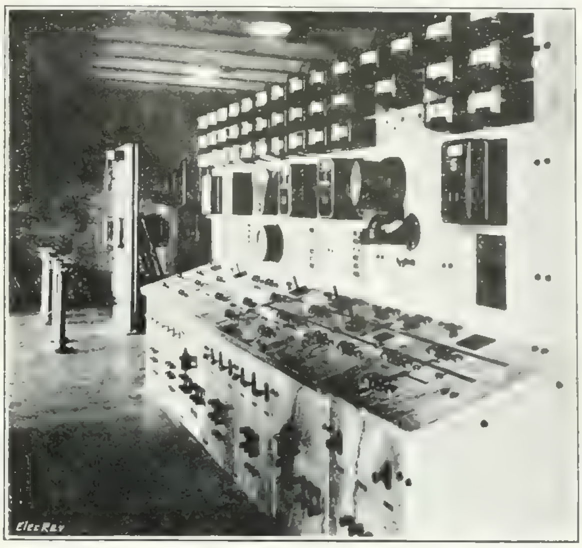


Fig. 16.—Bench Board controlling High-tension Switchgear.

The full-load efficiency at 0.8 power factor is 98.1 per cent., and the efficiency at half load is 97.2 per cent. The regulation is 0.8 per cent. at unity power factor, and 4.6 per cent. at 0.8 power factor.

The transformers are of the shell type, having flat primary and secondary coils placed vertically and surrounded by a laminated sheet-steel core, the design and arrangement being such that the heat is conveyed from the interior to the water-cooling coils and tank by natural circulation.

The tanks are of boiler-plate steel, cylindrical in form, and are supported on a cast-iron base. The high-tension bushings are of the compound-filled type, and consist of a conductor insulated from the top to the bottom, which is surrounded by several concentric press-board insulating cylinders, separated by spaces, outside which the exterior wall of the bushing is built up of a number of annular rings of moulded insulating compound, interspaced with impregnated press-board disks of larger diameter than the rings in order to prevent leakage.

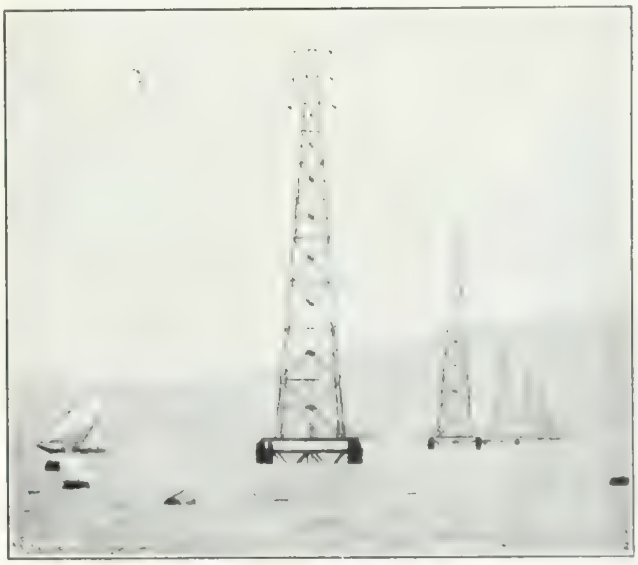


Fig. 17.—Transmission Line crossing Creek.

These disks and rings are cemented together and are tightly clamped by nuts at the top and bottom of the rod. The bushings are supported on cast-iron rings attached to the cover. The low-tension bushings are of porcelain.

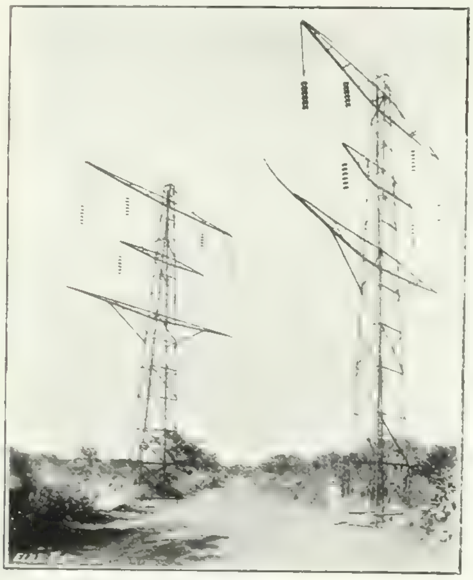


Fig. 18.—Road Crossing on 110,000-volt Line.

The principal dimensions of the transformers are as follows:—Height to the top of the high-tension lead 16 ft., and to the cover 13 ft.; diameter of the tank 8 ft. The weight when assembled and filled with oil is 24 tons, of which the core and coils account for 11 tons. The quantity of oil required for filling is 2,300 gallons, and weighs 8 tons. The oil used is a specially-prepared mineral oil, treated before filling, and from time to time in service, in a drying and purifying outfit in order to remove moisture and foreign matter. This outfit consists of a portable set comprising a filter-press, a motor-driven centrifugal pump, and a strainer, and is mounted on a truck. It is capable of treating 1,500 gallons of oil per hour, the filtering medium being blotting paper.

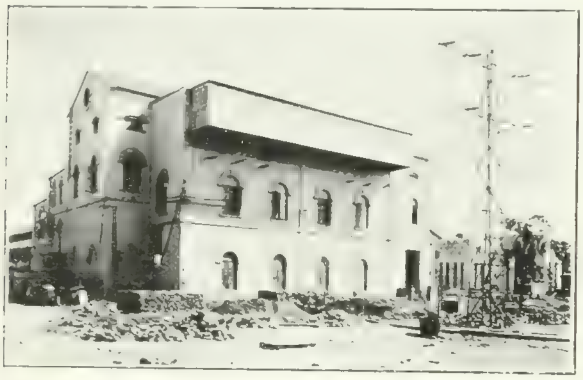


Fig. 19.—Receiving Station and Line Terminal at Parel.

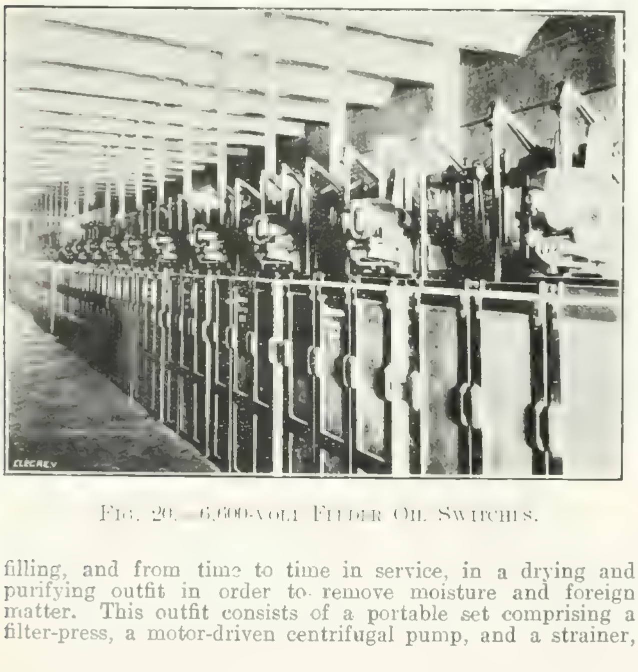


Fig. 20.—6,600-volt Feeder Oil Switches.

Provision is made in the oil-pipe system for connecting this set to any transformer the oil of which requires treatment. The oil is tested in a standard testing set, consisting of an oil receptacle with a 0.2 in. spark-gap and contacts, and a testing transformer, and the oil is filtered until the puncture voltage is raised to 40,000 volts.

The water supply for the cooling coils is obtained from the pipe line through a reducing valve, a tank being provided for the system, whence the water is fed by gravity at an inlet head of about 20 ft. through the necessary piping and valves connecting up the three coils placed in the upper part of each tank, where they are constantly in contact with the heated oil rising from the windings and core.

Each bank of transformers on overload rating takes 3,600 gallons of water per hour at a temperature of 75° F., and the total requirements of the plant now being installed will be 18,000 gallons of water per hour. Each inlet pipe is provided with a water-flow indicator and a discharge alarm.

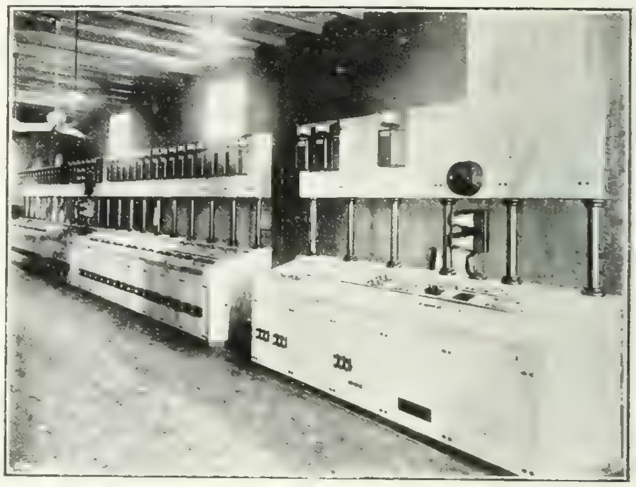


Fig. 21.—Bench Control Board at Receiving Station.

Provision is made for operating each main unit with its own transformer bank, or through the 5,000-volt transfer busbar with any bank as required, and on the high-tension side the transformer banks and outgoing lines are operated in parallel.

The equipment consists of remote-control, electrically-operated oil switches and other apparatus operated from the benchboard located on a gallery overlooking the generator room. The apparatus in the generator circuits consists of three single-pole, non-automatic, solenoid-operated oil switches in cell compartments, disconnecting switches, and current and potential transformers; and in the high-tension side of the transformer banks three single-pole, automatic, solenoid-operated oil switches in tanks, disconnecting switches, and series relays; and similar equipments in the outgoing lines with the addition of current transformers, choke coils, and lightning-arrester equipment.

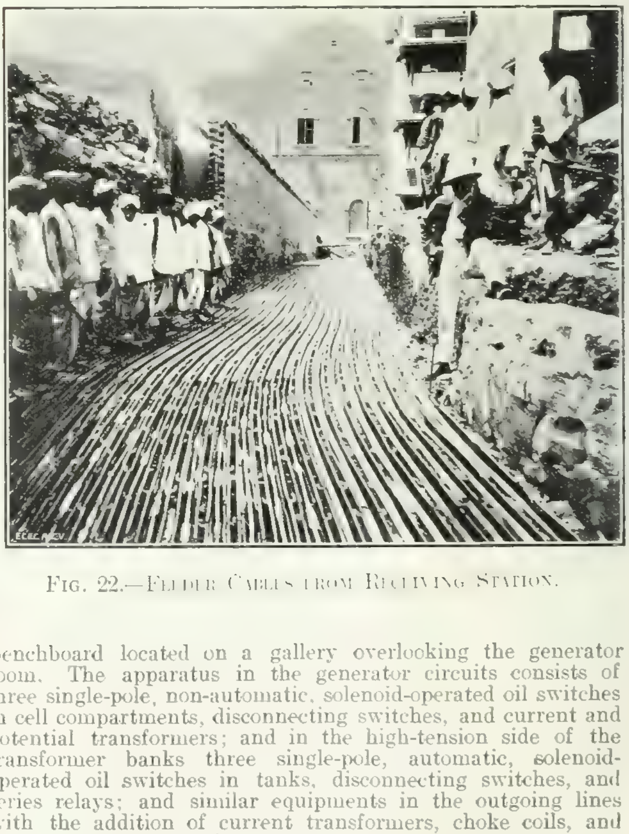


Fig. 22.—Feeder Cables from Receiving Station.

The high-tension oil switches are automatically tripped by inverse time-limit, overload, series relays which are mounted on post insulators, a long rod from the relay closing a switch on the wall in the opening-coil circuits of the solenoids in the control wiring. Each switch unit is designed to operate as one switch with a breaking capacity of 40,000 K.V.A.

The transfer bus-bar system consists of a copper bar carried on insulators and sectionalised by means of disconnecting switches, and the high-tension bus-bar system of copper tubing which is carried on post insulators, suspended from the roof, sectionalised with disconnecting switches and provided with three single-pole, automatic, solenoid-operated oil switches in tanks between the fourth and fifth banks. This switch is tripped by means of inverse time-limit, overload relays in connection with current transformers.

The low-tension wiring consists of varnished cambric-insulated, fireproof-treated cables, and the high-tension copper tubing on post insulators is arranged for a phase-spacing of 5 ft. and a striking distance to earth of 3 ft., the circuits being taken through the roof of the transformer compartments in compound-filled bushings.

The switchgear equipment in the duplicate station transformer circuits from the transfer bus-bar consists of triple-pole automatic, motor-operated oil switches, instantaneous, overload series relays, and disconnecting switches.

The benchboard, which is capable of extension as required, is built of blue Vermont marble panels, mounted on pipe supports, with grille work at the back fitted with the necessary instruments, control switches, and indicating lamps, a mimic bus-bar system of remote-control apparatus for operating the generators and transformer banks, exciters, outgoing lines, station transformers, a 200,000-volt testing transformer, and a water rheostat testing equipment. Calibrating and testing terminals are provided and also a swinging bracket carrying illuminated-dial voltmeters and a synchronism indicator. For signalling to the generator-room floor a complete signal system is installed, with a signal stand near each generator.

The control switches are of the "push and pull" button type, single-pole double-throw, a green pilot lamp indicating the open position of the oil-switches, and a red pilot lamp the closed position.

The system is operated at 220 volts from a 60-ampere 8-hour battery, or from the 18-KW. motor-generator charging set if required. From this supply are also operated the motors of the generator field-rheostats, air-duct shutters, and turbine governors.

The auxiliary switchboard controls the supply from the two 312 K.V.A. 5,000/440-volt 50-period 3-phase transformers for station power and lighting. It is built of blue Vermont marble panels, carried on pipe supports. There are two transformer panels, six double feeder panels, a lighting panel, and a battery and motor-generator panel.

The bus-bars are of copper bar and are carried on insulators at the back of the board. The oil switches are of the triple-pole, automatic hand-operated type, and are fixed behind the board, the transformer circuits having current transformers and inverse time-limit overload relays, and the power circuits trip coils for automatic protection.

Voltage regulators are installed for maintaining a constant voltage on the bus-bars.

The lighting supply is furnished from three 30-KW. 440/220-volt 50-period single-phase transformers.

Two Willans-Siemens Diesel sets installed in an adjacent building provide a stand-by supply through a "tie" feeder provided on the board. Each set consists of a 100-H.P. 200-R.P.M. engine direct-coupled to an 80-K.V.A. 440-volt 50-period 3-phase alternator.

The voltage on the high-tension bus-bars is automatically maintained between certain limits by means of a Tirrill or Brown-Boveri regulator operating from a 100,000/100-volt potential transformer.

Each outgoing line is protected with choke coils and an aluminium-cell lightning-arrester equipment complete with horn gaps, disconnecting switches, a discharge alarm, and discharge recorders. The generators are star-wound for operation with an unearthed neutral, and for protection against pressure-rises are provided with "over-tension" apparatus, consisting of isolating switches, static dischargers, and star-delta horn-gap arresters.

The route of the transmission line is shown in fig. 23. It has a length of 43 miles from the power house at Khopoli to the receiving station on the Island of Bombay, and crosses two tidal creeks, one 10,000 ft. wide and 42 ft. deep at high tide, a railway, and several roadways. There will be four transmission circuits for normal parallel working, the circuits being carried on two lines of towers. Two change-over stations are provided, each with air-break disconnecting switches, and divide the line into three sections for cutting out or interconnecting different sections as required.

(*To be continued.*)

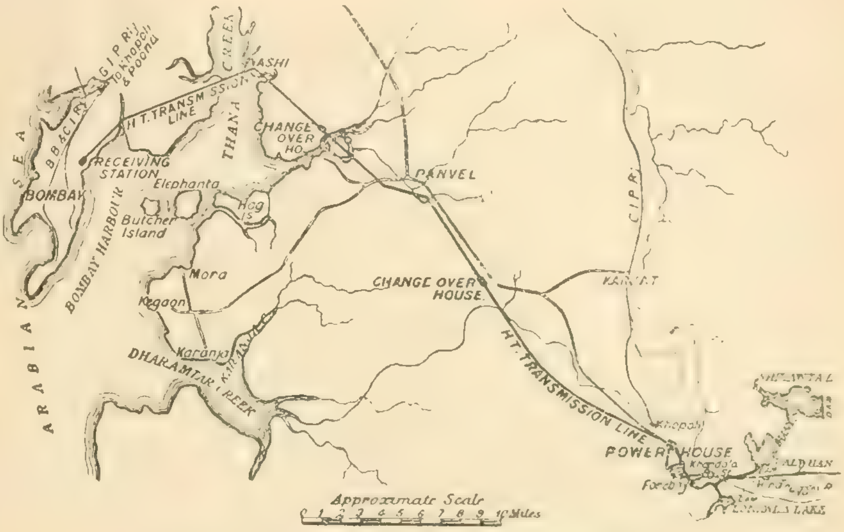


FIG. 23.—STORAGE LAKES AND TRANSMISSION LINE.

NOTES.

Smelting Tin Dross Electrically.—In the manufacture of tin plate large quantities of tin dross are formed consisting, say, of 50 per cent. tin, 8-12 per cent. zinc, and 10-18 per cent. iron. Hitherto it has been usual to charge batches of this dross, which varies considerably in composition, into reverberatory furnaces, together with soda ash and carbon sufficient to flux and reduce the dross, but yielding metal which is relatively impure, and needs more or less refining, according to the approximation of the actual furnace charge to that chemically desirable. If the dross be analysed before treatment, subsequent refining is simplified, but such scientific procedure seems still to be exceptional amongst smelters, and, in any case, the ordinary reverberatory furnace process suffers from the defect that highly siliceous slags cannot be used, and practically all the copper and iron oxides in the dross are reduced to copper and iron, which must be separated from the crude tin by subsequent refining.

By using an electric furnace it is possible to eliminate this serious disadvantage of the reverberatory process. A slag containing 66·6 per cent. silica, 16·6 per cent. lime, and 16·6 per cent. soda can be used. This forms silicates from the iron and copper oxides present in the tin dross, but, if worked above 3,000°, the slag reduces tin oxide without forming tin silicate. At lower working temperatures as much as 15-17 per cent. tin collects in the slag, but at higher temperatures the loss is negligible, say, 0·5 per cent., and reduction is more rapid. As a result, metal tapped from an electric dross-furnace is much purer than from other furnaces, and the expense of refining is much reduced. To secure the best results it is necessary to analyse each batch of dross, and proportion the slag accordingly, but the cost of so doing, and the higher cost of energy for smelting, as compared with coal costs in reverberatory plant, are more than compensated by the saving in refining processes, reduced loss of tin and improved quality of product. There is no need to re-run slag in the electric furnace, owing to its low tin content; no addition of lead dross is required, and, by adding silica with the tin dross and carbon charge, the silica content of the slag can be kept constant and continuous operation maintained. It makes no difference to electrical resistance or results whether the slags are soda, lime or iron silicates, hence the formation of iron silicate does not disturb the working. Such is the experience quoted recently by R. S. Wile in describing the first commercially successful furnaces used in this service. These furnaces are of the shaft type, operated two in series on 230 volts, direct current, at 800 to 1,000 amperes. On starting the operation, slag is melted first by striking an arc and charging slag material round the electrodes. The latter are then raised gradually, and the operation is continued on the resistance principle, dross carbon and silica being fed in the proportions dictated by analysis. Air is practically excluded from the furnace, and, with 50 per cent. tin dross, the energy consumption is 300 KW.-hours per ton, *i.e.*, 700 KW.-hours per ton of tin produced.

Detecting Production Losses with a Tachograph.—With the aid of a recording tachograph, a device which shows the momentary speed variation occurring in the shaft or machine to which it is connected, the commercial department of the Dayton Power and Light Co., Dayton, Ohio, was recently able to show a prospective customer that his engine-driven factory shafting underwent a recurring speed loss of 6 per cent. during each revolution. The same tachograph applied to a similar installation driven by an electric motor showed speed variations reaching a maximum of only 0·5 per cent. Such a tachograph, according to Mr. J. C. Matthieu, power engineer for the company, is of great usefulness in revealing the production losses due to speed changes in engine-driven factories and in preparing the way for the obvious remedy—electric motor drive.—*Electrical World.*

Institution and Lecture Notes.—Junior Institution of Engineers.—In the course of a lecture which he recently read before the Institution, on "The Electric Vehicle," Mr. R. J. Mitchell says that the phenomenal progress which the petrol vehicle has made during the past 15 years has obscured the fact that on the Continent of Europe, and more particularly in the United States, an immense advance has been made in the use of accumulator-propelled commercial vehicles. There are now in operation in the American Union nearly 75,000 of these vehicles. Immense improvement has been made on the mechanical side, largely due to the work of the regular automobile engineer. The electrical engineer, on the other hand, has contributed his quota, and accumulators, electric motors and controllers, &c., are rapidly nearing perfection; in fact, it may be said that for practical purposes the modern electric vehicle would remain an exceedingly useful machine were it not improved for the next 20 years. The advantages of the electric are manifold, and include very low cost of operation, a safe speed, very slight damage to road surfaces, great handiness of operation, occupation of little floor space, total absence of fire risk, smoke, smell, &c., and the fact that they can be driven by relatively unskilled labour, with a minimum of tuition. An average machine will give the equivalent of four gross ton-miles for one unit input of energy; this compares exceedingly favourably with the 30 to 35 ton-miles in commercial work obtainable from a gallon of petrol only on a very well tuned commercial petrol chassis. The mechanical wear and tear of the electric motor is infinitesimal as compared with that of an internal-combustion machine, and an average figure appears to be about a quarter of 1 per cent. per 1,000 miles of travel, on the initial capital cost of the chassis only. Tires for electric vehicles have a specially long guarantee, and in actual practice far outlast the terms of such warranty; and the modern accumulator has reached the point of being entirely dependable. The price of electrical energy also has come down to an average of 1¼d. per unit, or thereabouts.

Institute of Metals.—Sir J. J. Thomson, O.M., D.Sc., F.R.S., will deliver this year's Institute of Metals May lecture, his subject being "The Passage of Electricity Through Metals," at the Institution of Electrical Engineers on Wednesday, May 12th, at 8.30 p.m. Visitors' tickets can be obtained on application to Mr. G. Shaw Scott, M.Sc., the Secretary of the Institute of Metals, Caxton House, Westminster, S.W.

In the absence, on active service, of Dr. G. D. Bengough, M.A., Honorary Investigator to the Corrosion Committee, now a captain in the Royal Garrison Artillery, the Council of the Institute of Metals has appointed Mr. W. E. Gibbs, M.Sc., as Acting Honorary Investigator to the Committee. Mr. Gibbs, prior to the outbreak of the war, was acting as Dr. Bengough's assistant in connection with the work for the Corrosion Committee. He is now engaged on a series of important investigations, the results of which will be embodied in the third report to the Corrosion Committee, which it is hoped will be presented at the forthcoming autumn meeting of the Institute.

Association of Mining Electrical Engineers.—At a joint meeting of branches of the National Association of Colliery Managers and the Association of Mining Electrical Engineers at Stoke, Mr. G. S. Corlett read a paper on the subject of colliery electric lighting.

At a meeting of the West of Scotland Branch of the Association of Mining Electrical Engineers, a paper was read by Mr. Andrew Gibson on "Bearings of Electrical Machinery."

Royal Institution.—The annual meeting of the members was held on Saturday afternoon, Sir J. Crichton-Browne, treasurer and vice-president, in the chair. The annual report of the Committee of Visitors for the year 1914, testifying to the continued prosperity and efficient management of the Institution, was read and adopted. Forty-four new members were elected in 1914. Sixty-two lectures and 19 evening discourses were delivered. The books and pamphlets presented amounted to about 338 volumes, making, with 652 volumes purchased, a total of 990 volumes added to the library in the year. The following gentlemen were unanimously elected as officers for the ensuing year:—President, the Duke of Northumberland; treasurer, Sir James Crichton-Browne; secretary, Col. Edmond H. Hills. The names of the managers included the following:—Sir Robert Hadfield, the Hon. R. C. Parsons, and Messrs. Alexander Siemens and A. A. Campbell Swinton.

Copper.—Messrs. H. R. Merton's statistical circular for April 30th shows an excess of supplies over deliveries, and, therefore, an accretion to European visible supplies, a state of things not easily anticipated under present circumstances. The increase is 2,431 tons. There is a small increase registered for stocks at Havre—23 tons—and English stocks are up by 758 tons. In detailed supplies, European arrivals from N. America are lower than last month, amounting to something like two-thirds of the pre-war average. Supplies from Spain and Portugal to England and France are well up at 2,415 tons, or one-third more than the pre-war average. The quantity under "other countries" is slightly lower than the pre-war average, as a set-off against unusually heavy supplies in March. Chile shipments are 4,218 tons, against a pre-war average of 3,280, while Australian are steady at 2,500 tons, but have not yet reached last year's figures. Total deliveries at 31,811 tons show smaller after the large quantity of last month, but have only been twice exceeded since last July. The considerable increase in price should have an influence on supplies for the coming month.

Appointments Vacant.—Assistant electrical engineer (£150), for Government of Malta; plumber jointer, for City of Sheffield Electric Supply Department. Particulars are given in our advertisement pages.

Electricity Committee-men and their Relatives.—A very lengthy discussion took place on Thursday last week, at the meeting of the Stoke-on-Trent Council, on the following motion:—"That it be an instruction to the chief electrical engineer that no further appointment of employés of the electricity department be made from amongst relatives of members of the Electricity Supply Committee." Councillor Sampson Walker said that there were six members of the Labour Party on the Electricity Supply Committee, and he was given to understand that five of them had sons working for the Committee. He did not suggest that they were not earning their money, but it was not proper in the interests of maintaining and preserving the clean hands of the Corporation. He also said that it was not fair to the electrical engineer. It was contrary to the interests of the Council, the chief engineer, and of public government. An amendment was moved as follows:—"That it be an instruction to the town clerk that no further appointment of employés who had relatives on the Council should be made." Alderman Leese, in the course of the debate, said that so far as he was concerned the difficulty would be ended by the resignation of both his sons that night. He complained that he had been most unfairly attacked. The amendment was carried by 30 votes to 29. A further amendment was carried that no member of the Corporation should sit on a committee under which he had a relative employed. The Town Clerk intimated, in reply to a question by a member, that the effect of the resolutions would be that the members affected must resign their positions on the committee or that the relatives must go.

A recommendation to increase the salaries of six members of the electricity staff was rejected. The Committee considered that in the interests of the department these salaries should be advanced, particularly in view of the fact that the staff had been seriously reduced owing to the war, and that extra duties had been thrown upon those remaining. The proposition was rejected on the ground that all Committees must be dealt with alike, as it had been decided that no increases of salaries should be given to those receiving more than £100 per annum. Speakers seemed to be quite incapable of seeing any reason why electricity staffs should be treated differently from others. Perhaps they may have a rude awakening when they find out that a great need exists for central station men just now

Electric Cooking Exhibit.—In connection with the "Women and their Work Exhibition," referred to on page 613 of our issue of last week, the Westminster Electric Supply Corporation were asked by the *Daily Express* to illustrate the advantages of electric cooking for women, and have organised quite an attractive exhibit with the aid of the Carron Co., Messrs. Ferranti, Ltd., Simplex Conduits, Ltd., W. A. S. Benson & Co., Belling & Co., and the Dowsing Radiant Heat Co. The annexe has been fitted up as an electric kitchen with cooking stoves by the various makers; there are tables showing many of the electric specialities of the above makers, such as electric heaters, grills, hot plates, irons, and oricalcum wire. There is also an attractive show table for articles which are cooked in the kitchen. Short lectures are given at 3 and 6 each day, which are well attended, and practical demonstrations go on all day. The space is well lighted by indirect and semi-indirect systems, and some handsome alabaster pillars and vases lighted internally are shown by Miss Austen. This exhibition, which closes to-day, should do good work in bringing the advantages of electric cooking before the public, not only in the Westminster Co.'s area, but in most parts of London.

The Budget Speech.—The Chancellor of the Exchequer, in his Budget speech on Tuesday, showed the necessity that exists from a financial standpoint for maintaining the exports of the country during the war. He also expressed, from the same standpoint of finance, the view that the time had arrived when recruiting should not be allowed to interfere with the output of munitions of war, and when it should be allowed to "interfere as little as possible with the output of those commodities which we export and which enable us to purchase munitions for ourselves and for our Allies." This new attitude of the Government will be welcomed by those conducting engineering and other works where, notwithstanding the shortage of skilled labour, and that the product is for war purposes, the recruiting sergeant has, as stated in our pages last week, continued to exercise his persuasive powers with success.

Patents and Alien Enemies.—Applications have been made to the Board of Trade for the avoidance or suspension of the following patents:—No. 22,565/12, granted to Honold for runners for Francis turbines, by J. J. Armfield; Nos. 12,868/05, 12,869/05 and 12,870/05, granted to Goldschmidt & Weber, for the detinning of tinned plates, by G. H. Forrester; and Nos. 27,516/11 and 19,696/12, granted to Eickhoff, for trough conveyors and motors for operating reciprocating conveyors, by Babcock & Wilcox, Ltd.

Karachi Installation: Correction.—In our reference to this installation in our "Lighting Notes" last week, it should have been stated that Messrs. Crompton & Co., Ltd., carried out the whole installation. This included the erection of the mains supplied by Messrs. Henley.

Educational.—MUNICIPAL TECHNICAL INSTITUTE, Romford Road, Stratford, E.—Seven lectures on "Some Industrial Applications of Electricity," will be given on Monday evenings at 7.30 p.m., commencing May 17th. Further particulars are given in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The municipality of Worcester, Cape Province, has appointed Mr. Johnson Tighe, of Cradock, as resident engineer for the new electric lighting installation. There were 23 applicants for the position. The consulting engineer (Prof. Bohle) urged the Council to commence the wiring of the municipal buildings, as probably the street wiring would be completed before the whole of the domestic services were ready.

Mr. H. H. Sutcliffe having declined the appointment as assistant electrical engineer at Aylesbury, the U.D.C. has now appointed Mr. S. H. Fowles, of Belvedere.

The Erith U.D.C. has decided to pay a month's salary (£33 6s. 8d.) to Mr. Coveney, the late electrical engineer, as a grant for services rendered in a supervisory capacity for two months after the expiration of his resignation.

Mr. P. Smith, meter inspector at the Ilford electricity works, has resigned his appointment.

The Derby Electric Lighting Committee has appointed Mr. G. H. Hayes, as assistant mains superintendent, at £2 per week, *vice* Mr. W. R. Poole, resigned; and has increased the salary of Mr. A. Thompson, switchboard attendant, from £2 2s. to £2 7s. per week.

The Coventry City Council E.L. Committee recommends that the salary of Mr. G. Touch, engineer and manager of the electricity works, be increased from £650 to £750 per annum.

Mr. H. D. Winchester, district superintendent for the Newcastle-upon-Tyne Electric Supply Co., Ltd., at Durham City, was married to Miss Maidie Logie Robertson, at Edinburgh, on April 29th.

The salary of Mr. J. Fairchild, assistant electrical engineer at St. Annes-on-Sea, has been increased from £170 to £200 per annum.

Tramway Officials.—Mr. L. J. Yorke, of the Underground Electric Railway mechanical engineering staff, who was gazetted to the 4th Yorks. Regiment in February last, left England for the front on May 5th.

General.—We understand that Mr. F. S. Grogan, who during his eight years' active work in connection with the Tricity cookers has acquired a unique position in the culinary branch of electrical engineering, is about to sever his connection with the British Electric Transformer Co., Ltd., in order to take up an appointment as manager of a new concern for the manufacture and sale of electric fires and cookers. Personal communications should be addressed to him at 14, Argyll Mansions, Beaufort Street, Chelsea, S.W.

Mr. A. R. Kibblewhite, superintendent of the cable department of Callender's Cable and Construction Co., Ltd., Belvedere, has been elected chairman of the Erith Urban Council.

Mr. Charles Bright delivered an interesting lecture on "Nothing as Usual" at a meeting of the Tonbridge Chamber of Trade held last week.

Mr. J. Shepherd, electrical assistant in the L.C.C. tramways department, has resigned, and his resignation is to take place as from September next. It was reported at Tuesday's Council meeting that Mr. Shepherd had been in his present position since November, 1910, and had previously held the position of assistant electrical engineer. He has purchased the business of a consulting engineer, which he will take over on July 1st.

Councillor H. J. Bouchier has been appointed chairman of the Hindley Tramways and Electricity Committees.

Councillor Barnes has been appointed chairman of the Atherton Electricity Committee.

At the annual meeting of the Textile Institute, which is to be held to-day (Friday) in Manchester, Sir William Mather is to be elected president. Past presidents of the Institute have been associated with the cotton and woollen manufacturing industries, and Sir William Mather is the first president selected from the machinery and power branch of the textile industry.

Mr. R. S. Wadie, who has been gazetted as Second Lieutenant in the 10th Batt. King's Own Lancaster Regiment, is the son of Mr. W. S. Wadie, electrical engineer, of Chiswick, W.

Mr. J. H. Davies (late of the Salford and Greenock Corporation electricity department), who has been engaged erecting the electrical plant at Messrs. J. Levinstein & Co.'s Crumpsall Vale Works, nr. Manchester, has been appointed electrician-in-charge at the above works, and commences his duties on May 10th.

Obituary.—The *Morning Post* states that the death is announced of M. Hermann Jent, managing director of the Agence Telegraphique Suisse since 1902.

NEW COMPANIES REGISTERED.

Electrical Wholesalers' Federation, Ltd. (140,094).—This company was registered on April 27th as a company limited by guarantee, not having a share capital. For the purpose of registration, the number of members is declared not to exceed 100, but the committee may register an increase. Each member is liable for not more than five guineas in the event of winding-up. The objects are to promote and protect the interests of wholesale dealers in and factors and suppliers of electrical goods and appliances, to promote the consideration and discussion of all questions affecting the wholesale electrical trades, to procure [illegible] and supply information [illegible] tion) to obtain the most favourable terms and rates from manufacturers of goods and from railway and shipping companies and other carriers, to encourage the settlement of disputes by arbitration, to act as or nominate arbitrators and umpires, to promote displays of electrical goods, machinery, appliances and fittings, and drawings of the same at national and international exhibitions, and generally to watch over and protect the interests of persons engaged in selling electrical goods and appliances. The subscribers are:—M. Beales, 12, Norfolk Street, W.C., engineer; F. Pooley, 25, Victoria Street, S.W., engineer; R. W. Smith, 1, Felix Street, S.E., engineer; F. S. Smith, 12, Norfolk Street, W.C., engineer; A. G. Beaver, 118-120, Charing Cross Road, W.C., electrical engineer; P. L. Davies, 1-3, Stanley Street, Liverpool, electrical engineer; G. O. Donovan, 47, Cornwall Street, Birmingham, electrical engineer. All, persons, firms, or companies who are *bona-fide* wholesale dealers in or factors or suppliers of electrical goods and appliances are eligible as members. The [illegible] not less than seven or more than twelve members. The first members are to be appointed by the subscribers, who themselves constitute a provisional committee. Manager, F. S. Smith. Registered office: Amberley House, Norfolk Street, Strand, W.C.

Ferguson, Pailin and Co., Ltd. (140,150).—This company was registered on May 1st with a capital of [illegible] to carry on the business of electrical, mechanical, hydraulic and general sanitary, gas and water engineers, switchboard and cabling makers, manufacturers of machinery and apparatus of all kinds, etc. The subscribers (with one share each) are: S. Ferguson, 7, Broadway North, Fairfield, Manchester, electrical engineer; J. Pailin, Glengarry, Queen's Road, Hazel Grove, Ches., buyer and director. Private company. The number of directors is not to be less than three or more than six; the first are S. Ferguson (permanent), J. Pailin, G. Pailin, J. W. Pailin, A. Pailin, and G. Pailin, jun. Qualification, 500 shares. Remuneration, £250 [illegible] R. A. F[illegible], 20, B[illegible] Street, Manchester.

CITY NOTES.

Calcutta Electric Supply Corporation, Ltd.

The directors' report for the year 1914 shows that 15,387,471 units were sold, compared with 14,070,927 units in 1913. The number of houses connected at December 31st last was 8,180, an increase of 583.

Year.	Houses connected.	Units sold.	Gross revenue.	Net revenue.
1911	6,383	10,566,038	£1[illegible]	£[illegible]
1912	7,030	12,043,398	£173,907	£[illegible]
1913	7,597	14,070,927	£188,676	£127,092
1914	8,180	15,387,471	£202,[illegible]	£[illegible]

Exchange is calculated at 1s. 4d. per Rupee.

The profits for the year 1914 amount to £140,610, which, with the balance brought forward from 1913 and interest received on money at deposit, makes £148,141. After deducting the interim dividend of 3½ per cent., actual, paid on the ordinary shares in November, 1914; the dividends paid and accrued on the preference shares, and the other items set out in the net revenue account, there remains £102,476. £72,000 is to be placed to the credit of the depreciation and renewals account; £10,000 added to reserve fund; and a final dividend is to be paid on the ordinary shares, for the second half-year, at the rate of 5½ per cent., actual, making 9 per cent. for the year, leaving £11,482 to be carried forward, after providing for the directors' extra remuneration of £2,500, and a bonus of £1,406, payable to the staff in India. The reserve for depreciation and renewals will thus be increased to £188,629 and the reserve fund, with the addition of £2,011 from dividends on investments, will stand at £109,974. The expenditure on capital account last year amounted to £61,443, making the total £1,270,145. The demand for electrical energy continues to increase and the directors have, since the 31st December, 1914, found it necessary to issue additional capital.

Statement of Electricity Generated, Sold, etc.

Total generated in kw. hours	[illegible]
Kw. hours sold: Public lamps	[illegible]
By special contract	700,776
By meter for lighting	4,115,484
By meter for power	[illegible]
Total sold	15,387,471
Used on works	[illegible]
Not accounted for	[illegible]
Accounted for	[illegible]
Kw. connected for public [illegible]	[illegible]
Max. supply demanded	5,525 kw.

Annual meeting: May 13th.

Cuba Submarine Telegraph Co., Ltd.

The annual meeting was held on Wednesday at the offices, [illegible] Old Broad Street, E.C. Mr. [illegible] presided and said it was very satisfactory to note that during the past twelve months the company had [illegible]. There was a drop in the receipts for the first six months as compared with the previous year, [illegible]. There had been a large increase in their expenditure in connection with the West India Station [illegible] shallow water [illegible] and they had also [illegible] the expense of a new building to replace their old one which was destroyed at Cienfuegos. The total expenditure had amounted to £16,702, as against which the total receipts were £38,245, leaving a balance of £21,542, to which had to be added [illegible] from last year, making a total of [illegible] to be dealt with. [illegible] the reserve [illegible] hand, and £2,000 added to the general reserve fund, which now stood at £[illegible]. The directors [illegible] a further dividend of 5 per cent. on the preference shares, [illegible] to 10 per cent. less income tax, and [illegible] per cent. on the ordinary shares, free of income tax; this, he regretted, was rather [illegible]. [illegible] increased rate, it would perhaps be advisable in the future to let the shareholders pay their [illegible] increase in the dividend accordingly. This matter, however, was under consideration. The main cables, continued the Chairman, were all working well. The cable running from Santiago to Cape Cruz, [illegible] was now being repaired and the expenses of that would come into the current year's accounts. Traffic over the company's cables had been well maintained, and he thought they would look forward to a good year.

Mr. Dryzell seconded the motion, which was carried unanimously.

The Chairman reported that they had received a letter from the British Red Cross Society, and he asked their permission to contribute 100 guineas to that worthy cause. The motion was seconded and carried.

Stratford-on-Avon Electricity Co., Ltd.

The directors report that although there has been a considerable accession of consumers during 1914, the revenue for the latter half shows a slight decline, owing partly to general economy in lighting and partly to the closing of one of the picture houses where a considerable amount of current was taken during the corresponding period of the previous year. The expenditure was higher principally in consequence of a general rise in all the requirements of the company. The directors might have recommended a small dividend, but consider it desirable, in face of the present outlook, to strengthen the reserve and slightly increase the amount to be carried forward. After writing off £200 to reserve and depreciation account and building sinking fund, making it £802, the available balance is £189. Directors' fees absorb £50, and £139 is to be carried forward.

	1912.	1913.	1914.
Units generated	192,479	190,582	210,825
Units sold	131,777	143,708	142,790
Lighting	79,940	78,044	74,451
Power	40,895	55,217	56,370
Heating	10,984	10,447	11,969
Used on works	48,000	36,874	21,114
Unaccounted for	12,661	10,000	46,921
8 c.p. lamps connected	12,150	15,852	16,352
Maximum load in kw.	120	100	90
Average price obtained	3.304	3.374	3.261.

British Thomson-Houston Co., Ltd.

The directors, in their report for 1914, state that prior to the outbreak of the war the company was making excellent progress in all its departments, but its business was seriously disturbed in many directions in August and September last. In a comparatively short time satisfactory re-adjustments were made to cope with the new conditions with the idea of doing as much work as possible to fill orders to meet, directly or indirectly, the requirements of the Government, and at the same time carry out so far as reasonably possible obligations to other customers. Over 1,000 employés have joined the Colours, being a large percentage of those eligible for military service. The loss of this number of employés, and the difficulty found in filling their places, even partially, has been a source of considerable embarrassment, but those who have remained have loyally supported the efforts of the management in all directions. For months past the company has been manufacturing munitions of war at its various factories, and has bought a large number of machine tools for this purpose. It is particularly gratifying to note that notwithstanding the disturbed financial conditions, collections were excellent during the whole of 1914; practically no customers availed themselves of the privileges afforded by the Moratorium, and losses from bad debts were so small as to be inappreciable. This conditions of affairs under the circumstances was remarkable, and indicated the strong financial condition of the country.

The buildings and machinery of the company had been maintained in first-class condition during the year, and all buildings under construction and authorised at the date of the last annual report had been completed and were now in use.

At the end of December, due to the number of employés joining the Colours who were familiar with the stocks of finished apparatus and work in progress, it was physically impossible, within a reasonable time, to take an actual inventory of the Rugby Main Factory, so that in making up the accounts for the year the directors have relied upon the book figures and, although in the past years the inventory figures have shown a considerable increase over the book figures, and the directors have reason to believe the percentage of increase would have been equalled, if not exceeded, for the year 1914, they have taken no profit on this account, but have allowed the book figures to stand. In the Lamp Factory at Rugby, in the factories at Coventry and Willesden, and in all branch offices, a complete inventory has been taken in the usual way. The profits for the year, after deducting all expenses and charges other than interest on debentures and loans, are £130,868, plus £12,944 brought forward, making £143,812. The amount paid for interest on debentures and loans during the year was £56,705, leaving a net profit of £87,107. Of this amount the directors have thought best to appropriate for depreciations £73,309, so as to still further strengthen the company's position, and carry forward £13,798 to new account. Heretofore the first two items on the credit side of the company's balance sheet have been "goodwill, patents and licences," and "investment in Patent Owning Company." The second item is of substantially the same character as the first, and as the company owns all the shares in the "Patent Owning Company," the directors have decided to consolidate these items, and hereafter they will jointly appear under the first title only. Under the terms of the Trust Deed securing the issue of the company's debentures, the Company has this year to pay to the trustees the sum of £4,452 to be applied by them in redeeming debentures at 105 per cent. by drawings. Since the closing of the books debentures of the par value of £4,240 have been redeemed, making the total par value of debentures retired to date £30,025, and leaving a net amount outstanding at the date of this report of £181,975. The amount outstanding at the 31st December, 1914, was £186,215. The directors have followed their usual practice in making reserves to cover risks in connection with bad debts, and other contingencies. In addition to the amount shown in the profit and loss account, the directors have applied the reserve heretofore made, in writing down the debentures and shares held by the company, to the value now shown. During the year Mr. F. Fraser, secretary to the company, was appointed a director to fill an existing vacancy.

Annual meeting, May 12th.

Eastern Telegraph Co., Ltd.

The directors report that for 1914 the revenue amounted to £1,645,741, from which is deducted £621,866 for the ordinary expenses, and £164,583 for expenditure relating to maintenance of cables, sundry differences in exchange, income tax payable abroad, and interest on temporary loans, leaving £859,293, plus £25,687 brought forward, making a total available balance of £884,979. After providing for income tax payable in England, interest on mortgage debenture stock, and dividends on the preference stock, which in all absorb £177,237, there remains £707,742, out of which the directors have placed £390,000 to the general reserve fund, £5,000 to the insurance of goods in transit fund, and have paid three interim dividends of 1¼ per cent. each on the ordinary stock, aggregating £150,000. A final dividend on the ordinary stock of 1¼ per cent. is recommended and a bonus of 2 per cent., amounting together to £130,000, both payable on May 12th, free of income tax, and making, with the three previous payments on account, a total distribution of 7 per cent. for the year. It is proposed to carry forward £32,742. The general reserve fund has been charged with £273,973 in respect of new cables and other special expenditure, and after crediting the £390,000 referred to above, the net addition to the fund for the year is £116,027.

Annual meeting: May 12th.

Dudley, Stourbridge and District Electric Traction Co., Ltd.

The annual meeting was held on Monday at the offices of the Electrical Federation, Kingsway. Mr. S. R. Blundstone (chairman) presided, and on his formal motion the report was adopted. This statement shows that the total revenue for 1914 was £50,780, compared with £52,843 for the preceding year. After payment of all expenses properly chargeable to revenue, interest on debenture stock, and placing £2,500 to the renewals fund, there was a surplus, including £75 brought forward, of £7,351. After putting to reserve £500, paying a dividend of 5 per cent. on the preference shares requiring £5,000, and a dividend on the ordinary shares at 1 per cent. requiring £1,000, £851 is to be carried forward. The company has continued to benefit during the past year from the operation of its tramways as part of the system worked by the Birmingham and Midland Tramways Joint Committee, and the arrangement has, therefore, been continued.

Wolverhampton District Electric Tramways, Ltd.

Mr. S. R. Blundstone (Chairman) presided on Monday at the offices of the Electrical Federation, Kingsway, over the annual meeting. The proceedings were purely formal, and on the motion of the Chairman the report was adopted. This statement showed that during 1914 the total revenue was £28,359. After deducting all expenses chargeable to revenue, including debenture interest, repairs and maintenance, and providing £2,000 for the renewals, there remained a profit of £2,350, plus £134 brought forward. After placing to reserve £500 and paying a dividend on ordinary shares at the rate of 1 per cent. per annum, £386 is carried forward. The arrangement with the other companies operating tramways in the district for joint working under the management of the Birmingham and Midland Tramways Joint Committee has proved satisfactory, and has been renewed.

West African Telegraph Co., Ltd.

The revenue for 1914 amounted to £55,523, from which is deducted £17,633 for the ordinary expenses, and £8,536 for expenditure relating to maintenance of cables, sundry differences in exchange, and income tax abroad, leaving a balance of £29,354, plus £66 brought forward, making a total available balance of £29,420. £543 has been provided for income tax, £19,000 has been transferred to general reserve fund, and an interim dividend of 2 per cent. (free of income tax), absorbing £4,622, was paid on December 1st last. The directors now recommend a final dividend of 2 per cent. (free of income tax), payable on and after May 13th, making, with the interim distribution, 4 per cent. for the year, £633 being carried forward. Sir Albert J. Leppoc Cappel, K.C.I.E., has been appointed to a seat on the board, in the place of the late Mr. Robert Kaye Gray.

Annual meeting: May 12th.

Johnson & Phillips, Ltd.

Mr. Robert W. Blackwell presided on Thursday last week over the annual general meeting, held at Winchester House, E.C. He said that the accounts showed a continued improvement. The 1914 trading profit, after the provision of £7,529 for maintenance of buildings and plant, stood at £37,119; £3,944 better than in 1913. He could repeat what he said at previous meetings—that the business was improving steadily in extent and value and would, in his humble opinion, continue to so improve. The balance sheet demonstrated that the company occupied a sound and strong financial position. They had a large amount of work in progress. The stock-in-trade had been taken on safe and conservative lines. Every department of the business showed a profit on the year's working. On December 31st, 1914, sundry creditors and bills stood at £100,063, against which they had sundry debtors amounting to £119,518, as against £94,311 and £107,855 respectively at the end of 1913. The stock-in-trade and work in progress represented £154,988; £4,558 less than the similar figure in 1913. Investments amounted to £2,368—patents, licences, etc., to £10,300—and cash in hand £15,509. During 1914 they spent on additions to buildings and plant £16,933 and set aside for depreciation £8,000. At the date of the balance sheet, the original issue of first debentures had been decreased from £175,000 to £118,136. The board recommended the payment of a dividend at the rate of 5 per cent. per annum on the 175,000 ordinary £1 shares. That dividend would take up £8,750, and would leave to be carried forward £15,545. The board did not consider that it would be justifiable to declare a larger dividend under existing conditions. It was unnecessary for him to point out how all-important it was to preserve a strong financial position at this juncture. He looked forward to the future of Johnson & Phillips with every confidence. Its manufacturing plant was well maintained and had been vastly improved during the past few years. Its shops had been, and were, well employed, and he could see no reason why its turnover and profits should not increase steadily, especially when happier times came to the country at large.

Mr. T. Dence seconded the motion.

The Chairman, in reply to questions, said he did not think the company had made investments in plant with a view solely to war business, and therefore he did not think at the end of the war they would be in possession of any machinery of doubtful value. They had made some additions and alterations and done what was necessary to meet the demands of the Government, but he was not aware of anything in the factory which would depreciate in value should the war stop to-morrow. Such new machinery as they had put in was being used partially for Government and partially for private contracts and was on the lines of the proper expansion of their business. The war had not benefited them, as the amount of work which they had offered them prior to the outbreak of hostilities would have put as great a demand upon the plant and would have resulted in practically as large a profit as anything they might look forward to obtaining from war business. In no sense did the prosperity of the company depend upon the continuance of the war—in fact they would like to see it over as speedily as possible.

The report was adopted.

Indo-European Telegraph Co., Ltd.

Mr. J. Herbert Tritton presided on April 29th at the offices, 18, Old Broad Street, E.C., over the annual meeting. He said that the outbreak of war had an immediate effect upon all telegraphic communications, especially those connecting Germany with the Allied countries. The Indo route to India and beyond was totally interrupted in Germany on July 31st without notice and before the declaration of war. Later the cable connecting Odessa with Constantinople was disconnected at both ends. These interruptions had necessarily curtailed the usefulness of the company's system, restricting the working to the transmission of traffic between Russia and places east of that country. It might have caused the shareholders some surprise to see that the company's revenue had not diminished, although their route had been interrupted since July 31st, but some of them might remember that in the early days the company entered into reciprocal working arrangements with the Eastern and Associated Telegraph Companies. These arrangements provided for the maintenance of revenue of the different parties to the agreements for a specific period despite the fact that the revenue contributed by one of those parties might be reduced or entirely stopped. They had at times heard complaints made of such mutual working arrangements, but the position of the company might have been serious had no such arrangements been entered into, and they thought their value had been amply demonstrated in this case—indeed they had proved a necessary safeguard. They had already approached the British Government on the subject of the future of the company, and had received an assurance from the Government that facilities would be given to the company for the re-establishment of the Indo route. He did not propose to go further into the question of the route that would eventually be decided upon by the company, and must ask the shareholders to be satisfied with the statement that the matter was receiving the serious attention of the directors and that steps were being taken to ensure the continuity of the company's communications. The company's lines in Russia had been placed entirely at the disposal of the Russian Government, and they were glad to know that the Russian military authorities were making very considerable use of them. The company's line passed through a part, a considerable part, of the area where constant fighting was taking place and through the town of Warsaw. Since the war began, the London staff had been employed by the Eastern Co. in London. That company had suffered from severe pressure owing, amongst other causes, to the fact that the Indian and Trans-Indian traffic had been carried by their cables, and they were glad to assist them by the loan of their experienced operators. It was satisfactory to learn from Sir John Pender, the managing director of the Eastern Telegraph Co., that they had rendered valuable services. The directors had voted £250 to the Prince of Wales's Fund as a first contribution. They had also made a contribution to the Red Cross organisation inaugurated by the Director-General of Telegraphs at Petrograd in connection with his department, and had received a graceful letter of acknowledgment from the Director-General. The war, of course, put a stop to practically all their wireless experimenting, and their large station in France was taken over by the French Government, whilst their small station in this country was taken over by their own Government. The directors proposed to set aside £10,000 towards wireless and other technical development. They were hoping to make experiments in the course of a few weeks with a wireless transmitting set of comparatively small power coupled with reception by an improved Orling wireless relay, and they had every reason to believe that the experiments would give satisfactory results. The restoration of the company's route might very likely necessitate some experimental work, and the directors thought it prudent to set aside the sum mentioned in the report to meet the expenditure that would be incurred in making such experiments and assuring their position. The directors had decided that £25,000 be set aside towards possible downward fluctuations in the investments. Although the Government had fixed minimum prices it must not be assumed that those prices were effective or would hold when the minimum had been taken off. In this they were making what might prove to be an over-provision, but in this case the company's reserves would have been strengthened. The financial side of the report called for little comment. The revenue for 1914 amounted to £189,383, showing an increase of £16,851, and the net result showed a balance carried to profit and loss of £100,988. This was the first occasion in the history of the company upon which their net revenue had reached £100,000. The expenses were £88,395, as compared with £91,441 for 1913. The decrease was accounted for by the interruption of their communications, certain items of expenditure having been lessened owing to this fact. The carry-forward this year was £20,592, as against £6,461 last year. The directors were of opinion that a larger carry-forward was desirable at the present time. The principal, if not the only, item of interest in the balance sheet was the entry of £50,000 war loan, for which they were glad to be able to subscribe. The resolution amending Article 90 of the Articles of Association, recommended for acceptance, was rendered necessary by the exclusion of the non-Government German director from the directorate.

Sir W. B. Brooke seconded the motion and it was carried.

In reply to a shareholder, the Chairman said the company were giving full pay to those of their staff who were serving with the Colours.

Weston-super-Mare and District Electric Supply Co., Ltd.

The annual meeting was held on April 29th, at Electrical Federation Offices, Kingsway, W.C. Mr. Geo. J. Somerville, who presided, remarked that in the electricity supply section they had had an increase in income, in spite of their having supplied less current to the traction section. Owing to the war that section of the business had not been so remunerative as in the previous year, but that was a cause quite outside their control.

Mr. C. G. Tegetmeier seconded the adoption of the report, and it was carried.

The report showed that the total capital expenditure at December 31st last amounted to £132,278. The accounts for the year showed a credit balance of £5,271 from electricity supply, £3,887 from traction and £90 from sundry receipts, making £9,251. Deducting administration and general expenses £1,672, debenture and other interest £2,022 and placing £1,000 to renewals account, there is a balance of £4,556, plus £403 brought forward. There is to be placed to reserve £500, a dividend on the 6 per cent. preference shares absorbs £2,400, a dividend at the rate of 5 per cent. on the ordinary shares requires £1,650 and £409 is to be carried forward. The installations connected to the mains at December 31st, 1914 (excluding the traction section) represented the equivalent of 40,489 lamps of 8 c.p., an increase of [illegible]. The number of consumers during the year increased from 505 to 597. The total revenue advanced by £460, and the expenses by £328, the net result being an improvement of £132. The gross receipts from the traction section were £7,091, a decrease of £1,646, due to the war. The expenses amounted to £3,204, leaving £3,887, a decrease of £1,377 compared with 1913.

Oriental Telephone and Electric Co., Ltd.

[illegible] (Chairman) presided over the annual meeting, held on April 28th, at the Great Eastern Hotel, E.C. He first alluded to the recent death of Mr. B. St. John Akers, who was the oldest shareholder in the company and served on the board for over 30 years. The vacancy had been filled by the election to the board of Mr. Ness. As to the addition of other directors to the board, it was suggested that two be left in abeyance for the moment, because, as the shareholders had been advised by various circulars, proposals would be made as early as possible, some of which effected a possible re-arrangement of the board. As to the accounts, in spite of the great events which had taken place since they last met, the progress of their branches had been maintained. It would be idle to pretend that the war had not affected them, as it had everybody else, but they had not been affected to the extent that many undertakings had. At the beginning of August there was a slump everywhere, but as soon as the first shock had passed, things recovered, and he was glad to say there was an increase in all their branches, although not so great as they might have hoped for in normal times. In the case of the China Co., there was a net increase in the revenue for 1914 of £1,619, and the number of new lines added to the system was 2[illegible]5. The Bengal Co. showed an increase of £3,143 in net revenue, and 358 new lines had been added. The Bombay Co. showed an increase of £2,403 in revenue and 199 lines. The dividends paid by the two former companies were the same as last year, viz., 5 per cent. for the China Co. and 7 per cent. for the Bengal Co., and in the case of the China Co. it would have been possible to have increased the dividend, but they thought perhaps under the present conditions it would be better to keep to the old figure. The Bombay Co. had felt itself able to increase its dividend to 16 per cent. He might mention in connection with the Bengal and Bombay Companies as to the remark in the auditors' certificate as to the valuation of the investments in subsidiary companies, that the latest quotation for the Bengal Co.'s 100 rupee shares was 125 rupees, and for the Bombay Co.'s 25 rupee shares 83 rupees. As regarded the Egyptian Co., as they knew Egypt had been more affected, perhaps, than any of the Eastern agencies by the war, and, in addition, for the last seven or eight years it had had a series of misfortunes. First there was the financial crisis in 1907, and then came the Turkish-Italian war, and next the Balkan war, and now the European war. Anyone acquainted with the population of Egypt, consisting as it did so largely of Italians, Greeks, French, Turks and Arabs, would understand that these events affected Egypt much more than they would any of their exchanges further East. To have been able to maintain their position under these circumstances would have been an achievement of no small merit, but in addition they had been able to show some slight advance on the previous year, which must be considered as particularly satisfactory under the circumstances and highly creditable to their officials and staff. This applied with equal force to their officials and staff further East. At most, if not all, of their exchanges, very considerable demands had been made upon their services in connection with telephonic communication, both by the military and civil authorities, and the company had succeeded in meeting their requirements in every case. In fact, their managers had been complimented upon the assistance they had been able to offer.

Mr. Hibbert formally seconded the motion, and said the shareholders knew that another meeting would take place shortly at which the action taken by a shareholders' committee would be dealt with.

Sir Fortescue Flannery expressed great surprise that the motion should have been put before the meeting without some further explanation of what was a matter of public knowledge. He referred to the action taken by Mr. Bailey before Mr. Justice Astbury first, and afterwards before the Court of Appeal, for the restitution of large sums of money by the directors to the shareholders. The result of both actions was in favour of Mr. Bailey. If he understood the circulars which had been sent round to the shareholders, there were at present negotiations going on between the directors and Mr. Bailey and his committee for a settlement of the matter with the object of avoiding further litigation. That settlement, he understood, included the restitution of many thousands of pounds by some of the directors—money which they had actually drawn and received, and which was now in their possession. If the meeting carried the report which contained the paragraph as to the re-election of Mr. T. Lloyd and Mr. H. J. Grewing to the board, he ventured to think the shareholders would be stultifying themselves. If the meeting was going to be adjourned for the purpose of receiving Mr. Bailey's report he saw no useful purpose which was going to be served by passing the report that day.

Mr. Skelding said he had not the least notion where they stood. All he knew was that a certain Mr. Bailey, with whom he was not acquainted, had agitated in conjunction with Mr. Ness, who also he was ignorant of. He was given to understand by a member of the board that the principal object of the agitation was to oust the old board, and if that was so, he congratulated Mr. Ness on having found a place on the board. That congratulation was coupled with a certain amount of sympathy with the gentlemen on the board in having to put their hands in their pockets for the sum of £53,000. Mr. Skelding proceeded to refer to a circular sent round, in which the board suggested that if the Court had been in real possession of the facts, they would not have made such scathing denunciations against the directors. Apparently they blamed counsel or the solicitors, and if so, why was it that the solicitors still remained with the company? The fact was that the shareholders had been left in the dark and had been told that the board would use the proxies of those silly people who sent proxies. The company was flourishing, and why should the board not be content to join in the advantages of a flourishing company without grasping for huge sums of money like he had referred to, instead of letting the shareholders know exactly what was being done?

A shareholder asked whether if the report was not adopted that day, it would mean that a dividend could not be paid.

The Chairman said that was so.

After further discussion regarding the adjournment of the meeting, the Chairman said that negotiations of an informal character had taken place with the Committee, and it was the intention to have called a meeting and to lay the proposal before the shareholders for an amicable settlement of the matter. For various reasons the meeting could not be called, and the death of Mr. St. John Akers had placed a further obstacle in the way. But he could assure them that nothing which could take place at that meeting would prejudice what might be arranged later on. Mr. Lloyd did not intend to offer himself for re-election, and with regard to himself, his re-election would depend entirely upon the shareholders, and if it was the wish that he should retire in favour of someone else he would do so.

Mr. Ness said he was one of the Committee to meet the directors to try and arrive at an amicable settlement. It was a pity Mr. Bailey did not issue a circular informing the shareholders of what had been done, but such a circular was actually drafted and would have been issued but for Mr. Akers's death. After the hearing of the case in the High Courts a committee of shareholders met together and thought it would be in the interests of the company to have some conferences with the directors, and this had been done. Eventually they succeeded in coming to a conditional understanding. Any compromise was, of course, conditional as the committee had no power to bind the shareholders. His own impression was that when they knew the terms, the shareholders would be satisfied. It consisted of three points: The first was a very substantial refund on the part of directors of moneys they had received. (A voice: "Why not all?") It was not possible to get everything one wanted, and if they had insisted on getting too much they would have been landed with litigation in the House of Lords. Put briefly, the compromise included a refund equivalent to a 12 per cent. deferred dividend which would be paid immediately on the conclusion of the transaction. Then three new directors were to be appointed, and there was to be a revision of the terms of remuneration and a fixed sum paid instead of a percentage of profits.

Answering a question as to the present terms of remuneration, the Chairman said the five directors of the Oriental Co. got £300 each, the four directors of the Egyptian Co. £200 each, and the three directors of the China Co. £175 each. This was exclusive of commission on profit in the Egyptian Co., which amounted to about £500 for each director.

The Solicitor endorsed the Chairman's statement that the passing of the report would not prejudice the shareholders' action at the meeting which was to be called. The liability of the directors did not arise as directors of the Oriental Co., but as directors of the Egyptian Co. Everything they received as directors of the Oriental Co. was perfectly in order. There was still the House of Lords, who might say that the money should not be paid.

The report was adopted by 20 votes to 13. Votes of thanks were passed to the Chairman and staff, and to Mr. Bailey.

Kidderminster and District Electric Lighting and Traction Co., Ltd.

Mr. J. A. Lycett (Chairman) presided on Monday, at the Electrical Federation Offices, Kingsway, over the annual meeting. He formally proposed the adoption of the report, which was seconded by Mr. S. E. Garcke and agreed to. The report stated that the total capital expenditure at December, 1914, on buildings and plant, etc., for electric supply amounted to £57,723. The net receipts of the lighting department were £4,261. Adding dividends receivable, £1,955, and the amount brought forward, £204, there is a total of £6,421. After deducting administration and general expenses, reserve for doubtful debts, interest on temporary loans and debenture interest, there remains £2,468, from which there is to be put to reserve £750; dividend on cum. pref. shares for the year absorbs £1,500, leaving to be carried forward £218. The company has sold its motor omnibus interests to the Worcestershire Transport Co., and now holds 11,109 £1 shares (fully paid) out of a total of 19,347 shares issued by that company. The report of the Kidderminster and Stourport Electric Tramway Co. for 1914 shows that no additional expenditure on capital account was incurred. The profit on working, after providing for renewals, is £1,964, plus £129 brought forward, leaving an available balance of £2,093. Out of this there has been applied to reserve £500, and to dividend at the rate of 2½ per cent. £1,430, carrying forward £163. The directors regret that owing to pressure of other business, Mr. C. Shirreff Hilton has resigned his seat on the board. Mr. Lycett has been appointed chairman.

Lisbon Electric Tramways, Ltd.

The directors report that the result of the company's operations for 1914, after deducting interest and amortisation due on the debentures of the "Companhia Carris de Ferro de Lisboa" and after the payment of £25,610 for interest on and redemption of the debentures of this company and also the payment of London office expenses and directors' remuneration, shows a net profit of £84,709, plus £1,749 brought forward. £15,000 has been placed to the credit of depreciation reserve, £5,000 to exchange reserve, and £19,013 formerly standing to the credit of "premium on ordinary share capital," has also been transferred to depreciation reserve to adjust the decrease in this year's appropriation from the profits. Out of the available balance of £66,458, the usual 6 per cent. preference dividend, amounting to £25,533, has been paid. On November 12th, 1914, the directors paid on the ordinary share capital an interim dividend of 3 per cent. net, amounting to £19,021, and they now recommend a final dividend at the same rate, making 6 per cent. net for 1914. The balance of £2,883 remaining to the credit of profit and loss account has been carried forward to next year's account. The tramways have carried 63,758,037 passengers, earning Es. 1,938,210 $79,3, as compared with 58,840,923 passengers, earning Es. 1,861,056 $93,9 in 1913. The traffic, therefore, has been more than maintained, but the increased cost of supplies, especially coal, and the falling off in the average rate of exchange from 46.199d. to 43.43d., both of which adverse factors were brought about by the disturbing conditions caused by the war, have resulted in a diminution of the profit to the extent of nearly £20,000. The extension of the power plant was completed during the year, and is in satisfactory operation. One of the most important of the Ascensores lines was electrified and re-opened to traffic during the period under review, and the remainder of the system will be completed in the course of the current year. No further progress has been made in the negotiations with the Municipality mentioned in last year's report. The board regret the death of Mr. S. W. Jameson, who was secretary of the company since its inception. Mr. F. Haines, who was acting secretary, has been appointed his successor. The board record their appreciation of the services rendered to the company by the members of the local board in Lisbon, by Mr. A. O. Kolkhorst, the general manager, and by the entire staff.

Annual meeting: May 12th.

Craigpark Electric Cable Co., Ltd.—For the year ended March 31st, 1915, the accounts show a net profit of £8,906, plus £1 391 brought forward, making £10,297. There is put to depreciation off buildings and machinery £2,500, to reserve account £1,000, to dividend on 6 per cent. preference shares £2,850, to dividend on 37,500 ordinary shares, at 6 per cent., for the year £2,250, leaving to be carried forward (subject to payment of directors' fees) £1,697. Business during the year was satisfactory, although the output of the company suffered somewhat from the dislocation inseparable from the war. The value of orders on hand at the moment is considerable, and the prospects for the coming year are good. The directors regret to report the death of Mr. William Henri Luther, who was appointed a director only last year. Annual meeting, May 12th.

Chloride Electrical Storage Co., Ltd.—A dividend of 10 per cent. on the ordinary shares is recommended for the year.

Auckland Electric Tramways Co., Ltd.—An interim dividend of 7d. per share, less income-tax, on the ordinary shares is announced.

Submarine Cables Trust, Ltd.—The directors report that the revenue for the year ended April 15th amounted to £25,175, and the expenses to £1,359, leaving £23,816, plus £30 brought forward. After providing £16,236 to meet payment of the coupons, £7,560 has been transferred to the redemption fund, leaving £50 to be carried forward.

Alderley and Wilmslow Electric Supply, Ltd.—The annual meeting was held on April 27th. The directors' report, to which brief reference was made last week, recorded the death of a director of long standing in the person of Mr. John Royle. Mr. H. S. Hadwen has been elected to the vacancy.

Anglo-American Telegraph Co., Ltd.—The directors' report for the year ended March 31st, 1915, states that the dividends paid absorbed altogether £262,500, being the rent paid by the Western Union Telegraph Co. for the year, equal to 3¾ per cent. on the ordinary stock, 6 per cent. on the preferred stock, and 1½ per cent. on the deferred stock. The balance at credit of revenue account (£71,250) includes £5,625 interest received, and the balance of £65,625 is available for the payment of dividends for the quarter to March 31st, 1915.

Tramways and General Works Co., Ltd.—A dividend of 6½d. per share, less income-tax, for the year is recommended, carrying £207 forward.

Yorkshire (Woollen District) Tramways, Ltd.—The revenue for 1914 amounted to £65,385, an increase of £2,876. After deducting all expenses chargeable to revenue, including repairs and maintenance, payments to local authorities under agreements, debenture and other interest, and setting aside £4,500 to renewals fund, there remains £9,696, plus £1,891 brought forward. There is to be put to reserve fund £2,000, to dividend at the rate of 3½ per cent. per annum on the ordinary shares £7,001, carrying forward £2,586.

Chiswick Electricity Supply Corporation, Ltd.—The directors report a capital expenditure of £4,357 during 1914. The profits, after paying sinking fund premium and trustees' fees, were £8,386. Interest on first mortgage debenture stock amounting to £3,600 has been paid, leaving £4,786 to the credit of the net revenue account. A dividend at the rate of 6 per cent. for the year is recommended, carrying £1,018 to depreciation reserve fund account.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The gross receipts for the year 1914 amounted to £819,583, against £738,129 for the previous year. The working expenses, including £61,174 for maintenance of cables, absorb £364,978, against £354,864 for the previous year, leaving a balance of £454,604. From this is deducted £13,754 for income-tax payable in England, and £30,096 for interest on debenture stock, leaving £410,753 as the net profit, plus £30,616 brought forward, making £441,370. Three interim dividends of 1¼ per cent. each have been paid for the year, and it is now proposed to distribute a final dividend of a like amount on June 12th, making a total dividend of 5 per cent. It is also proposed to pay a bonus of 4s. per share, or 2 per cent., making a total distribution of 7 per cent. for the year. £200,000 has been transferred to the general reserve fund, and £31,370 is carried forward. The balance of cost, amounting to £194,078, of the Penang-Singapore-Hong-Kong cables has been charged against the general reserve fund. £35,443 has also been charged against the fund for partial cable renewals carried out during the year, together with the loss amounting to £43,901 incurred on the sale of investments.

Buenos Ayres Port and City Tramways, Ltd.—In a circular issued to holders of 6 per cent. first mortgage debenture stock and 6 per cent. extension first mortgage bonds, it is stated that the committee representing both classes of debenture-holders consider that the best interests of the debenture-holders would be served by the adoption of a scheme for consolidating and re-arranging the funded debt, thereby avoiding difficult questions which would inevitably arise if receivers were appointed. The trustees concur in this decision. It was anticipated that it would have been possible to submit a scheme of reorganisation before this date, but, unfortunately, delays have occurred, through technical difficulties, in dealing with matters connected with the floating debt of the company, which it is hoped may shortly be overcome.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended February 26th amounted to 990,763, compared with 1,080,419 in the corresponding four weeks of 1914. For the four weeks to March 26th the figures were 1,212,991 for 1915, and 1,220,009 for 1914. It is stated that general slackness of trade in Calcutta, owing to the war, has caused the above decreases.

South Wales Electrical Power Distribution Co.—The report states (says the *Financier*) that as, under the working arrangement with the Treforest Electrical Consumers' Co., Ltd., the whole of the working expenses in connection with the undertaking are now borne by that company, there is, for the time being, no revenue account to be submitted. Notwithstanding the dislocation of trade during the last five months of the year, the business of the company shows an increase, the units sold amounting to 26,510,198, as compared with 25,812,031 sold in 1913, an increase of 698,167 units. The surplus, after payment of all working expenses and interest on prior lien debenture stock, and making due provision for depreciation of new plant, amounts to £5,347, as compared with £2,915, the surplus for 1913, an increase of £2,431. The accumulated profits are now sufficient to deal with the indebtedness of £13,500 due to certain members of the Treforest Co. for overcharges, as explained in previous reports. The continued expansion of the company's business necessitates the provision of further capital, for which the requisite steps are now being taken by the directors under the borrowing powers already possessed by the company, and, subject to these and incidental arrangements being accomplished, the directors confidently look forward to being able to make a payment in respect of interest on the original debenture stock in the course of the coming year.

Costa Rica Light and Traction Co., Ltd.—At a meeting of the holders of the 6 per cent. prior lien debentures, held on Wednesday, resolutions were, according to the *Financial Times*, to be submitted to release the company from liability to make payments to the sinking fund until May 15th next following the expiration of one year after the termination of the present European war.

Reduction of Capital.—GELL TELEGRAPHIC APPLIANCES SYNDICATE, LTD., AND REDUCED.—A petition for the confirmation of the reduction of capital from £40,000 to £20,000 has been presented, and will be heard on May 11th.

STOCKS AND SHARES.

TUESDAY EVENING.

A good many of the markets in the Stock Exchange have come to something like a pause, investment and speculative investment both being checked by the recent news from France, and, still more, by that from Russia. Although so neatly wrapped up in the official dispatches, the advance established by the Germans has not been ignored by those closely following the sphere of operations in the Western theatre; and that the enemy should have progressed at all, just at the time when the Allies were expected to make a sweeping forward movement, has caused a little disappointment to those who profess to see in it something more than the mere ebb and flow of events connected with a great war. As regards the Russian operations, the German tales are, of course, not credited without confirmation from Petrograd, but it is thought that our Allies may have suffered a setback.

Moreover, the grave statements with reference to labour difficulties which have been contributed by Admiral Jellicoe, Mr. Lloyd George, the Director of Transports, and others combine to produce a feeling of uneasiness in the minds of the investing public. Money itself remains almost ridiculously easy—the result, principally, of the disposition of capitalists, large and small, to keep their cash resources liquid rather than employ them in Stock Exchange channels for the time being.

The Home Railway market continues to give way, in consequence of the labour troubles. Principally, the demands made by the Miners' Federation for an increase of 20 per cent. in wages are responsible for the refusal of the public to put money or faith into the leading industry of the country. It is true enough that the floating supply of stock is comparatively small—a factor which will assume correct proportions as soon as any attempt is made to buy Home Railway stocks. Just at present, however, such attempts are conspicuous only by their absence; and the result is reflected in what dealers in the market euphoniously call a softening process, in contradistinction to the "hardening" of values which might have been expected to take place at the present time, had it not been for the labour unrest.

Metropolitans and Districts drooped with the rest. Central Londons keep steady, and there are one or two buyers about of the Company's ordinary assented stock. The Underground Electric group as a whole, apart from the two issues mentioned, maintains its ground with more tenacity than is shown by the Steam stocks. There is little setback in the prices of debentures and preferences—a testimony to the determination of investors to retain their holdings for better times, rather than evidence of demand to-day.

The Telegraph market is one of the firmest in the electrical departments. Cuba preference rose 10s. Great Northerns at 32 are £2 up, thanks to the increase in the dividend. Globe preference eased off a little. Indo-Europeans at 56 are £1 higher, very little inquiry sufficing to put up the price. Anglo-American deferred slipped back ½ on a few profit-taking sales by those who bought the stock some weeks back at a lower figure and who consider themselves fortunate in being able to take a quick turn in war time, but the preferred regained all the 1½ per cent. dividend deducted last week from the price. Eastern Extensions are firm on the issue of what, in the circumstances, must be regarded as an excellent report.

Telephone shares are also wanted. There are rises this week in Chilis, United River Plate, and Orientals. New York Telephone 4½ per cents. are 98, ex the half-yearly interest; allowing for deduction of tax, the movement on the week is practically nil. Marconis remain at 1¾, Canadians at 5s., Americans at 10s. 6d. There is nothing much to induce purchases of Marconis while other markets are dull, but in any breath of revival the optimists who profess to see the shares at £2 are quite likely to be justified. The Telegraph Manufacturing group is also good. Telegraph Constructions at 37½ have gained a fraction; Callender's preference improved to 5, their par value; British Insulated at 11½ are easier to sell than they are to buy.

Brazil Tractions are lower at 55½, which, allowing for the dividend, makes a fall of a point on the week. The shares fell, in company with most of the active securities round the House, on Tuesday (to-day), when the effect of the Russian news was to make most things weaker. Mexicans are fairly steady, and Anglo-Argentine Tramways 1st preference continue to improve. The Buenos Aires Port and City Tramways Co. has circularised its bondholders, through the committee, to the effect that a new scheme of re-organisation is under consideration. There is an idea that a fresh first charge debenture stock will be issued, and possibly income bonds as well, in exchange for the existing bonds.

The Home Electricity list is very quiet. County of Londons stand at ⅛ harder at 11½, but apart from this there is not a quotable change in the catalogue. Nor is the Miscellaneous list much different, from the point of view of movements in prices. Castner-Kellners are good at $3\frac{5}{16}$, and there was a slight recovery in Edison & Swan partly-paid shares. The Chiswick Electricity Supply Corporation proposes to pay a dividend on the shares at the rate of 6 per cent. for the year.

East London Railway ordinary stock has been changing hands fairly frequently about 4½, and this has caused a recrudescence of some of those rumours with which we grew so familiar some years ago, as to the company being taken over by one or other of its bigger brethren.

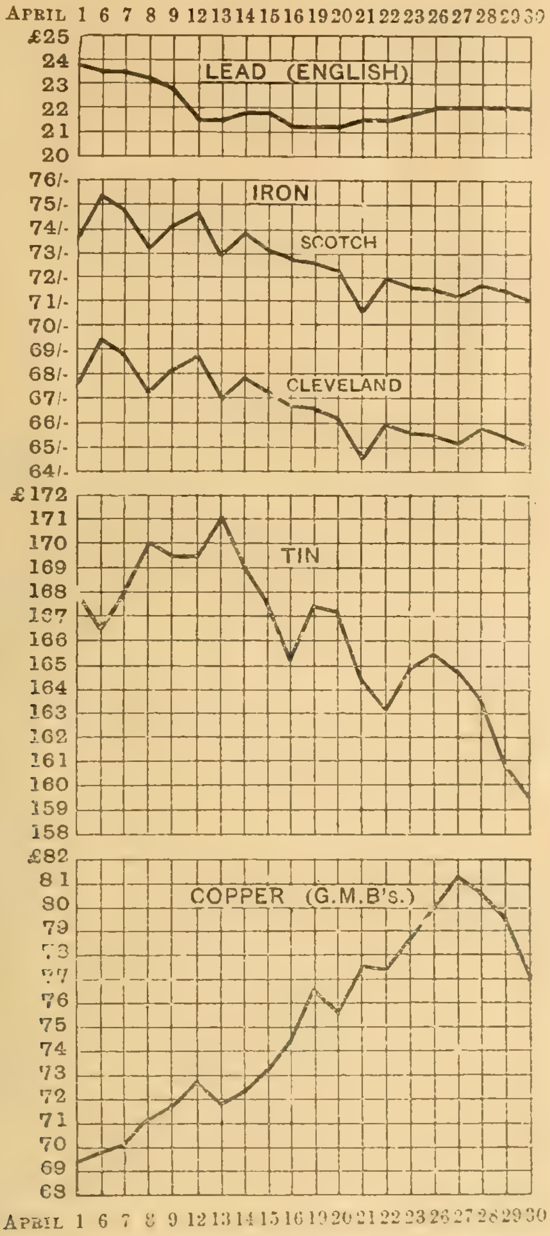
Rubber shares have weakened, on profit-taking by those who thought, justifiably enough, that prices had been run up rather rapidly, and that a time of reaction was due. The price of the raw material, after giving way for several consecutive days, took a turn for the better and is on the mend again. Armament shares are also droopy, mainly on account of the Government's decision to curtail war profits and on the serious state of affairs which is said to prevail amongst a section of the men employed upon the work of turning out munitions of war. The Budget is not likely to affect the stock markets in any material manner.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	May 4, 1915.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.				
Brompton Ordinary	10	8¼	—	£6 1 3
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4½	—	5 11 1
do. do. do. 4½ Pref.	4½	4⅛	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	14⅝	—	6 5 2
do. do. 6 per cent. Pref.	6	12¼	—	4 18 0
do. do. 5 Deb.	5	112	—	4 9 3
do. do. 4½ Deb.	4½	98	—	4 11 10
County of London	7	11½	+ ⅛	6 1 9
do. do. 6 per cent. Pref.	6	11¾	—	5 3 6
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	95 xd	—	4 14 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1¾	—	6 18 0
do. do. 6 per cent. Pref.	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	3½	3⅛	—	5 12 5
do. 4½ per cent. Pref.	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	75	—	4 13 4
St. James' and Pall Mall	10	8	—	6 5 0
do. do. do. 7 per cent. Pref.	7	6⅝	—	5 9 10
do. do. do. 3½ Deb.	3½	80	—	4 7 6
South London	5	8	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7½	—	6 0 0
do. 4½ Pref.	4½	4⅞	—	4 12 4
TELEGRAPHS AND TELEPHONES.				
Anglo-Am. Tel. Pref.	6	106½ xd	+1½	5 12 8
do. Def.	1½	22¾	— ½	6 11 10
Chile Telephone	8	6⅞	+ ½	5 16 5
Cuba Sub. Ord.	5½	8¾	—	6 5 9
do. Pref.	10	16	+ ½	6 5 0
Eastern Extension	7	13½	—	5 5 8
do. 4 Deb.	4	92	—	4 7 0
Eastern Tel. Ord.	7	136	—	5 8 0
do. 3½ Pref.	3½	74	—	4 14 7
do. 4 Deb.	4	93	—	4 7 0
Globe Tel. and T. Ord.	6	11½	—	5 6 8
do. Pref.	6	12	— ½	5 0 0
Gt. Northern Tel.	22	32	+2	6 17 6
Indo-European	65/-	56	+1	5 16 1
Marconi	20	1¾	—	11 8 6
New York Tel. 4½	4½	98 xd	—	4 11 6
Oriental Telephone Ord.	10	$2\frac{1}{16}$	+ $\frac{1}{16}$	4 17 0
do. Pref.	6	$1\frac{3}{16}$	—	5 1 1
Tel. Egypt Deb.	4½	88	— ½	5 2 8
United R. Plate Tel.	8	6½	+ ½	6 3 1
do. Pref.	5	5	—	5 0 0
West India and Pan.	1	$1\frac{5}{16}$	—	3 16 2
Western Telegraph	7	13⅝	—	5 2 8
do. 4 Deb.	4	92½	— ½	4 6 6
HOME RAILS.				
Central London, Ord. Assented	4	78	+ ½	5 8 2
Metropolitan	1½	29½	—1	4 4 9
do. District	Nil	17	— ½	Nil
Underground Electric Ordinary	Nil	$1\frac{13}{16}$	—	Nil
do. do. "A"	Nil	5/6	– 3d.	Nil
do. do. Income	6	81	—	7 8 8
FOREIGN TRAMS, &c.				
Anglo-Arg. Trams, First Pref.	5½	$4\frac{7}{16}$	+ ⅛	6 4 0
do. 2nd Pref.	5½	3⅛	—	7 2 0
do. 4 Deb.	4	83	—	4 16 5
do. 4½ Deb.	4½	89	–1	5 0 0
do. 5 Deb.	5	89½	—	5 11 9
Brazil Tractions	6	55½ xd	—1	10 16 2
Bombay Electric Pref.	6	10⅜	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	80	—	Nil
do. 5 per cent. Bonds	—	58	—	Nil
do. 6 per cent. Bonds	—	85	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	42	—	Nil
do. 1st Bonds	—	50	—	—
Adelaide Sup. 6 per cent. Pref.	6	5¼	—	5 14 3
do. 5 Deb.	5	103	—	4 17 1
MANUFACTURING COMPANIES.				
Babcock & Wilcox	14	52/-	—	5 7 8
British Aluminium Ord.	5	20/6	—	4 17 7
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	11½	—	6 10 5
do. Pref.	6	6⅞	—	5 0 0
British Westinghouse Pref.	7½	$1\frac{15}{16}$	—	7 15 0
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	99	—	6 1 3
Callenders	15	12	—	8 6 8
do. 5 Pref.	5	5	+ ⅛	5 0 0
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	$3\frac{5}{16}$	—	4 10 6
Edison & Swan, £3 pd.	Nil	13/3	+3d.	Nil
do. do. fully paid	Nil	1¾	—	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	5	13/6	—	7 5 6
do. do. Pref.	7	1	—	7 0 6
Gen. Elec. Pref.	6	10⅛	—	5 18 5
Henleys	20	14½	—	6 18 0
do. 4½ Pref.	4½	4⅞	—	4 12 4
do. 4½ Deb.	4½	97	—	4 12 9
India-Rubber	5	9⅛	—	5 9 7
Telegraph Con.	20	37½	+ ½	5 8 6

METAL MARKET.

Fluctuations in April.



A New Radioscopic Process for Localising Bullets.—A very simple method of finding the depth of a foreign body in the flesh is described in the *Génie Civil*, as the invention of Messrs. Hirtz & Gallot. The patient is laid on a table, with the X-ray tube beneath it, and a fluorescent screen with a hole at its centre is supported above him. The tube and screen are moved so that the vertical ray from the tube throws the shadow of the bullet or splinter on the hole in the screen, and a mark is made on the skin of the patient at that spot. The tube is then moved in any direction in a horizontal plane, and the new position of the shadow is marked on the screen. The patient is then removed, and the screen replaced in the same position as before. The tube, still in its last position, is operated, and a plumb bob is lowered through the hole in the screen, until its shadow falls upon the spot marked on the screen: the bob is then in the exact position previously occupied by the bullet, and the depth of the latter is thus at once obtained.

East Africa Protectorate.—The annual report for 1913, by Mr. F. W. Major, Chief of Customs, East Africa Protectorate, shows that the value of imports of electrical apparatus advanced by £3,481 to £6,970. Industrial machinery imports were up by £15,199 at £66,771. All classes of metals, manufactured and unmanufactured, porcelain, china and earthenware, iron and steel ware, and hardware, also scientific instruments showed satisfactory advances. The enormous expansion in industrial machinery is more apparent when it is mentioned that the figure of £66,771, compares with only £21,065 two years earlier. Machinery imports of all kinds take the fifth place in order of value. Telegraph materials almost entirely British imported for the past three years have been £16,795, £19,839 and £10,048 for 1912-13-14 respectively.

POWER PLANT TESTING.

At a meeting of the Scottish Local Section of the Institution of Electrical Engineers on April 13th, a discussion took place on Mr. Selvey's paper on power plant testing, which was abstracted in our issues of December 11th and 18th, 1914.

Mr. W. W. Lackie (Glasgow), while agreeing that in cities, towns, and areas having a population of over 500,000 there would be a complete obsolescence, in from eight to ten years, of plant purchased at the present time—rated at less than 5,000 kw. in the case of turbo-alternators or 30,000 lb. for boilers—he did not think that this was a correct statement as applied to smaller towns. He agreed that they might look forward to a load factor of approximately 50 per cent. on their works, and that economy in fuel ought to be one of the first considerations in buying new plant; but in his figures to show the importance of low steam consumption, he thought Mr. Selvey rather over-stated the case. Mr. Selvey had entirely omitted to take into consideration the extra interest, depreciation, and sinking fund on the additional £24,000, and that at 8 per cent. represented £1,900, or over £15,000 in eight years. The net result was that the machine taking 1 lb. less per kw.-hour on 8,000 hours' load was worth only £8,600 more, and on 4,000 hours' load it would be worth only £4,300 more. He did not wish to depreciate the importance of steam consumption, indeed Mr. Selvey could have gone further. If a set of turbines was bought to take 5 per cent. less steam it followed that 5 per cent. less boiler plant would suffice also. As to the testing of plant, within recent years they had had to test 3,000, 4,000, and 6,000-kw. turbines and boilers of 30,000 lb. evaporation. One series of tests represented ten sets of readings, and it took 110 sheets of foolscap to make a proper record of these tests, necessitating a staff of 20 to 24 men, but the importance of having the facts accurately set down was seen when one remembered that every tenth of a pound of steam over 13.7 lb. meant a penalty of £750 to the contractors. He did not think that any manufacturer would agree to let the plant run for six months before a test was made, unless he got payment for the plant on erection, and, alternatively, no buyer would agree to pay for the plant until it was officially tested. The plant should be tested as soon as possible after erection, and again twelve months thereafter; but before the second test the contractor should have an opportunity of examining the turbine, and there should be no decrease in the efficiency of the turbine at the end of that period.

Mr. Page (Glasgow) pointed out that the difficulties between buyer and seller arose when the tests proved non-compliance with the specification, more especially if the tests were carried through by engineers in the buyer's employment. This showed the desirability of having specialists who would be accepted by both parties to carry out tests. The trouble all along had been that there were so many variables. On getting in tenders, the steam consumptions were invariably given with a margin of 2½ per cent. They had succeeded sometimes in getting the successful contractor to depart from this stipulation, but the I.E.E. Model General Conditions embodied an allowance to cover errors in observation: The remarks on obsolescence hardly applied to boilers in the same sense as to turbines. The smaller size of water-tube boiler with, say, 1,000 sq. ft. heating surface, installed 20 years ago, was just as efficient to-day as boilers put down recently. The same certainly could not be claimed for turbo-alternators. He could confirm what was done in power stations with new turbines in running them almost continuously. [illegible] the Glasgow Electricity Department installed a 6,000-kw. set. It was hardly fair to take the figures for the first six months, because during that time the turbine had to be tuned up, but if they took the second six months of the first year of that plant's life, he found they ran this 6,000-kw. set for 55 per cent. of the total load, and that it was responsible for 22½ million units out of a total output of 33½ million units, which only left 11 million units to be taken from the other plant. The capacity of the plant was 22,000 kw., leaving 16,000 kw. after the 6,000 kw. set was accounted for. Over the year the 6,000 kw. machine generated [illegible] out of the total of 61,000,000 units, although the total plant capacity was fully 22,000 kw., and that fully bore out Mr. Selvey's contention, that one-tenth of a pound of steam saved was extremely valuable. Automatic CO₂ apparatus required to be used with discretion, the firemen being apt to cut down the water and thus lower the output of the boiler [illegible] high CO₂. Indicating steam meters [illegible] greatly not only to work in conjunction with the CO₂ apparatus, but in the event of a shortage of steam to tell the engineer in charge where the trouble lay. In Glasgow they made a [illegible] practice of having [illegible] boiler. It served the same purpose as [illegible] generator, and had been found to be a thoroughly sound investment. Draught gauges connected above the fire and between the top of the fire and the back end of the boiler served not only their legitimate functions, but also showed at once when the boiler required cleaning. They had found this to be an even more certain way than going by the readings of thermometers, as excess air tended to lead them astray when depending upon the thermometers at the boiler and economiser [illegible] As to the analyses, they found they could now buy [illegible] on the daily figures obtained in the Electricity Department laboratory. Mr. Selvey spoke of the higher calorific value [illegible], but manufacturers were not much inclined to depart from the older method which employed a lower calorific value. Some pronouncement was wanted on the exact number of B.TH.U. in a KW.-hour. Marks and Davis put it at 3,415. Some of the engineering year-books gave it as high as 3,420, and manufacturers varied from 3,411 to 3,415. When considering tenders the difference in these figures had its effect in getting at a fair comparison. They had found that the rotary air pump performed its work very well, but some forms took too long to create the vacuum in the condenser at starting. Where steam or water ejectors were employed this time was greatly reduced. The figure of 1.3 lb. of air per 1,000 lb. of steam was much too high. An air pump capable of handling that quantity of air and yet only being called upon to deal with about 0.4 lb. per 1,000 lb. was wasting power continually. The better arrangement was to put in two sets of air pumps, each capable of dealing with 0.5 lb. per 1,000 lb. and run only one under normal conditions, the other being brought into service when there was excessive air leakage or when there was something wrong with the first one. The temperature of the sealing water to these rotary air pumps should be kept down, as this had a bearing on the power taken to drive them. On the question of the size of surface condensers, to allow one square foot of surface for every 5 lb. of steam seemed to him on the high side. Even with high inlet cooling water temperature, where K had to be run up, 1 sq. ft. to 6 lb. should be enough, and on jobs where the inlet cooling water temperature might be as low as 50° F., 7½ lb. ought to be condensed per sq. ft. The coefficient of heat transmission referred to as K would repay study. It ought never to be referred to unless the whole application of this factor was thoroughly understood. For instance, it might be as low as [illegible] as high as [illegible], and it depended upon local conditions; and the correct K for one job was probably quite wrong for the next. The tendency, however, when the cooling surface was not specified, was to keep that down, working with high K brought about by high velocity of the cooling water through the tubes. In plant running on a good load factor this might mean very high pumping costs, and as a rule it generally paid to buy more surface and keep down the friction head against the pumps.

Mr. D. A. **Starr** (Glasgow) thought that high efficiency was sometimes obtained at the expense of good mechanical construction, and good efficiency could be obtained sometimes with more rugged construction and better clearance between running parts, etc. No matter how carefully the testing was carried out, the main thing was the economical operation of the plant afterwards, and he thought it was important to watch results very carefully from the coal to the output of the station. In many undertakings the class of fuel varied, not only in calorific value but in size and quality also, and if careful analysis was made and the size of coal kept account of week after week, in conjunction with the load factor of the station, the output and the relative demand on the sizes of units in commission, as well as the lb. of coal per unit sent out, and the cost per ton of each class would indicate in the cost per unit whether the plant was keeping within its test conditions.

Mr. J. K. **Stothert** (Glasgow) emphasised the need for experienced and expert observers. Unless the methods for making the various measurements required in boiler trials were standardised and of calculating efficiencies were on the same basis, the results, apart from the accuracy of observations, were bound to be different and possibly misleading. He thought that the report of the Committee of the Institution of Civil Engineers on tabulating the results of steam engine and boiler trials recently published, if adhered to by engineers, would tend to attain the object which the author had in view. The author attached too much importance to the value of the CO_2 measurements, which might be used to cause a waste of money instead of the saving counted on. As a matter of practice, the cost of evaporating 1,000 gallons was the best test, and the CO_2 records were a guide to help them to attain the result. There was a good deal to be said for the author's desire for specially designed furnaces for each class of fuel, but he was afraid that this was ideal. Manufacturers had to aim at an average plant, and he had often known cases of specially designed furnaces for a particular class of fuel which had proved a disadvantage to steam raising when the particular kind of coal was unavailable.

In the course of his reply, Mr. **Selvey** said that he found it took six months to tune up a plant, and, personally, he would not advise testing until that period had elapsed. A matter of 3 per cent. reduction in efficiency was not likely to occur on large sets, but it certainly occurred a great deal upon some of the smaller power station sets, and it arose very often through running with too fine clearances. There were many pitfalls in testing, and people seldom got within 2 to 4 per cent. He had not been pleading for a very high CO_2, but he thought 6 per cent. was upon the low side and ought to be improved. A very high CO_2 in the absence of complete knowledge had often led to extraordinary results. The question about K was rather a subtle one, and there was no doubt generally that they were returning to a reasonable water velocity and consequently a more reasonable pump power. A furnace was usually specially designed for a poor class of coal, and there was no difficulty in running in a better class of fuel. He was recently testing a new gas engine, of which the makers wanted to know the lower calorific value. He spent six weeks in trying to find that out, and he had great pleasure in telling them that there was no such thing. He consulted twenty-two authorities and text-books, and the ultimate conclusion he came to was that there was complete disagreement, while as to the value of the B.TH.U. per KW.-hour he would say it was 3,413.7.

THE POWER SUPPLY OF THE CENTRAL MINING-RAND MINES GROUP.

By J. H. RIDER, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 15th*, 1915.)

(*Continued from page* 636.)

In 1913 a new type of control apparatus was suggested by the South African General Electrical Company (G.E. Co., of America). The general arrangement of this apparatus is as follows:—

(1) Electrically-operated contactor switches are used for the stator circuits, similar to those now working on several 3-phase winders on mines of the group.

(2) The rotor resistance is of the metallic type, the various sections being cut in and out by a series of nine 3-pole electrically-operated contactor switches.

(3) The operation of the stator and rotor contactor switches is effected by a small master controller of the cylindrical type mounted on the driver's platform. The controller lever moves in a similar manner to the ordinary operating lever.

(4) The rate of accelerating the speed of the motor is automatically controlled by a relay system in the rotor circuit, so that, although the control lever may be put right over at the start, no succeeding rotor switch closes until the rotor current, which has increased on the closing of the preceding rotor switch, has fallen to a predetermined and adjustable amount.

The advantages claimed for this method of control were:—

(*a*) No heavy work is imposed on the driver in operating the control lever.

(*b*) No energy is wasted in continually pumping electrolyte.

(*c*) The full speed of the motor is obtained, as, when the last rotor switch closes, the rotor is metallically short-circuited.

(*d*) No energy is wasted in the rotor resistance during the period of full-speed running, but only during the periods of acceleration and retardation.

(*e*) There is no possible risk of flashing over, however quickly the control lever is operated.

(*f*) There is no cooling pipe system to be kept clean and in order.

The equipment was erected in the winding engine-room at the Village Main Reef, Ltd., and was used with great success for several weeks, during which time the drivers expressed themselves as being very well satisfied with it. Several defects in the apparatus appeared, however, as follows:—

(1) The control gear was mounted on a pipe framework on the light wooden floor of the engine-room. The continual opening and closing of the contactors shook the bolts loose, and it was soon seen that the mounting was too light and should be on a solid floor.

(2) The rotor resistance was formed of metallic grids, built up in frames like an ordinary tramcar resistance. These frames were arranged in a metal tank filled with water to keep down the temperature. The water and the electrolytic action gradually destroyed the insulation between the grid sections, and affected the cable contacts on the grids.

Apart from these defects the general working was so satisfactory that it was decided to re-erect the control gear on a solid framework and foundations in a small house outside the engine-room, and to use, instead of cast-iron grids under water, a series of air-cooled rods or tubes for the main portion of the rotor resistance and three iron plates in water for the remainder. Several experiments were made to ascertain the correct size and lengths of the rods, and the whole arrangement as completed now appears to be quite sound and effective. The gear is illustrated in figs. 2 and 3.

Fig. 2 shows the stator contactor switches and fig. 3 the rotor contactor switches. It is in successful daily operation at the Village Main Reef G. M. Company, Ltd. Although a little more expensive in prime cost than the ordinary type of liquid control, this is more than repaid by the effectiveness and the saving of the heavy losses in the rotor resistance during the times of full-speed running.

With a view to obtaining competitive arrangements, the author, in July, 1914, sent particulars of the contactor-relay system of control to a British firm which claims to be expert in that class of work. It took nearly five months for a reply, other than an acknowledgment, to be received, and then the information sent was entirely useless. Wake up, England!

Electrically-operated contactor switches for the stator circuits are used with great success on several 3-phase winders of the group. The contacts are self-cleaning and are broken under a magnetic blow-out, and the maintenance is exceedingly small when compared with the ordinary pattern of oil switch. A contactor switch is shown in fig. 4, from which its essential parts will be seen.

Manufacturers do not seem to realise the nature of the duties which winder oil-break switches have to perform, and they usually supply the ordinary switchboard type. While the latter is only called upon to open and close feeder or machine circuits occasionally, and generally with no load on at the time, switches for 3-phase winders frequently have to make and break circuits from 500 to 1,000 times per day, and the breaking is usually done under full load. It requires a very substantial switch to stand up to this sort of work, and the arcing contacts and the oil have to be renewed at least once a week. This is a very "messy" and expensive job, and contactor switches are being insisted upon for all future 3-phase winders. On a 3-phase winder at Rose Deep, Ltd., these switches have made and broken the stator circuits over 388,000 times without any cost whatsoever for repairs or maintenance.

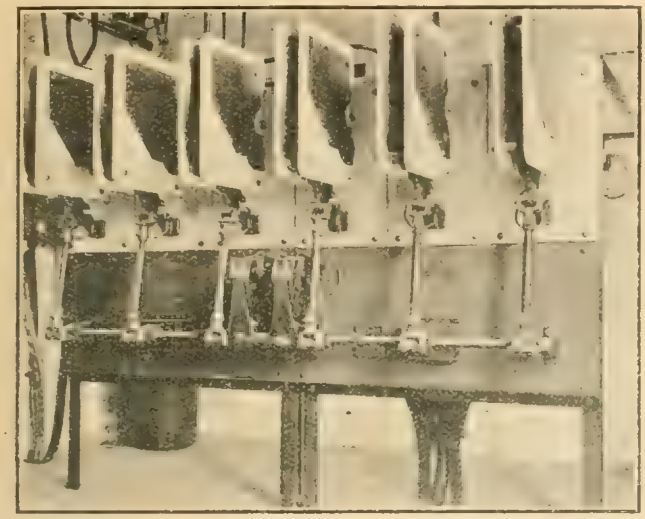


Fig. 2.—Stator Contactor Switches.

The deeper the shaft the cheaper is the 3-phase system compared with the Ward Leonard, particularly if the contactor system of rotor control is used, because with the latter the resistance losses are entirely eliminated at full speed. With balanced (double-drum) winders working without a tail rope, there is, however, a limit to the depth at which a 3-phase winder is the more economical, because the weight of the descending rope ultimately overbalances the weight of the ascending load and reverse current has to be applied to prevent the winder running away. Such energy has to be paid for, but with the Ward Leonard winder the greater part of the breaking energy can be returned to the line. There is therefore not only the saving of a loss, but a distinct gain to be made.

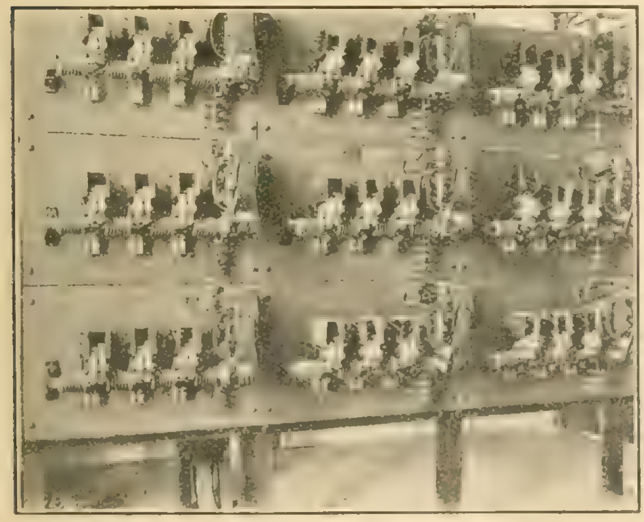


Fig. 3.—Rotor Contactor Switches.

For a winder which is frequently or constantly used for lowering loads, such as men or material, or, in some cases of inclined shafts, lowering rock to a point where it can be better raised by a vertical shaft winder, the Ward Leonard system is much to be preferred.

It is only by drawing out a diagram for each individual case that a proper decision can be made as to which type of winder is the correct one to employ.

One advantage which the 3-phase winder has over the Ward Leonard is that geared motors running at 375 R.P.M., or at higher speeds, can be most conveniently employed in the majority of cases, which not only means a much cheaper equipment, but a better and more economical motor than if a direct-coupled one were used. With the Ward Leonard system a direct-coupled low-speed motor, although more expensive, gives a better working machine.

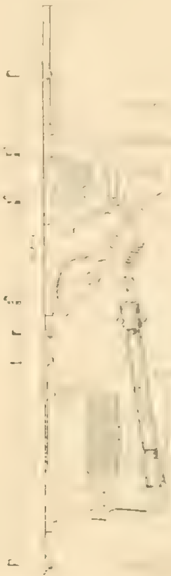


Fig. 4.—Electrically-operated Contactor Switch.

Most of the so-called overwinding accidents which have occurred on the Rand have been caused, not by any failure to stop the skip, but by starting the winder in the wrong direction when one skip is at the tipping point. In such cases the skip is pulled into the headgear sheaves before the winder drum has made half a turn.

Overwinding devices which cut off the supply of energy when the skip has reached a pre-determined point are not of much use for avoiding such accidents, because the driver must retain full command of the winder, in whatever position the skip is, to be able to bring the skip to the exact tipping point. This operation frequently calls for slight movements of the winder after it has first been stopped.

In 1912 the author's attention was directed to an electrical

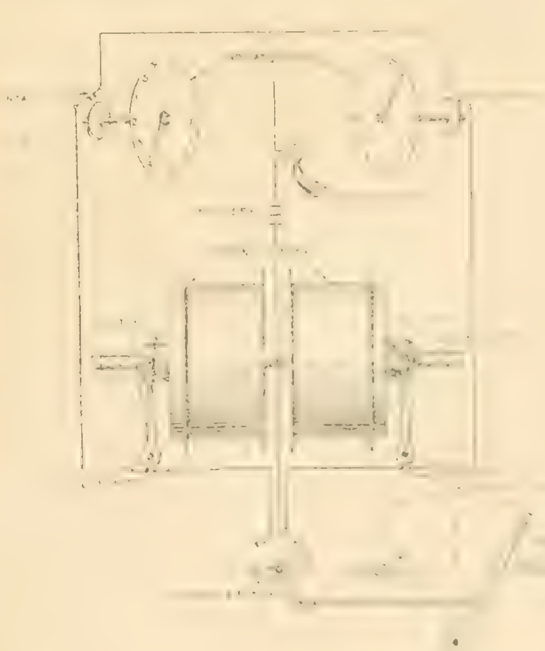


Fig. [illegible]

device in use at the [illegible] and Jack East mine, near Johannesburg, the invention of Mr. W. Philip, the resident engineer, which, it was claimed, would give unmistakable warning to the driver if he attempted to start the winder in the wrong direction with the skip in the tip without in any way taking from him the full command of the winder. [illegible] was found to be fully justified, [illegible] the [illegible] of the winders on the mines of the group have been fitted with the Philip device. The action is as follows:—

A 2-way controller switch is connected to the driver's operating lever, so that the contacts are open when the lever is in the neutral or "off" position. A slight motion of the lever in either direction closes the contacts on one side or the other. An insulated disk, with a short metallic insertion on the edge, is fixed on the spindle of each depth indicator dial, with two contacts arranged so that the circuit is closed when the depth indicator shows the skip to be anywhere in the region between the headgear sheaves and, say, 150 ft. below the collar of the shaft.

A battery and a loud warning hooter complete the apparatus, which is connected up as shown in fig. 5. In the case of winders with loose drums operated through clutches (a great many of these winders are in use on the Rand to wind from different levels) an auxiliary contact is provided which is broken when the clutch is open and the brakes are holding that drum.

By following through the connections it will be seen that when a skip is within what may be called the "danger zone" the smallest movement of the operating lever in the direction to raise the skip will sound the hooter, which is placed close to the driver. He is at once warned, and unless he has deliberately put his lever into that position he quickly pulls it back before any damage has been done. He can only raise the skip within the danger zone with the full knowledge of what he is doing, and he is also warned by the hooter if he keeps the power on past the pre-determined point in the shaft. This simple apparatus has already been the means of preventing a great many accidents.

(*To be continued.*)

Discussion at Manchester.

Mr. S. J. Watson said it was difficult to understand why the power plant load factor should be about 75 per cent. whilst the load factor of the air system was only 30 per cent. The 75 per cent. load factor indicated that some of the processes were working right through the 24 hours, and presumably the processes employing air compressors were only used part time.

Mr. A. E. MacKenzie said the author had uttered a word of warning, which some engineers present would perhaps have to take to heart during the next few years, in stating that it was only courting failure to attempt to give a permanent and reliable supply without a proper reserve of generating and transforming plant. Many central station engineers in this country would be pleased indeed to have the reserve of 25 per cent. which the author considered essential for a large supply like the Rand. It was difficult to understand why the power company stipulated in their agreement a possible frequency variation of 10 per cent.; such a variation would not be good enough for a Lancashire cotton mill owner, and considering a 75 per cent. load factor and the serious trouble encountered by the author with stamps and speed of rotary mills, it would appear that this variation was frequently obtained. The expense of three meters was warranted in view of the immense power to be metered. It would appear advantageous to have each series of three composed of different types, preferably with different characteristics. The author stated, "It is a very common and erroneous practice to install oil switches without considering the volts that they may be called upon to deal with." In justice to engineers in this country, the author should substitute "was" instead of "is," as this feature had been generally recognised in this country for a long time. Regarding a switchboard maker's guarantee as to the maximum kw. which could be safely broken at normal voltage, the speaker would not place the slightest reliance upon such a guarantee.

Mr. Alcock was much impressed by the permissible pressure variation of 10 per cent. up or down, especially having regard to the necessity of uniform speeds in certain operations. It would be interesting to consider how far this power supply would have been commercially feasible if in the first place the power company had been compelled to deliver energy under the rather restricted variations prescribed by the Board of Trade.

Mr. W. H. Lea, who returned from the Rand about nine years ago, expressed his surprise at the phenomenal change in plant which had taken place since he left. The weights of the stamps ten years ago varied from 750 to 1,250 lb., whereas to-day they were 2,000 lb. Again, the heaviest skip load encountered by the speaker was four tons, against the modern eight tons. The suggestion had been made some years ago to employ taper ropes having a top diameter of about 2 in. and bottom diameter about ⅞ in.; had this been developed? The idea of placing the crushers at right angles to each other was quite novel and good.

Mr. Cramp asked why, both in the present paper and that read by Mr. Sparks, nearly the whole of the mining machinery appeared to have been obtained anywhere but in this country. If the motors, centrifugal pumps, and compressors were better designed and better made abroad, the sooner this was realised the better; if such was not the case, what was the reason for so little of the machinery being made here? It was clear that recently some of the switches had not been made abroad, and it was only fair to the English that the point should be emphasised. If it were simply a question of price, that was another matter. Regarding the control of winding machinery, the cascade motor had not been mentioned, but nevertheless was worthy of consideration. Instead of wasting the energy absorbed in the rotor resistance, the intermediate system might be adopted, whereby the rotor currents were led to a small polyphase motor which would make use of the energy so provided to drive additional machinery. This system had been successfully adopted in mining in this country. In any case it was more efficient than the plain polyphase system, and actually was about a mean in cost and efficiency between the plain polyphase system and the Ward Leonard control. The author's use of the term "root mean square" was not clear.

The Author, in reply, said that under the agreement with the power company the Rand Mines group took the whole of their power from the company. Steam plant was entirely scrapped. The price paid was 0.525d. per unit, but with certain discounts dependent upon the carriage on coal, etc., the net price came down in round figures to 0.5d. The air unit was paid for at the same figure. Regarding the large difference between the load factors for electricity supply and air supply, the reduction operations on the mines continued uninterruptedly except for a few hours a month to clean up. The only variable electrical load was the winding, the pump load and everything else was constant. If the winders were removed, the load factor would increase from 75 per cent. to 98 per cent. The air load factor, on the other hand, was low on account of the drilling, which could not be a continuous operation. The drilling was done on a single shift, and generally finished about one or two o'clock in the day. The hole was then charged and blasted. Some mines had two drilling shifts, one day and one night shift, which improved the load factor, but it could never be as good as the electrical load factor because of the time occupied in charging, blasting, and clearing away the rock. The gate meter was certainly better than the Venturi, and anyone interested in air meters should consult Mr. Hodgson, who was an expert on such matters. Contrary to Mr. Alcock's assertion, pressure variations did not affect the speed, this being governed by the frequency. The transformers used by the power company were oil cooled, with a natural air draught coming in from outside. The question of taper ropes raised by Mr. Lea brought up an old story and an important point. The depth from which a winder could draw rock was dependent upon the rope, and if carried to extreme depth the rope alone would represent the full load without any addition. This point led to the suggestion and trial of the taper ropes referred to by Mr. Lea, but they were quickly given up. The author had no actual report of the reason of failure, but suggested that difficulties were experienced in working such ropes on the drums. The existing ropes were 2 in. in diameter, and the greatest depth of any winder was 4,144 ft. There was another reason besides that of the rope which determined whether one or two winders should be used, one winder being at a lower stage. A deep shaft of, say, 5,000 ft., using only one winder would produce 5 to 8 tons at one operation, and with the winder going at 2,500 ft. per minute would take 2 minutes to get the rock to the top. If another winder were installed half way down, so as to wind in two stages, twice the amount of rock could be dealt with in the same time. This was the critical point determining whether to use one winder or two. Regarding remaining steam plant, as stated previously, the whole of the Rand group was electrified, but there were other mines on the Rand which had not contracted for the whole of their supply and retained steam, particularly for winders, because unless they contracted for the whole supply they could not get a flat rate. They chose that type of load on their mines which gave the best load factor, and thereby brought their rate down. In reply to Mr. Cramp, more than half the plant was ordered out of England, a good deal being bought from America. The author had pointed out to the owners that there were points other than price to be considered in placing orders, but, nevertheless, three-quarters of the plant was ordered almost entirely on a price basis. Lately, however, matters were altered and the price question had been largely eliminated in favour of quality. Reliability was the first demand, and efficiency to the purchaser meant something which would always run and give no trouble with ordinary attention. Balanced three-phase meters were used throughout, as the loads, except in the case of a few odd circuits, were balanced. There were no three-phase cascade motors on the Rand group, and the author did not feel disposed to go out of his way to adopt them. If a plain three-phase winder was unsuitable, the Ward Leonard type would be installed. The formula for the air meter had been proved correct by the measurements of the displacement meter. The size of the orifice should be about ¾ in., which could be made within reasonable limits, say, ⅛ in up or down. It could be used without objection if it came within those limits. There was no apparent reason why rope-driving should not be used other than the enormous amount of space occupied by the rope drive. It was much cheaper and better in every respect to install high-speed compressors. The author had no figures regarding air losses in pipes, but emphasised the importance of maintaining a good air pressure at the drills. The definition "root mean square" was not, perhaps, a scientific expression, but its meaning was obvious: it was the true average horse-power which the plant was called upon to do. The term was in common use on the Rand, and if it were stated that a winder had a root-mean-square power of 2,000, it meant that in starting the machine might have to develop 4,000 h.p. for a short time.

THE RHEOSTATIC CONTROL OF SEPARATELY EXCITED GENERATORS.*

By L. Boothman.

The use of a main field rheostat in conjunction with an exciter field rheostat is in some cases necessary, particularly where the voltage of the exciter circuit must be kept perfectly constant—for instance, where the exciter is also being used for lighting purposes; but in most cases the main field rheostat can be dispensed with entirely and the whole regulation obtained by the exciter field rheostat alone. The resultant saving in first cost, the saving of a continual larger watt loss due to a main field rheostat, and the saving in space, together with the increased simplicity of a single rheostat, make the use of such a method of control worthy of consideration. Such rheostats, however, must have a large number of steps of resistance in order to compensate for the following variable factors:—

The forms of two curves are required to be known for stepping out the rheostat resistance, namely, the load saturation curve of the generator and that of the exciter. These curves are usually calculated or are taken from tests of similar machines, and in either case some variation is to be expected, due to natural differences in material and differences in reluctance of the joints in the magnetic circuit.

Again, there is approximately twenty per cent. resistance variation in both machine fields from the cold to the final temperature when running, thereby displacing by a proportionate amount, during this period, the working position of the exciter field rheostat.

A further variation may be produced if an alteration in speed occurs, especially at low loads, if the exciter saturation curve approximates a straight line form at this position. This, of course, raises or lowers the terminal voltage of the generator in sympathy with the alteration in speed.

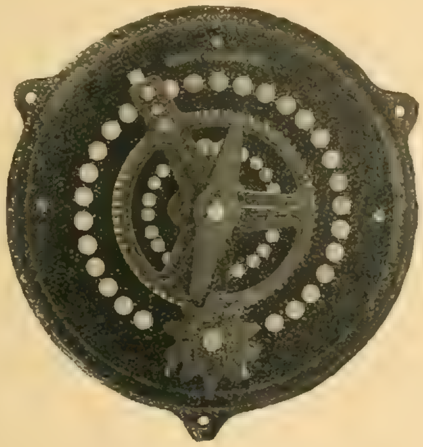


Fig. 1.—Type "MBR" Field Rheostat giving 280 to 308 Steps.

Displacement of the commutating brushes of the exciter from the correct or neutral position, particularly if the machine has interpoles, affects the shape of its load saturation curve with a consequent derangement of the stepping of the rheostat resistances.

Where an alternator is designed for a certain power-factor and is run on a load with a different power-factor, the necessary range of exciter voltage is changed. For example, when running on a load with a lower power-factor, a larger amount of resistance is required in the working range of the exciter rheostat.

The rheostat must have a sufficient number of steps to ensure that the permissible variation of generator voltage on load is not exceeded, also, the total ohmic resistance must be sufficient to obtain the lowest generator voltage required at no-load.

The conclusion derived from the above considerations is that an evenly divided resistance in the exciter rheostat is the best proposition in order to cover all the above points.

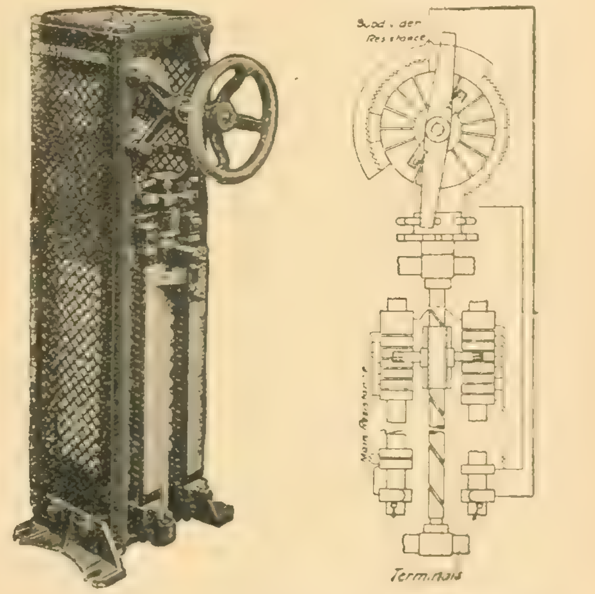
The usual exciter field rheostats now on the market, with about one hundred to one hundred and twenty-five steps maximum, have not a sufficient number of steps to render this proposition possible. If it were attempted to carry it out on them the regulation on the working range would be too "coarse," *i.e.*, there would be too much resistance between each step. In these rheostats, therefore, relatively large steps of resistance are inserted from the "all out" position up to where the estimated working range is reached, and comparatively small steps of resistance are inserted over the working range, with a few large steps at the no-load end to allow of some margin.

What is needed therefore is a rheostat of reasonable dimensions and cost, and with a large enough number of steps to allow of the resistance being stepped out evenly over the whole range. Rheostats which fulfil these conditions have been developed and patented by the British Westinghouse Co., and are shown in figs. 1 and 2. These rheostats, by means of a novel contrivance, give a large number of steps, and at the same time occupy about the same, or less, space than the usual form of exciter field rheostat. They are made in two types, viz.: a "straight" pattern designated MB. St. type with five hundred to five hundred and fifty steps, and a smaller round pattern designated MBR type, with two hundred and eighty to three hundred and eight steps.

The operation of both types is practically the same, and will be readily understood from an explanation of the type MB. St., which is illustrated in fig. 2.

This rheostat consists essentially of two rheostats connected in series, as shown in the diagram, the whole of the resistance of one rheostat called the "subdivider" being equivalent to one step of what is termed the "main" rheostat, which in this type is the straight portion.

By revolving the operating hand-wheel half a revolution in one direction, the ten steps of the subdivider resistance are cut out, and a slight further movement in the same direction puts the whole subdivider again in circuit. Simultaneously with the latter movement the equivalent resistance of one step is cut out of the main rheostat resistance. This is accomplished by means of the double arm, shown in fig. 3, which engages with and revolves the capstan fixed to the quick traverse screw which moves the brush of the main rheostat.



Figs. 2 & 3.—Illustration and Diagram of Type "MB. St." Field Rheostat giving 500 to 550 Steps.

It will be seen, therefore, that each main step of resistance is sub-divided and is cut out in ten steps every time the hand-wheel is rotated half a revolution in the one direction; the action is similar when putting resistance in.

There are in this type fifty steps in the straight portion and ten in the subdivider, thus obtaining, with twenty-five revolutions of the hand-wheel, five hundred steps from the "all in" to the "all out" position.

If the total subdivider resistance is arranged to be only ten-elevenths of the resistance of one main step instead of equal to it, then the eleventh part will be cut "in" or "out" as the case may be, during the transition stage of "balancing," and thus a total of 11 × 50 = 550 steps will be obtained.

As before stated, the type "MBR" rheostat operates in a similar manner to the type "MB. St." just described. In this case, however, the double arm, instead of moving a capstan which actuates a quick moving thread carrying a brush, actuates a toothed wheel which in turn moves, by means of a pinion and gear wheel, a contact arm fitted to an extension of the gear wheel.

The type "MB. St." rheostat is built up of metal and asbestos throughout and has laminated contact brushes. The resistance units are mounted directly on to the studs of the contacts, which is a valuable feature, as it avoids any intermediate leads or wires between the contacts and resistances.

The latter feature also applies to the type "MBR"; in this case, however, the contacts are mounted on a slate panel.

Both of these rheostats should have a large market in their respective spheres, as they are undoubtedly devices which have been needed for a long time.

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* From the *British Westinghouse Gazette*.

PUBLICITY—THE SOUL OF BUSINESS.

By L. P. BENNETT.

"Thousands of pounds wasted daily!" A statement of considerable force; nevertheless it is one that may be equally well applied, and with as much truth, to catalogues and advertising matter generally, as to the waste-paper disposed of each day by the destructor.

The present age is one of catalogues, for to-day every firm, large or small, issues lists, from the bulky volume of the manufacturer to the schedule of prices of the retail man. These catalogues are scattered broadcast in vast quantities every year by post, rail, or contract carrier. Some are issued upon elaborate systems, cleverly thought out in every detail, and seldom fail to reach the right quarter, inevitably repaying the enterprising concern or individual in whose interests they have been compiled, while others—and these the great majority—are foredoomed to failure.

For the purpose of classification, it would be interesting to separate the firms issuing these lists into three classes, viz.:—

(1) The concern which scientifically compiles, produces, and distributes.

(2) The concern which scientifically compiles and produces, but fails in the distribution.

(3) The concern which merely commits so much matter to paper, and leaves chance to be responsible for the distribution.

The results are probably in the same ratio to the cost of production.

Consider these three sections in detail, taking for the first a manufacturing company with a number of wholesale district branches.

At the headquarters of the company there is most probably a department—not necessarily large—exclusively devoted to publicity work. This department would be in close touch with the works manager, and working in concord with the organising secretary, the former regulating the prime costs and output of material, the latter stipulating the profits to be derived. The works manager would also be responsible for the quality of the material being up to the standard of competitive makers, the organising secretary being responsible for the ultimate prices being fixed strictly in line with the market's ruling figures.

In this way, all likely demands on the factory could be promptly met and precipitate advertising avoided, and buyers would invariably find the catalogues of interest and real value, owing to the absence of enhanced or erroneous prices of general market requirements.

So far, it will be observed that the works, organising secretary, and the publicity department, have been in close touch with one another; but from now the publicity department have the matter entirely in their own hands. All details of production, arrangement of descriptive matter, illustrations, and printing, which to adequately describe would require the pen of a publicity expert, are left to them, and the whole undertaking proceeding rapidly under their supervision—a most important point in the issue of any big list, if it is to be of maximum service—the completed publication is soon ready for distribution.

Advance copies are sent to the respective heads of the departments and branch managers, immediately followed up by a small quantity being sent to each branch, and the general distribution then commences. This distribution is started immediately prior to the appearance of the trade Press notices, and should preferably be taken charge of by a supervisor in the publicity department, who has an intimate knowledge of the various clients, and proceeds in the following order:—

(1) Government departments, public bodies, and corporations.

(2) Concerns on the ledger with current accounts (and here the supervisor's duties are to eliminate the casual or chance account to which a general list could be of little service).

(3) Prospective clients.

(4) Consulting engineers, works managers, and chief draughtsmen.

The latter could use the production with advantage when making requisitions upon their own purchasing departments, and in the case of consulting engineers, the publication could be of use in connection with their specified material.

Distribution 3 and 4 would be most effectively carried out by the branches, where managers and travellers are in touch with the more important men and departments, who could not so surely be reached by post or other delivery methods.

Where a company has overseas establishments, the lists are sent in bulk to the colonial or foreign offices, and the distribution is carried out on similar lines, under the direct supervision of the local manager or agent.

The entire system is indexed on a card file, kept up to date by constant revision, particulars of which are sent in at frequent intervals from all branches and the counting-house.

When applications for lists are sent in direct, as the result of Press notices or advertisements, these are indexed in a similar way, and the branch concerned is immediately notified. These applications in connection with any big lists or publications are confirmed by the branch before despatch. Thus waste is avoided, and it is reasonably certain that the catalogues are not being sent to any undesirable individuals or firms. By this system, losses are reduced to a minimum, returns through faulty despatch are negligible, and the issue is consumed in the best directions, and, above all, no waste is encountered by quantities of the lists being hoarded and eventually destroyed, owing to their becoming out of date.

Three-quarters of the complete issue thus disposed of, the remaining portion is left for distribution against subsequent demands from the head office or the branches.

For Section 2, a similar company might be illustrated, which, though possessing a department fully capable of producing a catalogue equal in every respect to that of the firm just considered gives that department no control over the distribution, or, again, specialising only in production, lacks the initiative or interest necessary for successful distribution. In this case, the work is left largely to the efforts of the junior members of the staff, who, without the help of an adequate system, invariably fail in securing the desired results.

The issue is made before the works are in a position to supply, and the departmental heads are often left to learn from outside sources that a new list is being circulated.

Press notices are frequently overlooked, and it is certain that numerous individuals secure a copy of an expensive list which is of no possible value to them. Returns are plentiful, owing to inaccurate addressing, and in all probability the "official" distribution is considered complete with a large supply of the lists still available. Upon their gradually becoming obsolete, they are finally destroyed to make room for new publications. It would be impossible to obtain an accurate estimate of the resultant loss, for, in addition to the production expenses and the cost of the faulty distribution, there is the more important factor of orders lost which might otherwise have been secured.

Take for Section 3 concerns well known to almost everyone, because they are so numerous. Collectively, they produce vast quantities of printed matter, which can hardly be described by any other term. True, the issue may be bound in a cover of striking colour, but should a buyer secure a copy by any means, it is immediately recognised as of no value or interest, and is therefore rapidly shelved, its very colour denoting that it is the one catalogue amongst all others to be avoided.

It is in this section that the waste is most pronounced. No correct calculations of requirements are made, and to avoid shortage, excess quantities are ordered, which soon accumulate to alarming dimensions, and either for lack of accommodation, or for fear of becoming obsolete, must be sent out broadcast.

Outlets must be found, and the branches, wholesale houses, and clients, are asked to share in the work of distribution. Lists are unloaded in bulk upon these distributors, to again lie idle and untouched, for the reason that the branches are fully aware that the catalogues are unattractive or obsolete. The wholesale houses find more remunerative lines to which to give publicity, and the client, through lack of enterprise, fails to see that he might make some use of the lists to help the returns of his own retail business.

Having briefly surveyed the three sections, the matter can be summed up as follows:—If to-day "Publicity is the soul of business," then that publicity must be of a high order of intelligence, so arranged and produced that all unnecessary trouble on the part of the buyer is avoided; descriptive matter must be short and decisive, clearly illustrated, and in form easy to handle, with every facility afforded for ready reference to particular sections, and, above all, there must be constant revision to keep the whole production up-to-date.

Such matter will give the firm concerned a high standard amongst the buying fraternity and, with prompt dispatch, will reflect on the capabilities of its organisation, creating a forceful influence and compelling an ever-increasing business, turning waste into profit, and ensuring success and dividends where there is now one continued struggle for mere existence.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AUSTRALIA.—H.M. Trade Commissioner in Australia has recently forwarded to the Board of Trade an extract from a letter which he has received from a firm in Melbourne, complaining that British firms do not always comply carefully with the regulations regarding certificates of origin for entry under the British Preferential Tariff. The extract reads as follows:—"We have recently received more than one invoice bearing on the back certificates which are inaccurately worded or signed with a rubber stamp. In such cases we have had to deposit the money and get fresh invoices from the manufacturers. It is surprising to us, as it doubtless is to you, that a large firm of British manufacturers should consider a rubber stamp signature sufficient for such a declaration as is necessary to satisfy the Commonwealth Customs. We bring these matters under your notice, thinking you may deem it worth while to mention them in your advices to the Board of Trade with a view to manufacturers being warned as to the correct form of declaration to be used, and also as to the necessity for such declaration being properly signed and witnessed."

GOLD COAST.—The Government of the Gold Coast have recently passed an Act consolidating the Customs tariff of that Colony, to make one uniform tariff throughout the Colony in place of the former tariff applicable to parts of the Colony lying East or West respectively of the River Volta. The rates of duty leviable in that part of the Colony lying to the East of the River Volta were previously lower than those leviable on similar goods imported into that part of the Colony lying to the West of the River Volta. The rate on goods not specially mentioned in the tariff is now fixed at 10 per cent. *ad valorem* (on the value of the goods at the port from which the goods were imported); this rate would be leviable on any electrical goods not exempt from duty. The following articles are permitted to be imported free of duty: Goods imported for the service of any Public Department in the Colony; apparatus and structural materials for telegraphs, telephones and electric lighting; appliances, apparatus, and materials imported exclusively for use in any process for the separation of metals from ores; cranes, derricks, and winches, whole or in parts, and machinery necessary for working the same; scientific instruments and appliances; electrical machinery, railway and tramway plant, material, and rolling stock.

NORWAY.—The following articles are now prohibited to be exported from Norway: Copper, unwrought (except copper produced in Norway and accompanied by a certificate of origin); alloys of copper with common metals, unwrought; scrap of copper and copper alloys; wholly or partly manufactured wares of copper and alloys of copper with common metals, viz., plates and sheets, ribbons, rods, rolled or drawn wire, cup-shaped materials for the manufacture of cartridges; bolts, rivets, and nails; tubes and shaped pieces; wire twisted into ropes; cables without insulation fitted with mantle, armoured or unarmoured, also cables covered with insulating materials of all kinds; and castings.

DENMARK.—The following articles, amongst others, are now prohibited to be exported: Ferro-manganese, ferro-molybdenum, ferro-nickel, ferro-titanium, ferro-tungsten, ferro-vanadium, graphite and graphite crucibles, manganese and manganese ore.

SWITZERLAND.—Exportation of the following goods has been prohibited as from April 24th: Iron and steel sheets of all kinds, including corrugated sheets and corrugated piping; piping of wrought iron and steel with an internal diameter of less than 40 cm.

BULGARIA.—Amongst a number of other articles whose exportation from Bulgaria is now prohibited are telegraph and telephone wires, copper of all sorts, tin, lead, and other metals, also raw copper and certain forms of metal from the Plakalnitze Mine.

MOROCCO.—The Resident-General of the French Zone in Morocco has prohibited the exportation and re-exportation (in process of transit, transhipment, or under the temporary importation regime) of, amongst other articles: Electrical apparatus; rubber in any form; celluloid; iron, steel, metals and ores; machines suitable for the manufacture of munitions of war or military arms.

UTILISATION OF SOLAR ENERGY.

What was probably the most complete account yet published of work performed on the utilisation of solar energy was presented by Mr. A. S. E. Ackermann at a meeting of the Royal Society of Arts on April 28th. The author's work in Egypt with the Shuman-Boys absorber was described fully last year (see Electrical Review, April 24th, p. 722), and the present paper deals exhaustively with the methods and results of earlier workers. There is no doubt that the direct utilisation of solar energy is feasible; the only question is whether such utilisation is economically practicable. About 5,000 H.P. per acre is transmitted by the sun to the earth's surface at noon on a clear day, and it is said that the solar energy received on 120 square miles of the Sahara is equivalent to the whole world's coal and oil consumption. Of this enormous power only about 4½ per cent. was utilised by the Shuman-Boys plant; but it must be remembered that the efficiency of storage of solar energy by plant life—from which the whole of our coalfields have been derived—is nothing like so great. Further, the thermal efficiency of the Egyptian boilers was only 40 per cent., and it is reasonable to suppose that this can be increased materially as experience is gained in sun-boiler construction. Ericsson, nearly forty years ago, claimed 72.5 per cent. thermal efficiency for his sun-boilers, and so reliable has time proved his data on the solar constant that it would be well worth while investigating the present possibilities of the boilers that he used.

Apart from bad luck in the way of purely mechanical defects in the engines and pumps installed, the Shuman plant in Egypt was affected adversely by the low steam pressure employed. Two compromises have to be made. By adopting higher steam pressure the engine efficiency is increased, but so is the loss from boiler radiation. Again, with small concentration and low boiler temperature, single or double cover glasses are required to reduce losses; but as concentration is increased, there comes a point at which the loss by reflection from a protected boiler equals the loss by radiation from a naked boiler, so that the cost and inconvenience of glass sheathing can then be avoided. Each sheet of glass involves a penetration absorption loss of about 15 per cent. On these grounds, said Prof. Boys, he was of opinion that greater concentration, and hence higher boiler temperature and pressure, should be employed in later absorbers of the Shuman type. From the Meadi plant nearly three-fourths of the brake horse-power theoretically possible was actually obtained (relative efficiency referred to Carnot cycle, 73.2 per cent.). The special type of Shuman engine developed for use with sun-absorbers consumes only 22 lb. per B.H.P.-hour of steam at atmospheric pressure, and, at 20-30 lb. per square inch, which seems to be the pressure range indicated by experience as most favourable, considerably better steam efficiency would be attainable. Pumps and condensers of such perfection are now available that there need be no appreciable wastage in using other vapours than steam, with water as the intermediate heating agent. The possibilities of two-fluid systems and of low-pressure turbines seem yet to have been very incompletely investigated.

Though heat is obtained "for nothing" in sun plants, the capital cost and depreciation of the latter are considerable. As the result of his 1913 investigations and subsequent experience with the Shuman engine, Mr. Ackermann concludes that the utilisation of solar energy is practically a solved problem "where there is plenty of sunshine and coal costs £3 10s. per ton." That statement takes full account of capital and depreciation charges, and it is assumed that silvered glass mirrors are used, since these are much more satisfactory in practice than metal reflectors. There is good reason to believe that considerably better results will be obtained in the next plant erected, and there seems nothing extravagant in the suggestion that solar heat will, in the near future, be equivalent to coal at £2 a ton. In many parts of the world coal is used regularly at this and higher prices, and it is a fortunate coincidence that where coal is dear, sunshine is often plentiful. Primarily, sun-power plant is best adapted to irrigation work, the availability of sun-heat and the necessity for irrigation being interdependent, but there is no reason to doubt that, once waste places of the earth, remote from coalfields and transport facilities, have been reclaimed by irrigation, the power and lighting requirements of the district can be supplied by solar-electric generation. In stimulating further research in this promising field and in preventing waste of time and labour in fruitless or already explored directions, Mr. Ackermann's latest paper should prove very useful

NOTES FROM CANADA.

(From our Special Correspondent.)

A Dominion Government report giving statistics of the various telegraph systems operating in Canada has been issued recently.

There are twelve such systems, including those of the Marconi Wireless Telegraph Co. and the Dominion Government Telegraph Service, the latter operating in those outlying sections of the Dominion which are not served by commercial telegraph organisations.

The financial results of the working during 1914 have not been so good as they were in the previous year; the gross earnings (amounting to $5,983,204 in 1914) being $112,008 less and operating expenses $208,059 more, making a total adverse difference of $320,067; the operating expenses for 1914 were $4,242,539.

By far the larger share of business goes to the system of the Canadian Pacific Railway Co., that of the Great North-Western Telegraph Co. coming next with only one-third of the C.P.R. Co.'s business; these two systems together handle about two-thirds of the total telegraph business of the Dominion.

The items of operating showing the greatest increases are "line and equipment" and "buildings," followed by "salaries and wages" and "stationery and printing," in order of importance.

Figures of pole and wire mileage are given, from which it is seen that the Province of Ontario leads, after which come Quebec, Saskatchewan, British Columbia, Alberta, Manitoba and Nova Scotia. The ratio between pole mileage and wire mileage varies a good deal, from 1s. 6d. in Ontario to practically 1s. 3d. in Quebec; this is exclusive of the Yukon and Newfoundland, where the ratio is 1s. 1d., the conditions evidently being special. As a conductor, galvanised iron holds the first place, there being over 126,000 miles in use last year; next comes multiple, of which there were 10,000 odd miles; then copper, overhead 21,000 miles; copper, underground 7?7 miles, and copper [illegible]

INDIAN NOTES.

[From our Special Correspondent.]

Darjeeling Hydro-Electric Scheme.—Mr. Stonebridge, one of the partners of the electrical engineering firm, Messrs. Luke Stonebridge & Co., has been temporarily engaged by the Darjeeling Municipality to report further on the hydro-electric scheme on which the late Mr. Robertson was engaged when he was drowned. Originally, the two stations Lebing and Talapahar, and areas in between, were only to be provided with current, but in view of more extensive possibilities the temporary engineer is engaged in making observations and taking particulars in the Dam Dimma Valley, where it is conjectured several power-houses might be established and interlinked, so that sufficient power may be obtainable for the various tea gardens in the area right down to Nuxalbarie and Siliguri. It may not be outside the range of possibility to provide, at no distant date, sufficient cheap power to electrify the Darjeeling Himalayan Line. This is a 50-mile narrow-gauge line from Siliguri to Darjeeling, with an ascent of 8,000 ft. It now takes over seven hours to travel the zig-zag distance, and is not far off being one of the most expensive railway journeys in the Empire.

Cauvery Power Scheme.—Mr. A. G. Forbes, the chief electrical engineer, read a very interesting paper recently at the Mysore Engineers' Association, having for his subject the Cauvery Power Scheme. He went on to say that the fourth installation of 4,000 H.P. was almost completed; and this, with a similar installation proposed for next year's budget, would make over 20,000 H.P. generated from the Cauvery Falls. Since the first installation was put down several years ago the phenomenon of high-tension transmission has become of every-day use and hence the local problem of long-distance transmission has been made easy. Under a new agreement with the Kolar Mining Co., the Mysore Government are to supply them with 14,500 H.P. at the motor terminals—a distance of 92 miles away, with an option of 2,500 H.P. more on two years' notice being given. Mr. Forbes went on to say that as the Cauvery power scheme was the pioneer of its kind in India, the future of electrical development in this country was dependent on its unqualified success. He added that from an engineering and economic standpoint the Cauvery scheme was the most successful one in operation to-day.

NEW PATENTS APPLIED FOR, 1915.

NOT YET PUBLISHED.

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

5,832. "Process for the manufacture of heating-conductors for thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, February 6th, 1915, Germany.) (Complete.)

5,833. "Sound chamber for thermic telephones and the like intended to be inserted into the auditory passage." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, February 8th, 1915, Germany.) (Complete.)

5,834. "Construction of heating-conductors for thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, February 8th, 1915, Germany.) (Complete.)

5,835. "Process for the manufacture of heating-conductors for thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, February 9th, 1915, Germany.) (Complete.)

5,836. "Thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, February 10th, 1915, Germany.) (Complete.)

5,837. "Thermic microphone." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, February 11th, 1915, Germany.) (Complete.)

5,838. "Thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, February 11th, 1915, Germany.) (Complete.)

5,839. "Thermic telephone with adjustable sound effect." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, February 12th, 1915, Germany.) (Complete.)

5,840. "Thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, February 12th, 1915, Germany.) (Complete.)

5,841. "Mounting for thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, February 12th, 1915, Germany.) (Complete.)

5,842. "Heating-conductors for thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, February 13th, 1915, Germany.) (Complete.)

5,843. "Heating-conductors for thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, March 6th, 1915, Germany.) (Complete.)

5,844. "Process for the manufacture of heating-conductors for thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, March 6th, 1915, Germany.) (Complete.)

5,845. "Thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, March 17th, 1915, Germany.) (Complete.)

5,846. "Thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, March 17th, 1915, Germany.) (Complete.)

5,847. "Thermic telephones." **Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij.** April 19th. (Convention date, March 17th, 1915, Germany.) (Complete.)

5,848. "Commutators." **T. Zimmerman.** April 19th. (Convention date, April 17th, 1914, United States.) (Complete.)

5,853. "High-speed rotating bodies." **British Thomson-Houston Co., Ltd.** April 19th. (General Electric Co., United States.)

5,865. "Ignition devices for starting internal-combustion engines." **R. Bosch (firm of).** April 19th. (Convention date, April 17th, 1914, Germany.) (Complete.)

5,866. "Lanterns for electric lamps." **R. Bosch (firm of).** April 19th. (Convention date, June 15th, 1914, Germany.) (Complete.)

5,870. "Production of zinc or other metals by electrolysis." **M. Perreur-Lloyd.** April 19th. (Addition to 4,625/15.) (Complete.)

5,875. "Portable telephone and telegraph instruments." **International Electric Co., Ltd., R. G. le Noir, and E. Funccius.** April 19th.

5,879. "Combined electric switch and wall plug." **W. H. Sturge.** April 20th.

5,883. "Method of obtaining a sparkless break of an inductive electric circuit." **T. F. Wall.** April 20th.

5,887. "Electrical conductors." **A. Marr & J. Lister.** April 20th.

5,889. "Electric heating-element." **Cable Accessories Co., Ltd., & F. H. Reeves.** April 20th. (Complete.)

5,909. "Telephone call recorder." **F. P. Reid.** April 20th.

5,918. "Windings for electrical machines." **British Thomson-Houston Co., Ltd.** April 20th. (General Electric Co., United States.)

5,935. "Process for the electro-deposition of zinc." **S. O. Cowper-Coles.** April 20th.

5,936. "Solder." **S. O. Cowper-Coles.** April 20th.

5,937. "Process for the electrolytic coating of sheets and plates with other metals." **S. O. Cowper-Coles.** April 20th.

5,938. "Manufacture of electrolytically-coated metal plates." **S. O. Cowper-Coles.** April 20th.

5,943. "Electric switches." **G. Giles.** April 20th. (Convention date, April 24th, 1914, Germany.) (Complete.)

5,955. "Polyphase generators for high-frequency currents with polyphase tuned spark gap." **L. Rouzet.** April 20th. (Addition to 519/15. Convention date April 20th, 1914, France.) (Complete.)

5,964. "Combined automatic electric taximeter, flag, and fare dial illuminator with reflector." **G. S. Lysaght.** April 21st.

5,969. "Thermostats." **H. E. Moul.** April 21st.

5,992. "Generator of mechanical and electrical power by different currents." **D. Suchostawer.** April 21st.

5,994. "Sound transmitter." **C. Stille.** April 21st. (Complete.)

6,003. "Electro-magnetic driven pumps." **E. Bachelet.** April 21st.

6,055. "Lamp-sockets and lamp-holders for incandescent electric lamps." **E. Edser.** April 22nd.

6,063. "Signalling or telegraph apparatus." **R. H. Walker & J. J. Walker.** April 22nd

6,066. "Separators or covers for the plates of secondary batteries." **Electrical Power Storage Co., Ltd., & C. C. Rattey.** April 22nd.

6,086. "System of control for maintaining the relative speeds of a number of electric motors." **F. C. Anderson & C. A. Atchley.** April 23rd. (F. G. Warburton, Canada.)

6,093. "Lead jointing-sleeve for electric joints." **C. J. Beaver & E. A. Claremont.** April 23rd.

6,096. "Carriers for electric hand lamps." **Associated Portland Cement Manufacturers (1900), Ltd., & C. P. Taylor.** April 23rd.

6,098. "Electric generating set." **A. Collet.** April 23rd. (Convention date, April 30th, 1914, France.) (Complete.)

6,117. "Electrical distribution apparatus." **W. T. Henley's Telegraph Works Co., Ltd., & E. E. Judge.** April 23rd.

6,135. "Construction of insulated conductors for electrical purposes." **J. I. Hall.** April 24th.

6,151. "Magnetic brakes, clutches, and the like." **F. Newton & Newton Brothers (Derby), Ltd.** April 24th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of **Messrs. W. P. Thompson & Co.**, 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1914.

136. ELECTRIC HEATER. J. R. Quain. January 2nd.

299. SUBMARINE TELEGRAPHY. J. S. Withers (Cox). January 6th.

3,221. ELECTRIC WATER-HEATERS OR GEYSERS. J. R. Quain. February 6th. (Cognate applications, 8,019/14 and 14,394/14.)

8,049. TELEPHONE TRANSMITTING APPARATUS. J. J. Comer. March 30th. (March 31st, 1913.)

8,505. ARC-LIGHT CARBONS. H. Ayrton. April 3rd. (Addition to 22,319/13.)

8,804. ELECTRIC WELDING. E. H. Jones and Light Steel Tubular Wheels, Ltd. April 7th.

8,946. AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE SYSTEMS. G. A. Betulander, N. G. Palmgren and O. Grahn. April 8th.

9,411. ELECTRIC RESISTANCES. F. Celeri. April 16th.

12,912. TELEPHONE SWITCHING APPARATUS. Western Electric Co. May 26th. (F. T. Woodward acting for Western Electric Co.)

14,577. SYSTEMS OF ELECTRIC DISTRIBUTION. British Thomson-Houston Co. June 17th. (General Electric Co.)

14,841. ELECTRICITY METERS OF THE MERCURY MOTOR TYPE. Chamberlain, Hookham, Ltd., and W. S. Sprague. June 20th.

17,590. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. and A. B. Sperry. July 24th. (Divided application on 1,970/14. January 24th.)

17,945. ELECTRIC HEATERS. R. Weaving, F. Smith, & Ferranti, Ltd. July 29th

18,106. ELECTRIC CURRENT GRADUATING DEVICES OR RESISTANCES. W. Sumner. July 31st.

22,261. APPARATUS FOR ELECTRIC RIVETING AND HEADING. F. P. Kobert. November 9th.

24,780. ELECTRICALLY-OPERATED ALARM APPARATUS. J. F. X. Miller. December 30th

THE
ELECTRICAL REVIEW.

VOL. LXXVII. MAY 14, 1915. No. 1,955.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: May 14, 1915. [No. 1,955.

Page
Electrostatics and Industry 677
Rubber 678
British Industries Fair 678
The Electrical Precipitation of Smoke and Fumes (*illus.*) ... 679
Large Electric Furnace for Routine Foundry Work ... 680
Automatic Lift Accidents, by Frank Broadbent, M.I.E.E., M.Cons.E. (*illus.*) 681
Correspondence—
  The Engineering Industry and the War 683
  Cab Signalling 683
  The War and Future Trade 683
Parliamentary 683
New Electrical Devices, Fittings and Plant (*illus.*) 684
Legal 684
War Items 685
Business Notes 687
Electricity Works Extensions at South Shields (*illus.*) ... 693
Electricity Supply at Ahmedabad, India (*illus.*) 695
The Works of Messrs. Bruce Peebles & Co., Ltd. (*illus.*) ... 697
British Industries Fair 697
Notes 698
City Notes 700
Stocks and Shares 703
Electric Tramway and Railway Traffic Returns 703
Share List of Electrical Companies 704
Market Quotations 704
The Power Supply of the Central Mining-Rand Mines Group, by J. H. Rider (*illus.*) 705
The Bombay Hydro-Electric Scheme, by A. Dickinson, M.I.E.E. (*illus.*) 707
Coal Supply Conference 710
Some Peculiar Views on Electric Light Switching, by W. Perren Maycock, M.I.E.E. 711
New Patents Applied for, 1915 712
Abstracts of Published Specifications 712
Contractors' Column ... ... Advertisement page xx

THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

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Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).
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ELECTROSTATICS AND INDUSTRY.

THE property of an electrostatic field, whereby it tends to sweep up all suspended particles within it and deposit them on the charged surfaces, is a phenomenon with which we have been acquainted from a very early period; but little use has been made of it until comparatively recently. There are two principal ways in which it may be manifested. One is by the mimic hailstorm of small pellets of pith or other light material between two metal plates, due to the actual charging of the pellets by contact with one of the plates and their subsequent repulsion from it and attraction to the other plate; this is a familiar experiment of the entertainment order, but probably has little bearing upon industrial problems. The other way is by the bombardment of electrons and ions due to the ionisation of the medium by the electric field, the floating particles being thus charged by the attachment or detachment of electrons without actual contact with either of the electrodes, and being then propelled along the lines of force of the field to the electrodes. It is by this means that the phenomenon is turned to good account on a practical scale.

It will be remembered that, some years ago, Sir Oliver Lodge, who has always been keenly interested in the phenomena of static electricity and allied questions, discussed the feasibility of employing this method for dissipating fogs on the large scale. Mr. B. H. Thwaite applied it experimentally to the purification of blast-furnace gases, but was hampered by the lack of suitable apparatus for generating a supply of static electricity—if it can be called static under the conditions of use.

In the United States remarkable progress has been made, with the aid of high-pressure transformers and mechanical rectifiers, and we give elsewhere in this issue some account of the methods recently employed and the results obtained. The earlier stages of the work were described in an article which we published in our issue of January 17th, 1913.

The simplicity of the apparatus and the small consumption of power render the system cheap to install and economical to maintain, while the efficiency of the process is surprisingly high, as much as 98 per cent. of the suspended matter, or even more, being deposited. In some cases the deposit itself contains valuable substances, the recovery of which may be worth many times the cost of its collection, and, indeed, we are told that at a Portland cement works the potash salts precipitated, which had previously wrought great injury to neighbouring orange plantations, proved to be an excellent fertiliser for the orange trees; the process may also be employed not merely for the prevention of nuisance, but as an actual intermediary to other industrial processes of manufacture. In other cases the sole object is to prevent the fouling of the atmosphere, as in the deposition of smoke, which probably offers the widest field of utility, and indirectly may confer immense benefits upon mankind.

In this connection we may emphasise the fact that the progress made in the United States has been due almost wholly to the efforts of a few men—especially Dr. F. G. Cottrell—who formed a philanthropic body for the purpose of research; the result of their work has been the repayment of the original capital and the accumulation, within three years, of ample funds to prosecute the work on more extended and efficient lines. It is especially significant that the money has been paid by clients who have found the process of commercial utility to their undertakings. The Research Corporation makes no profits for individuals. We strongly commend the subject to the notice of the British Coal Smoke Abatement Society, in the hope that that body may find it desirable to work on similar lines, and thus to accelerate the attainment of its altruistic aims.

As the power required rarely exceeds a few kilowatts, the kenotron, of which we gave a description in our last issue, appears to be ideally adapted for use in the process of precipitation, in place of the mechanical rectifiers hitherto employed; the fact was pointed out in the discussion by Dr. Dushmann. Curiously enough, the kenotron itself depends for its operation upon the flow of electrons between electrodes, with the vital difference that in this case the intervening space is evacuated to the utmost possible extent.

That knowledge of every phase of Nature is ultimately useful to man is further exemplified in this relation. First-year students in technical colleges, 10 or 20 years ago, we fear, despised if they did not abhor the rather flimsy apparatus with which they studied the phenomena of static electricity; but they were wrong. Even the electroscope, so apt to leak or to stretch its leaves to pieces, has proved to be invaluable in the investigation of radio-activity, to which we owe so much already. In wireless telegraphy, in the working of transmission lines at very high pressures, in the deposition of dust, in the acceleration of plant growth, and in other directions, the science of electrostatics has "made good," and we may yet owe to it the purification of the atmosphere and the improvement of crops on the largest scale.

A few days ago a deputation from the Royal Society and the Chemical Society pointed out to the Presidents of the Boards of Trade and Education that British industry was hampered by the starvation of scientific research and the lack of appreciation of scientific work on the part of the public generally, and advocated the adoption of measures by the Government for the assistance of scientific research. We are pleased to say that both gentlemen gave the deputation a very sympathetic reception and fully endorsed their claims, stating also that proposals were under consideration for the formation of an organisation for the purposes suggested. This is indeed good news. The undoubted success of the National Physical Laboratory bears out the statements of the deputation, and points the way to the attainment of their desires, in part; but the education of manufacturers and the public generally to an adequate realisation of the part that is now played by science in connection with industry, and the vastly more important benefits that it can confer upon the latter, ought to be vigorously carried on by every possible means, as one of the most effectual weapons with which to defend ourselves against our present and future opponents.

Rubber. The tone of the market for rubber has been, on the whole, quiet during the past two or three weeks. There was at one time a tendency to improve, and a very fair volume of business was transacted, with No. 1 Crepe rising to 2s. 4½d. per lb., but this was the apex, and the market has since undergone a reactionary tendency, the full extent of the fall being not far short of 2d. per lb. It appears that arrivals from abroad are being dealt with more rapidly than was the case some time ago, which, of course, ensures a larger supply of material available for the satisfaction of trade requirements, while the demand at the same time has been on a rather less active scale. There has been some talk of difficulties experienced in connection with making shipments abroad, owing to the necessity of securing licences, and this may account to some extent for the easier tendency of the market just lately. Nevertheless, there is some confidence felt that Russian demands will develop on a large scale before long, and the resumption of navigation at Archangel is regarded as somewhat of a bull point. It is quite clear that production is making fairly satisfactory headway in the Near East, and it is significant that the cost of output is in all directions undergoing a marked and sustained reduction. It is impossible for the general tendency of rubber prices to be other than on the easy side while the average cost continues to fall, and while the world's trade is at sixes and sevens owing to the war. The exports of plantation rubber from the Federated Malay States during the month of April amounted to 2,777 tons, as compared with 3,418 tons in March, and 2,151 tons in the corresponding month of last year. For comparative purposes the following table of exports from the Federated Malay States will be found interesting:—

	1913.	1914.	1915.
January	2,131	2,542	3,473 tons.
February	1,757	2,364	3,411 ,,
March	1,737	2,418	3,418 ,,
April	1,626	2,151	2,777 ,,
Total	7,251	9,475	13,079 ,,

British Industries Fair. The exhibition that is now in being, and will remain so until Friday next, at the Agricultural Hall, Islington, has afforded British industries an opportunity such as we do not think has ever occurred before of bringing together under Government auspices an imposing collection of articles in which there is scope for a very large turnover. It is not an engineering exhibition, nor is it, save in respect of a very few popular and specialised lines, electrical, but we do not criticise it on those grounds, for the hall is packed with a very excellent collection of all sorts of things which, generally speaking, cannot well be displayed side by side with electrical manufactures. We doubt if there is anywhere in London a building anything like large enough to accommodate all branches of industry with exhibits on such a scale as to satisfy everybody. To attain to such proportions we should have to organise on the vast lines that have characterised some of the great international exhibitions, and unless we monopolise the White City, the Crystal Palace, or some other such site, that is impossible in London. War time is not a convenient time for organising a mammoth exhibition—the present collection of manufactures has had to be organised and brought together in as many months as a big exhibition would have taken years. In some respects the conditions of war time, which have really given rise to the holding of this display, and made for its success, have militated against the making of the necessary arrangements by exhibitors. Considering all the peculiar circumstances of these times, we must congratulate the Board of Trade Commercial Intelligence Department and the exhibitors upon the excellence of their Fair. We cannot remember any occasion when an exhibition has been so complete on its opening day as was this one when Her Majesty the Queen made her tour of the Hall on Monday afternoon last. Though, as we have said, the exhibition is not devoted in anything but a casual way to the classes of manufactures which we represent, we welcome it as an excellent augury for the future. Though the Board of Trade may have been criticised for some things that it has done and in respect of some things left undone, it gives promise here of a development of a trade interest which cannot fail to meet with acceptance at the hands of industry, however much it may displease private exhibition promoters. We look to the Board of Trade, now that it has shown in these months of war how excellent a beginning it can make, to proceed consistently with the larger policy of trade encouragement that everybody industrial desires.

THE ELECTRICAL PRECIPITATION OF SMOKE AND FUMES.

At a meeting of the American Institute of Electrical Engineers in February, a symposium of papers was presented on the subject of the electrostatic precipitation of fumes, smoke, dust, &c., from which it appears that valuable progress has been effected in this important field. Dr. F. G. Cottrell, to whose work we recently referred, described very fully the history of the subject, which was mentioned as long ago as 1824 ; the work of Sir Oliver Lodge, which received special attention, led to the formation of the Research Corporation in the United States, by Dr. Cottrell and others, to study the process. Sir Oliver Lodge's work had been directed especially to the precipitation of fog in the atmosphere ; that of Dr. Cottrell was directed towards the precipitation of fumes and smoke as the more pressing problem, which would assist in solving the former.

The progress of the work of the Research Corporation was described in a paper by Mr. Linn Bradley, who pointed out that there were dangerous pitfalls to be avoided, and that a process worked out to perfection in the laboratory might have to be enormously modified before it could be applied to practice ; not only was it necessary to be fully conversant with the process itself, but also it was essential to be well acquainted with the details of operation of the plant to which it was to be applied.

The Research Corporation was organised in 1912 to develop certain patents assigned to it gratis by Dr. Cottrell and his associates, and the stock-holders were prohibited from ever making any profits from their holdings ; the working capital was only £2,000, and therefore clients were required to pay all expenses incurred in connection with their particular problems. A commercial plant, designed by Dr. Cottrell, had then been at work for two years condensing sulphuric acid mist in a California smelting works, and this is still in operation.

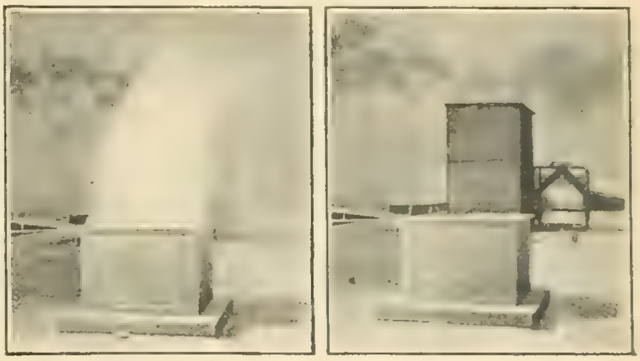
Experimental installations had been put down in other works, and electricity had been employed for separating water from crude oil with which it was emulsified. A plant installed at a Portland cement works in 1912 has been extended, and now deposits about 100 tons of dust a day from the gases from rotary cement kilns. In another case the gases from copper matte converters were treated, to reclaim the lead compounds, and this installation has been extended to the whole of the converters at Garfield, collecting over 95 per cent. of the suspended matter.

Briefly stated by Mr. Bradley, the method employed is to subject the gases and suspended particles to the action of a strong electric field maintained between "collecting electrodes" and "discharge electrodes." The current flowing through the gases must be unidirectional, and is obtained by transforming alternating current up to, say, 100,000 volts and rectifying it. Pressures up to 250,000 volts have been rectified successfully. The form of the electrodes depends very largely upon the local conditions, which vary greatly. Provision must be made for access to the electrodes and insulators, and for the removal of the dust or liquid deposited. Slight changes in the methods employed have sometimes converted apparent failures to complete successes, and no detail must be considered unworthy of attention.

At the Raritan Copper Works valuable fumes remained in silver refinery gases of a very corrosive nature, even after they had passed through a water scrubber. Cast-iron was used for some parts of the electrodes, and an alloy of lead and antimony for other parts. With 2·5 to 3 KW. at 35,000 volts, several thousand dollars' worth of fumes have been saved. An improved type of treater employing lead pipes, 12 and 24 in. in diameter, has been employed with advantage in recent additions, and further improvements have been made by installing a 10-K.V.A. 25-cycle single-phase 100,000-volt transformer. The deposited fume sometimes starts an arc between the electrodes, and to meet this difficulty an automatic device has been successfully adopted.

At the plant of the Hooker Electrochemical Co. a large volume of air containing a small percentage of chlorine gas is treated for the removal of the latter ; hydrated lime dust is used to assist in the removal, and a few tons of weak bleaching powder are collected daily.

The volume of gas is 30,000 cb. ft. per minute, and the power used is 3 to 5 KW. at 50,000 volts. The effect of the treatment is shown in figs. 1 and 2.



Pressure Off. Pressure On.

Figs. 1 and 2.—Exhaust Flue from Treater at the Hooker Electrochemical Works, Niagara Falls.

A boiler used for testing coals at the U.S. Bureau of Mines was fitted with a treater to eliminate black smoke, consisting of 12 iron pipes 12 ft. long by 12 in. in diameter, through which the gases were led. The electrodes passed through the pipes, which were placed vertically, as shown in fig. 3. With one kilowatt at 50,000 volts the result shown in figs. 4 and 5 was attained. Mr. Bradley states that the smoke can be precipitated readily, and the insulation problem is not now a difficult one ; the apparatus uses little power, and can operate continuously with but little attention.

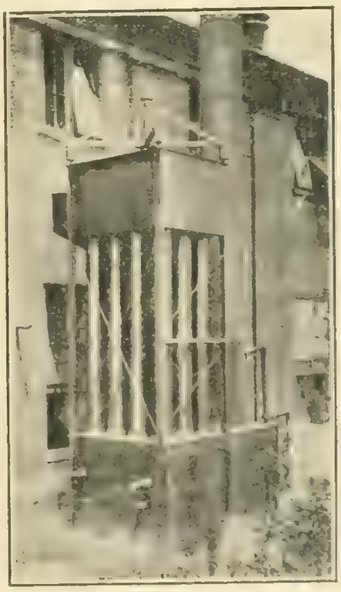
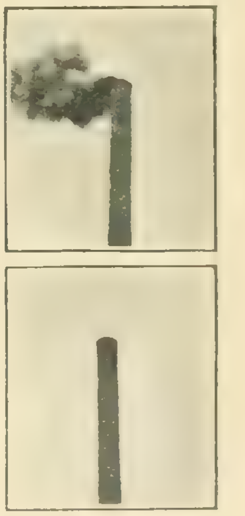


Fig. 3.—Smoke Treater at the U.S. Bureau of Mines.



Figs. 4 and 5.—Pressure Off and On.

The most puzzling question is what to do with the material deposited !

Many other examples were given by Mr. Bradley, such as the removal of tar from illuminating gas, the deposit of fume from sintering machines and detinning plant, dust from food product works, fumes from roasters, &c.

An important opening is found in the removal of mechanical impurities from gases containing volatilised substances such as arsenic, so that the latter can subsequently be condensed and recovered without further refining. An iron pipe as large as 4 ft. in diameter has been successfully employed as the collecting electrode, with a pressure of 250,000 volts and a mechanical rectifier. An installation for collecting potash salts volatilised from feldspar employs 40 pipes 14 in. in diameter and 12 ft. long, the electrode spacing being 7 in. ; the temperature of the gases ranges from 500 to 1,000° F., and the volume dealt with runs up to 18,000 cb. ft. per minute. The voltage is 70,000 volts, and the power factor 70 to 80 per cent.

An installation for collecting volatilised hydrochloric acid was recently put down with complete success at the first attempt, the exit gases being so free from acid that a trace of it could hardly be detected by delicate chemical tests. Treaters are also being installed at sulphuric acid works, to eliminate suspended particles from sulphurous gases before delivery to a Glover tower; in this case the treater will be in three sections, any one of which can be laid off for repairs without interrupting the process. Various other installations are in hand, including one for cleaning iron blast-furnace gases at the works of the Bethlehem Steel Co.; we may here mention that the late Mr. B. H. Thwaite, the first to generate power from blast-furnace gases in gas engines, made a number of experiments with the object of cleaning the gases by means of electrical precipitation many years ago. Several companies have purchased licences to use the Research Corporation's processes, and the success already attained with a small staff has enlarged the resources of the Corporation, which has thus been enabled to engage a larger staff and create special departments to deal with the various classes of conditions. The original stockholders have been repaid, and the Corporation has nearly £30,000 in hand. Mr. Bradley gave a long list of industries to which the application of the process was pending or in operation, and touched upon many points which we have not space to deal with here. His paper, to which a bibliography is appended, will rank as a classic in this comparatively new branch of electrotechnics.

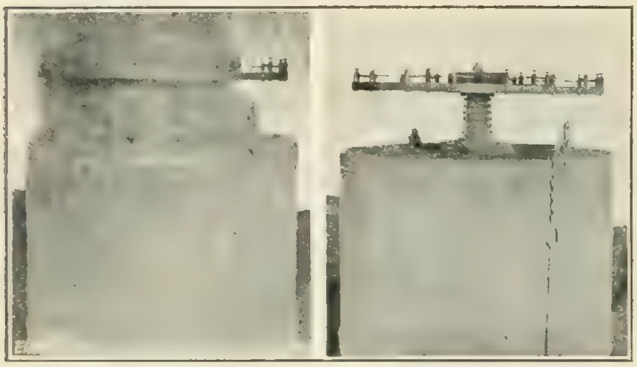


Fig. 6.—Top of Precipitator. Pressure Off.

Fig. 7.—One Second after Closing the Circuit.

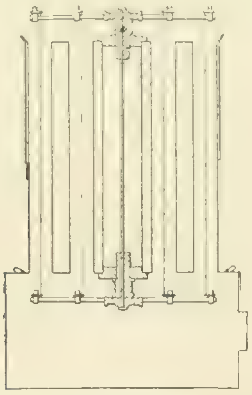


Fig. 8.—Section of Strong-Nesbit Precipitation Chamber.

Another paper on the subject was contributed by Prof. A. F. Nesbit, who approached it from the theoretical and experimental side, showing that the particles suspended in a gaseous medium, when subjected to the action of intense electric fields, became charged by the action of the travelling ions and electrons, and consequently tended to travel along with these ionic streams.

Electrical precipitation takes place on an enormous scale in Nature—the downfall of rain after a flash of lightning is a familiar example.

A negative ion is formed when a neutral molecule of a material substance has imparted to it from any source one or more electrons in excess of the number contained in its neutral state; similarly a positive ion is formed when one or more electrons are removed from a neutral molecule.

These ions may become the centres or nuclei about which large aggregates of particles may be clustered. Ionisation may be produced by high temperatures, chemical action, the electric field, and other agencies.

The author described a precipitator designed by Dr. Strong and himself, consisting of groups of 25 pipes 4 ft. long and 5 in. in diameter, through which fine wires were stretched, as shown in fig. 8. Figs 6 and 7 show the appearance of the top of the apparatus when 900 cb. ft. of coal smoke was moving through it per minute at a velocity of about 5 ft. per second. The instantaneous change produced by the electric field is striking.

The author stated that the action of the precipitator was due to the corona discharge from the electrodes. When the wires were positively charged, the corona appeared to occupy nearly the whole cross-section of the pipes; when the wires were negative, the coronas round them were only a few millimetres in radial depth. It was found that an alternating corona precipitated about 50 per cent. of the suspended matter; the positive corona deposited 70 to 80 per cent., and the negative 95 to 98 per cent. The inefficiency of the alternating current was due to the reversal of polarity of the active electrode, and therefore of the motion of the electrons and ions. With hot air passing through the pipes and a negative corona the breakdown voltage was about 32,000 volts; with cold air the voltage was slightly greater, and with a positive corona the voltage was less in both cases. The breakdown voltage was about the same for cold smoke as for cold air, but with hot smoke the voltage had to be decreased to 28,000 volts. There was but little deposit on the electrodes, and such deposit could be dislodged by the momentary application of a disruptive discharge.

Prof. Nesbit pointed out that the process not only precipitated carbon from smoke, but also ash, which could not be eliminated from the flue gases by the most efficient stoking. The cleaning of producer and blast-furnace gases offered an important field for the system.

LARGE ELECTRIC FURNACE FOR ROUTINE FOUNDRY WORK.

[COMMUNICATED.]

There is, among many engineers, a tendency to regard electric steel furnaces as a luxury—capable, it may be, of producing and refining limited quantities of high-grade tool steel and other superfine products, but economically impracticable for ordinary foundry work. With large and highly efficient turbo-units, such as are now to be found in all our large industrial centres, this presumed limitation of the utility of electric furnaces cannot be justified. A number of electric furnaces are already in use in Sheffield and other steelworking centres, and important additions are frequently being made to their number, but, with the exception of a few installations described in these columns during recent years, little information has been published concerning British experience in this field. It has been suggested repeatedly that electric furnaces cannot compete with other types in melting large charges, and it is, therefore, specially interesting to note that in the Otis Foundry, at Buffalo, a 3-ton electric furnace is in operation, melting and working up 54 tons of steel per six-day week. This furnace represents a serious attempt to make electric steel castings on a scale comparable with open-hearth practice, and so successful has it proved that, after only six months' operation, it has been decided to put in a second furnace of equal capacity. Energy is taken from Niagara, but the secret of successful operation does not lie in this fact. Unfortunately, the actual price paid for energy is at present withheld, though it is interesting to note that a considerable reduction in rate is allowed in consideration of the furnace being operated only between 7 p.m. and 6 a.m., the day staff being engaged solely in moulding. It is stated, however, that the furnace consumes 655 KW. for two hours at a time, and averages 64,000 KW.-hours per month. From this information it is easy to see that abnormally cheap energy is not at the root of the furnace's success. In Sheffield a number of electric furnaces are supplied at 0·33d. per KW.-hour, but even assuming 0·5d. as an easily obtainable power tariff, the Otis furnace would cost 0 5d. × 64,000 × 12 = £1,600 per annum to supply on this flat rate. The equivalent charge per horse-power demand (the usual basis for bulk supply from Niagara) would be £1 16s. per H.P.-year, and it is not probable that anything like so low a rate is obtained even under the limited-hour agreement. In other words, electrical supply in steel-working centres in this country is cheap enough to permit equally satisfactory operation for general foundry purposes of such electric furnaces as that now described.

Energy is taken at 2,200 volts three-phase and transformed by two Scott-connected transformers to 220 volts single-phase, which is further reduced by ohmic losses to 195 volts net, across the arc. The furnace is of the Snyder tilting type, built of riveted steel plate and lined with silica brick. The bottom is of silica sand, and the domed roof is of silica bricks carried in a detachable cast-steel ring, and has a life of 150 to 175 heats (four to six weeks). Two spare roofs are kept ready for use, only two or three hours being occupied in replacing one that is burnt through. The total cost of linings and repairs averages less than 2s. 6d. per ton of steel.

A single 6-in. graphite electrode passes through the roof and costs about 2s. 10d. per ton of steel to maintain. This cost and the cost of linings and repairs compare very favourably with figures quoted in this country. Current is taken through the bottom of the furnace bed by a steel casting, the lower end of which is water cooled to protect the copper connections, while the solid upper end melts flush with the lining and is covered at the end of each shift, before the slag has "set" over it, by a steel plug which displaces the slag and leaves the contact sufficiently clean for current to pass at once, when the furnace is next placed in commission.

A factor which contributes very materially to the overall economy of the furnace is the possibility of using up machine shop borings and turnings. These have a scrap value of only 20s. or so per ton, and cannot be dealt with satisfactorily in open-hearth furnaces. The charge used is 70 per cent. of such turnings and 30 per cent. foundry scrap, risers and headings, &c. The larger pieces are charged first, and the fine material piled on top up to or above the charging door. The main switches being closed, the electrode is lowered and regulated by hand (under guidance of wattmeter indications) for 10 or 15 minutes, after which the furnace is self-regulating through a ratchet and rack and pinion gear. The turnings used are very rusty, hence charcoal is added for reducing purposes; thereafter procedure is practically as in standard open-hearth work, ferro-silicon or ferro-manganese being added towards the end of the heat. The castings to be made include electric motor-frames and general elevator parts, typical analyses being as follows:—

	For motor frames.	For general castings.
Combined carbon	0·18—0·2	0·18—0·2
Silicon	0·45—0·5	0·35—0·4
Manganese	0·1	0·1 —0·45
Phosphorus	0·075	0·075
Sulphur	0·05	0·05

Slag is made sticky and drawn out before pouring by iron rabble hooks. Moulding sand is charged towards the end of the heat if needed to thicken the slag. Rack and pinion tilting gear driven by a 5-H.P. motor is installed below floor level, and is operated from a drum controller behind a sheet steel screen opposite the pouring spout.

Four heats, aggregating nine tons, are run off during each night shift. The first melt occupies two and a half hours and the remaining ones less than two hours each. The normal consumption during these periods is 655 KW., corresponding to a load factor of 30 per cent. during the whole 11-hour shift.

Oxy-acetylene torches are used to trim headings and risers from the castings, and the oxygen for this purpose is manufactured electrolytically, using a 25-KW. motor-generator set consuming 3,300 KW.-hours per month. Most of the foundry machinery and the various cranes are operated electrically, the total electrical consumption being 84,000 units per month, of which 75 per cent. is taken by the electric furnace. With the installation of the second furnace, the night demand of the foundry will rise to close on 1,500 KW., a very acceptable addition to the supply station night load.

AUTOMATIC-LIFT ACCIDENTS.

By FRANK BROADBENT, M.I.E.E., M.Cons.E.

The fatal accident which occurred recently in a well-known London club in connection with an automatic electric lift is one of those occasional reminders that automatic mechanism, no matter how perfect, is not infallible.

The facts of the case, however, show that a failure of the automatic gear to perform its function is, in itself, not sufficient to cause an accident of this kind, but that human oversight is a contributory agent.

The lift is of the kind known as the "full automatic" type serving four floors. The general principle of operation is briefly the following. On each floor there is a "calling" push which, on being pressed, "calls" the car to the landing. In the car are five pushes, viz., one for each floor, and an emergency "stop" push. On pressing any of the "floor" pushes, the lift automatically travels to and stops at the corresponding landing. Each opening is protected by a collapsible gate provided with an electromagnetic lock, the function of which is to prevent anyone opening the gate unless the car is standing behind it, and to render the lift inoperative when the gate is open. The general principle of such locks is shown in fig. 1, where A is the lock, B the latch, and C the lever operated by the car. Usually the apparatus is self-locking, that is to say, the locking lever is dropped by means of a spring or weight as soon as it is released by the car. The lever carries a roller on its free end, which engages with an inclined plane or striker D fixed on the side of the car. As the car passes a landing the striker lifts the lever, thus releasing the lock and permitting the gate to be opened. If anyone tries to open a

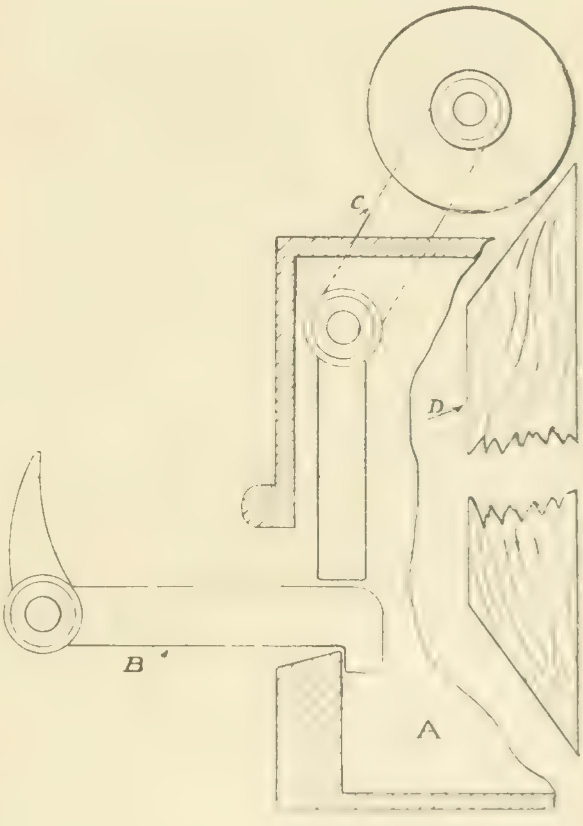


Fig. 1

gate when the car is above or below it, he is unable to do so; but if he pulls against the latch whilst the car is travelling, the gate will open as the car passes it. The opening of the gate stops the lift, as the lock is electrical as well as mechanical, and the withdrawal of the latch breaks the electrical contacts which are connected in series with the stopping circuit.

This is somewhat of a disadvantage as the lock, although it contains contacts, is not intended to be used as a switch to break the circuit. Not only do we run the risk of burning the contacts by so doing, but also of causing arcing from one to the other or over to the case, particularly on circuits of 400 volts and over.

If the contacts fail to break the circuit when the gate is opened in the manner described, due either to their failing to separate, or to arcing over and maintaining an arc, or to being temporarily short circuited, the car continues to travel with the landing gate open. In these circumstances one of the following accidents may happen. The person who opened the gate may lose his balance and fall down the lift well; or, some one may fall out of the car on to the landing; or, some one may, expecting the car to stop, try to step out and get crushed between the landing and the car. All these are possibilities more or less remote, but possibilities nevertheless.

On the mechanical side there is the possibility that when the gate is shut and the car leaves the landing, the latch is not securely held. This may occur by reason of the locking lever not falling properly, due to some obstruction or to stiffness. In some cases even a piece of paper falling down the well and lodging between the lever and the framework might cause this; stiffness due to dirt or rust may be sufficient to hold the lever up; or the gate may ride up on dirt in the bottom track and cause the latch to foul the locking mechanism. If the lock fails to fasten the latch securely, the gate can be opened when the car in not behind it.

In the case referred to it is not possible to state precisely what happened, as the member of the club who unfortunately lost his life lived only for an hour or two after the accident, and never regained consciousness; and there were no eye witnesses who actually saw him open the gate. It is clear, however, that he opened the gate on the ground floor when the car was on the first floor, and fell down the lift well. On inspecting the lift on behalf of the club a few hours after the accident, I endeavoured to open the same gate when the car was not behind it, but after repeated trials, and using considerable force I was unable to do so. Thinking that there might be a sort of half-cock position in which the locking piece rested against the edge of the latch, I had the cover of the lock taken off and attempted to set the mechanism in such a position that whilst making electrical contact the latch could be lifted and the gate opened. In this I was unsuccessful.

I then tried the basement gate and found that after several attempts I could lift the latch. This gate, however, had been forced open a little while previously in order to extricate the unfortunate gentleman who fell down.

Whilst I was attempting to open the first floor gate with the car at the second floor, a member succeeded after several attempts in opening the ground floor gate, and called me down. On closing the gate I was able to open it again once, but after that failed to do so.

From this it would appear that there must be some position of the locking gear, which occurs probably once in a dozen times, in which the latch can be lifted when the lock is not released by the car. Assuming that one person in a hundred attempts to open a lift gate when the car is not there, and that once in 10 operations the lock does not secure itself properly, the chances of the gate being improperly opened are fairly remote.

In a case of emergency it must be possible to open a gate in some way or other, and anyone who is conversant with the mechanism of the lock can do so. In many cases, as in the lift in question, all that is necessary is to put one's arm through between the bars of the gate and lift the lever, performing in fact the same function as the car would do in arriving at or passing the floor. There is then the possibility that, after opening a gate in this way, sufficient care is not taken to ensure that the gate is properly closed and secured before leaving it. Should this occur, the gate forms practically a trap for any person who comes along to use the lift, as in the event of his failing to note that the car was not at the landing, he would open the gate and step forward, possibly realising too late that he had made a mistake.

In factories such lifts are now in common use, and the workmen and factory lads very soon get to know how to open the gates. It is, in fact, not an uncommon thing for mischievous boys to slightly open one of the gates deliberately after watching the car pass to a remote floor. It is only necessary to open it a fraction of an inch in order to put the lift out of action. Another favourite trick of a man who wants to use the lift, and is not sure that it will stop at his landing, is to stand with his finger on the latch waiting for the car to pass. As soon as it reaches his landing the gate is unlocked and open it comes, stopping the lift, (assuming there is no fault in the electrical circuit).

Here, then, are two points capable of improvement. The first danger can be considerably lessened by placing the lock-releasing mechanism near the top of the gate, where it is not so easy to tamper with it. The gate must, of course, only be unlocked when the car is approximately at the landing level, and this is quite easily arranged.

The other weak point, namely, the ability to open the gate as the car is passing, is not so easily remedied, particularly in what are called semi-automatic lifts, in which some form of cage switch is used, as in this case the floor to which the lift is travelling is not selected until the car actually arrives at its destination. In the case of a full automatic lift in which the floor is selected as soon as the push-button is pressed, it would be possible to electrically interlock all the gates until the car had arrived at its destination. This, of course, introduces an additional complication, but in the interests of safety, particularly in factories where large numbers of men use these lifts, it may be considered worth while to add it. On the other hand, the less complicated the gear is the better, because, if it repeatedly gives trouble, the time comes when the engineer or electrician in charge will short-circuit or cut-out of action the cause of trouble, until he has time to attend to it properly, and, under these conditions, the whole lift is rendered unsafe. Moreover, these temporary jobs generally acquire a semi-permanent character.

As already mentioned, the possibility of accident is very remote, considering the number of journeys which a lift makes per day, and it is no doubt on account of the very small number of failures, taken as a percentage of the total number of journeys made by the lift, that one is apt to forget the possibility of accidents occurring, and to omit to take ordinary precautions.

The Nature of the Ultimate Magnetic Particle.—In a letter under this title to our contemporary *Science*, Messrs. K. T. Compton and E. A. Trousdale point out that for many years scientists have agreed in ascribing the magnetic properties of bodies to the action of exceedingly small elementary magnets, but the nature of these ultimate magnetic particles has been an open question. The influence of temperature, chemical composition and other factors has received the simplest explanation on the theory that molecules, or possibly groups of molecules, are the ultimate magnetic particles. On the other hand, the electron theory of magnetism seems logically sound, and is the only theory which has successfully accounted for diamagnetism.

The recently developed method of determining the positions of atoms within a crystal by X-ray photography, and the ferro-magnetic properties of magnetite, hematite and pyrrhotite crystals, suggested a direct experimental method of eliminating one or the other of these two theories. By comparing photographs taken through these crystals while magnetised and unmagnetised, it can be determined with certainty whether or not the atoms have moved from their positions of equilibrium during the process of magnetisation. The authors have obtained experimental results with magnetite and hematite which indicate that the atoms do not leave their positions of equilibrium during magnetisation. These results are consistent with the electron theory of magnetism and prove conclusively that magnetism is not a molecular phenomenon.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Engineering Industry and the War.

Your issue of Friday last contains a letter from Mr. J. S. Warner, two paragraphs of which appear to me a gratuitous gibe at the medical profession, as unwarranted as it is irrelevant to the subject of that queerly worded lucubration. Mr. Warner says: "Try any medical man you like, and he does not know that the average female heart pumps blood as 3 is to 5 of the average male, &c." . . . . Well, why should he? The facts as far as they were taught when I studied physiology are as follows: Weight of the heart (male): 266 to 346 grammes, average 312 grammes, = 1 : 169 total weight of body. Weight of the heart (female): 230 to 340, average 274, = 1 : 162 of total weight of body (Piersol). (Rouvière gives 275 as the average weight for both sexes—Precis d'anatomie, 1913.)* Mass of blood $\frac{1}{13}$ to $\frac{1}{15}$ of total weight of body (Arthur). Mass of blood propelled by the heart into the aorta during each contraction = $\frac{1}{30}$ of the total, *e.g.*, for a human being weighing 78 kg., containing 6 litres of blood, 6,000/30 = 200 cb. cm.

Thus, Mr. Warner's figures would apply in the case of a man and a woman whose relative weights would be as 5 is to 3, and only then. What of the old tag: *sutor ne supra crepidam?*

H. L. J.

London, S.W., *May 8th*, 1915.

* Rouvière's figures apply more particularly to French cases: Hutchinson's weight tables take the height into consideration without regard to sex, so does the old formula—

$$\frac{\text{H}'' \text{G}''}{17} = \text{W lb.} \left(\frac{\text{Height} \times \text{girth}}{17} = \text{weight.} \right)$$

Cab Signalling.

I hope you will allow me space in your valuable paper to contradict some of the statements that Mr. Acfield makes in the article appearing in your editions of the 16th and 23rd ult.

The notion that a cab signal should be audible only has often been shown to be both wrong and dangerous. No valid reason against making the cab signals both visual and audible has, as yet, been given in any of the many articles I have read on this important subject. The only "reason" I have ever seen advanced is the statement that the visual indication, notwithstanding the audible one, would take the driver's eyes off the track, and thus imperil the train. But this "reason" has been so often and so conclusively shown to be wrong, that I shall not ask for space here to repeat the proof against it.

Mr. Acfield attaches relatively undue importance to the distant cab signal indicators. He certainly must know that no distant cab signal, however satisfactory as a distant indication, could have been any good to the driver and fireman at the instant they both missed the *home* signal at Bromford Bridge. The Great Western distant cab signal did not prevent, and could not have prevented, the wreck at Reading, and would have been equally useless at Cannon Street.

Of all the cab signals that have come before the public, the only ones worthy of adoption, or test, are those which give indications that are both visual and audible, which plainly differentiate between clear, run slow, and stop, and which are controlled by means of electrical contact with ramps.

This fact has become so widely known that it is surprising to find that one in Mr. Acfield's position is still unaware of it.

Amos Ogden, M.I.M.E.

Derby, *May 9th*, 1915.

P.S.—The Mr. Acfield referred to is of the Midland Railway.

The War and Future Trade.

I quote from your leading article entitled "The War and Future Trade," which appears in your issue of May 7th. You write:—

"It becomes more and more obvious as we study the problems of peace, even as superficially as is possible at this date, that that stage of this world conflagration will be only slightly less difficult than are our vast and unprecedented naval and military operations. . . . . We trust that Mr. Runciman will recognise the need that exists for a measure of modernisation and organisation with certain supplementary alterations making for greater efficiency and usefulness, supposing that he cannot see his way to adopt the proposals that are being again advanced in some of the more ambitious schemes that have been put before him by critics and advisers."

The correspondence that appeared in the *Times* in the summer of 1908, entitled the "Electrical Industry" dealt, I think, with very much the same problems as those to which your leading article refers. The minds of many of us were occupied then as they are to-day—almost exactly seven years later—in endeavouring to find a solution of the difficulty of "industrial organisation."

In the month of July of that year I myself addressed a somewhat lengthy letter to the *Times*, suggesting that a Committee or organisation of business men should be formed in the City of London, with the object of attempting to study the disease from which I at the time felt that British commerce was suffering due to German competition, and I pointed out that it was hopeless to endeavour to prescribe a remedy before one had diagnosed the malady.

I find myself seven years afterwards, with experience behind me, still writing, still talking, still trying to induce those connected with our industry as well as other business men in the City of London to believe that if we are to assure success in war or peace we must not be ashamed to learn from our errors in the past.

Lord Selborne, in his letter to the *Times* of to-day, pleads with much emphasis for national organisation. Mr. Bonar Law, in his speech in the House of Commons yesterday, argued upon much the same lines, but we still go on talking and writing and nothing is done. The fact is, I believe, that we do not know where to commence.

To those members of our industry who are interested in this subject I would, therefore, make the following appeal, viz., that they should at once communicate with the Secretary of the London Chamber of Commerce, 97, Cannon Street, E.C., intimating that they would be prepared to attend a meeting, if called, for the purpose of endeavouring to solve the many intricate industrial and commercial problems arising out of this war. I have reason to believe that the London Chamber of Commerce is ready and willing to assist us to build the foundations of such an organisation as that for which everyone seems to see the need.

Edward Bergtheil.

London, E.C., *May 11th*, 1915.

[We shall gladly welcome the views of our readers respecting our correspondent's suggestion. We, of course, heartily support his proposal for a conference of the electrical industry, for we ourselves advocated it in our issue of October 16th last, page 514.—EDS. ELEC. REV.]

PARLIAMENTARY.

Electric Railways (Facilities) Bill.—On Tuesday the Examiners had before them a late Bill to authorise the City and South London Railway Co., the Central London Railway Co., the London Electric Railway Co., and the Metropolitan District Railway Co., or any of them, to make agreements with each other, and the London General Omnibus Co., for the purpose of providing increased facilities for the interchange and alternative routing of traffic, the application of receipts, and the appointment of a Joint Committee. Owing to the late notices, the Standing Orders of the House had not been complied with, and the Bill will go before the Standing Orders Committee, who will decide whether it shall be allowed to proceed.

Lincoln Corporation Bill.—A Select Committee of the House of Commons, presided over by Mr. Middlebrook, has considered the Lincoln Corporation Bill, which, amongst other things, provides for an extension of the electric generating station, and gives power to run trolley vehicles. Mr. S. Clegg, electrical engineer and tramways manager, gave evidence with regard to the extension of the station. The cost of the station was estimated at £36,260 exclusive of the land. There was no opposition, and the clause was passed. Mr. Forbes Lankester, K.C., explained the proposals with regard to railless traction, to which there was no opposition. What was proposed was practically a through route from east to west, on the lower level of the city. This part of the Bill was also ordered to go forward.

Plymouth Corporation Bill.—Lord Newton's Committee of the House of Lords on Tuesday concluded the consideration of the Bill of the Plymouth Corporation, which consolidated the Acts of Plymouth, Devonport, and East Stoneham, as the result of the amalgamation. The Bill covered 240 printed pages. A large number of clauses regulating the electricity and tramway undertakings were passed without any opposition.

Irish Electric Lighting Orders.—On Tuesday, No. 1 Electric Lighting Provisional Order Bill was ordered by the Examiners to go for first reading. The Bill confirms electric lighting orders granted by the Board of Trade to the Rural District Council of Clifden, Galway, and to the Urban District Council of Enniscorthy.

Electric Lighting Provisional Order (No. 2) Bill.—This Bill was ordered by the Examiners on Tuesday to go for third reading. It confirms electric lighting orders to the following local bodies:—Haworth U.D.C., Irlam U.D.C., Hull Corporation (Extension), Knaresborough U.D.C., Normanton U.D.C., Litherland U.D.C., Normanton U.D.C., Ryde Corporation (Amendment of Order), Shipton U.D.C., Stanley (Order granted to the Electrical Distribution of Yorkshire, Ltd.) and Tenby Corporation.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

B.T.H. Loom Motors.

The extended adoption of electricity for the individual drive of textile machinery has led to great advances in the design of simple induction motors for this purpose. These machines are totally enclosed and dust-proof, to meet the conditions prevailing in the mills, and usually run on three-phase circuits, with no regulating or starting apparatus other than a switch. For driving looms the motors are hinged to base-plates, with springs to control the belt tension and to facilitate smooth starting and running, as shown in fig. 1, which represents a new line of loom motors recently brought out by the British Thomson-Houston Co., Ltd., of Rugby. The rotor has a squirrel-cage winding and runs in ball bearings, which are carried in solid end-shields; the base-plate is slotted to provide for adjustment if the belt stretches. The stator punchings are firmly clamped between cast-iron flanges, and are directly exposed to the air. As the motor is frequently stopped and started, the rotor is designed to have small inertia, and a special loom motor switch has been developed by the B.T.H. Co., of the drum controller type, giving two long breaks on each phase, with renewable contacts. The motors vary in size from ⅓ to 1½ H.P.

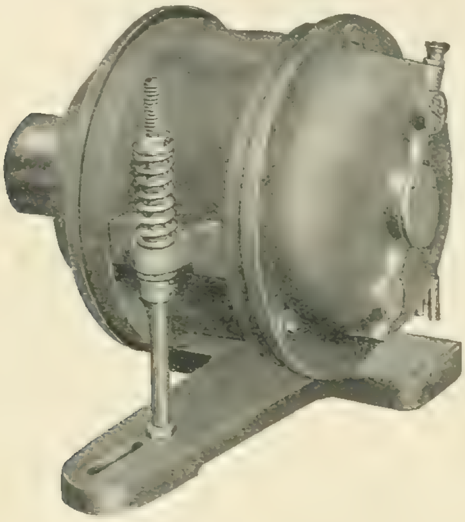


Fig. 1.—B.T.H. a.c. Loom Motor.

Witton Tramway Sectioning Switch.

At the request of a large municipality, the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., has constructed a sectioning switch for pole mounting on the tramway circuits, which consists of a 300-ampere "Peel" switch fixed in a cast-iron case, the case being of such a length that the switch can be fully opened and the lid closed. The lid is provided with a spring lock and a special key. The sides of the switch case extend some distance beyond the back and fit on to the pole, to which the case is clamped by two steel bands, the ends of which are screwed and provided with nuts and washers.

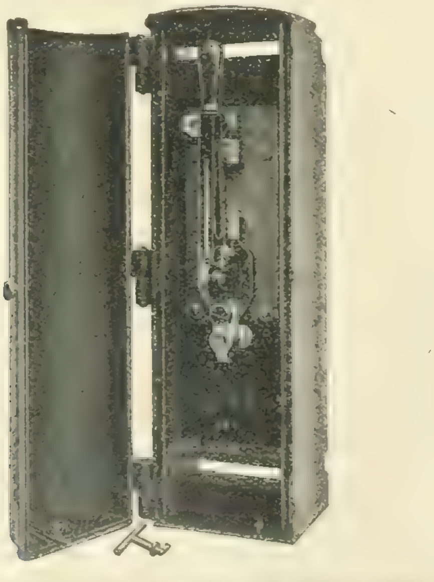


Fig. 2.—Witton 300-Amp. Tramway Sectioning Switch.

Spring Inspection Fitting.

The Steel Tubes and Conduits Co., of Alice Street Works, Keighley, are now making a new inspection elbow and tee for conduit work, called the "Spring" inspection fitting, which they have patented. The advantages of these fittings are that they give more room to inspect and work in, the lid can be prized off quickly, and to refix it, it is only necessary to press it on again. If the lid is not perfectly tight a slight pressure of finger and thumb on the lugs will adjust it. It is also very neat, and its price represents a great saving on the older patterns. The firm will be glad to give full particulars to anyone interested.

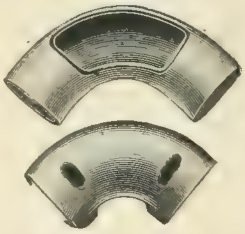


Fig. 3.—Inspection Elbow and Cover.

LEGAL.

Atwell v. West Ham Corporation.

On May 5th, at the Bow County Court, before Judge Smyley and a jury, a case was opened in which Mr. A. E. Atwell, a former employé of the West Ham Corporation Electricity Department, claimed damages for injuries received from an electric shock, in April, 1914.

Whittaker v. L.C.C.

In a Divisional Court of the King's Bench Division Justices Lawrence and Bailhache heard the plaintiff's appeal in the case from the decision of Judge Harrington at the Wandsworth County Court.

Mr. McCall, K.C., said the action was brought to recover damages for injuries sustained by the plaintiff through being ejected last September from one of the defendants' tramcars. It was admitted that the plaintiff was lawfully in the tramcar, having paid for his ticket, and he was ejected before he reached the point covered by his ticket. At the trial certain questions were put to the jury, and they were answered in favour of the plaintiff. The judge entered judgment in favour of the defendants on the ground that as the act of the conductor was illegal and would have been illegal if the defendants had done it themselves, therefore, the defendants were not liable. The plaintiff got into the car at Wandsworth High Street and took a ticket for Earlsfield Station. Before the car reached Tooting the conductor accused him of taking a penny journey for a halfpenny ticket. Plaintiff said he was going to Earlsfield Station, and that he had paid a penny for his ticket. The conductor told him to leave the car, and summoned the driver. Plaintiff was hustled off his seat and pushed out of the car. He fell in the street and injured his ankle.

The jury found that the plaintiff was ejected from the car; that he was not intoxicated; that the conductor did not think he was intoxicated; that he was ejected on the ground that the conductor thought he was endeavouring to travel to a point beyond that to which his ticket carried him; that the injury to his leg was the result; and they gave him £30 damages and found that plaintiff was not ejected through the malice or spite of the conductor. Counsel submitted that on these findings it was clear that the plaintiff was entitled to judgment.

Mr. Craig Henderson, for the L.C.C., submitted that the conductor ejected the plaintiff on the ground that he was committing a fraudulent offence. If his employers had been present in person the only remedy they could have adopted was to ask for the plaintiff's name and address. The conductor did not do that, but promptly ejected him from the car and that was outside the scope of his authority, and the defendants could not be held liable. If the jury had found that the plaintiff was intoxicated there would have been no case for the Council. The power to eject a person was limited to a case where a man was intoxicated.

Mr. Justice Lawrence: Suppose a sober man smashes a window and says he is going to smash the lot, what must the conductor do?—He must call a policeman.

Mr. Justice Lawrence: Then he can smash all the windows and you cannot turn him out.

Mr. Justice Bailhache: Suppose two persons begin to fight in a car, you are going to leave them there?

Mr. Henderson: They are committing an offence against the by-laws and their names have to be taken.

Mr. Justice Bailhache: That is impracticable; the men are busy.

In giving judgment, Mr. Justice Lawrence said that if a person travelled beyond the distance provided for by his ticket it was a form of trespass, and unless the company had authority to remove him the authority of the Council would be rendered ridiculous, and they would not be able to protect their own property. The act of the conductor was wrongful, and the plaintiff had a right to sue. Judgment ought to have been entered for the plaintiff in accordance with the jury's findings.

Mr. Justice Bailhache concurred, and judgment was given for the appellant accordingly with costs.

London Tube Railway Compensation Claims.

Mr. H. Chatfeild Clarke, president of the Surveyors' Institution, has given his awards in the proceedings which he conducted as Arbitrator between the London County Council and the London Electric Railway Co., in compensation claims relative to several easements and land for tube railways.

In the claim for the staircase built under the premises, Nos. 1 and 3, Oxford Street, measuring 45 ft. × 11 ft., and connecting the Charing Cross, Euston and Hampstead Railway Station with the Central London Railway, the actual area taken was 484 ft., and Mr. Howard Martin, for the L.C.C., on the basis of 10 per cent. of the surface value, £6 per ft., brought out the compensation at £290, to which he added 10 per cent. for forced sale, making £319. The land on the surface was, he said, worth £2,904. The railway company's expert witnesses, Mr. Leslie Vigers and Mr. Douglas Young, presented valuations of £44 and £36 respectively, being based on £1 per foot run reduced to lineal feet.

The second claim related to a total area of 11,640 ft. at Kingsway and Aldwych Island, part of a site of 120,000 ft., under which a tube ran at a depth of 88 ft. The site was stated by Mr. E. Morten, K.C. (for the L.C.C.) to be an exceptional one worth about £1,300,000, with a rental value of £50,000 a year. Mr. F. W. Hunt, chief assistant valuer to the L.C.C., gave evidence that the whole site would be damaged 1 per cent. of its total capital value, or £13,000, equal to a difference of three months' rental, or 10 per cent. of the part affected for surface value. For the railway company, Mr. Vigers and Mr. Douglas Young gave valuations for compensation amounting to £901. The latter characterised as extraordinary the statement that the presence of the tube depreciated the whole of the site.

The third claim involved the question of the easement under the Shaftesbury Memorial Fountain, Piccadilly Circus. The easement was 36 ft. in length, and compensation was claimed at £1 per ft.-run, £36. The property around was acquired by the Metropolitan Board of Works in 1889, and the railway company's experts contended that the rate was settled by the Crown in 1890 at 2s. per ft.-run, which for 40 ft. came to £4.

The Arbitrator has awarded the following amounts:—For Nos. 1 and 3, Oxford Street, £175; Kingsway and Aldwych Island, £1,355; and Piccadilly Circus Fountain, £40. An award of £195 was made in respect of an easement under Southampton Row, between Vernon Street and High Holborn, subject to the surface area being in a street within the London Electric Railway Act, 1906, Sec. 59; and of £80 for an easement under the pier and stage at Victoria Embankment.

Nicholls *v.* Astley & Barwell.

In the Lord Mayor's Court, last week, before the Common Serjeant (Sir F. Bosanquet, K.C.), and a jury, a claim was made by Messrs. R. Nicholls & Son, electrical engineers, 54, Basinghall Street, E.C., against Messrs. Astley & Barwell, dressmakers, 385, Holloway Road, for £29 2s. 1d. for electrical fittings supplied and work done in installing electric light in the defendants' premises. The plaintiffs' case was that an order was given by Mr. H. Astley, a brother of one of the defendants, who were two ladies carrying on an extensive dressmaking business. The plaintiffs, after making the necessary inquiries, proceeded to do the work, and upon completing the wiring of the premises on May 27th required payment on account. Mr. H. Astley had promised to get a cheque for £10 or £12. On June 3rd a payment of £3 was made. The plaintiffs were dissatisfied with the payment and sent their workman to bring away the tools. In consequence of a message sent by the workman that a substantial payment would be made the work was proceeded with. When it was completed and the defendants applied for payment of the account, a letter was received from Astley saying that the plaintiffs' account had been forwarded to him as the job had been carried out for him.

The plaintiffs in their evidence, said at the time the order was given by Astley there was already an indebtedness owing by that party which was being paid off by instalments. The work had been done for the defendants and not for Astley.

For the defence **Mr. H. Astley**, a builder and decorator, was called, and he said that the work of fitting up his sister's premises in Holloway Road was given to him, and he employed the plaintiffs, who agreed to carry out the work. The money which the plaintiffs had received on account was money he had paid out of his own funds. The plaintiffs had not rendered an account to him, and, therefore, he could not render the bill to his sister's firm. As soon as he did so he would receive payment, and the plaintiffs' account would be settled.

The jury found a verdict for the plaintiffs for the amount claimed, and judgment was entered accordingly.

Trading with the Enemy.

In the City of London Court, on May 10th, before his Honour Judge Atherley-Jones, K.C., Mr. Otto Bohndel, trading as Schoen Bros., 29, Cock Lane, Snow Hill, sued Messrs. H. A. Jones & Co., electricians, 171, Holland Road, Shepherd's Bush, for £19 1s. 2d. for electrical goods supplied.

Mr. Jones said he admitted that the claim was due, but he dare not pay it, because the plaintiff was a German.

Mr. Harry Strouts, plaintiff's solicitor, said that the plaintiff was a registered German. He had been carrying on business in London for 10 years.

Defendant: He is a German agent for the sale of foreign goods.

Plaintiff's traveller, A. J. **Conway**, who said he was an Englishman, said that the plaintiff was not naturalised.

The **Judge**: Is he interned?

Plaintiff's Traveller said he was not.

Defendant: His brother is.

Conway added that plaintiff bought all his goods from various German houses, and paid for them outright. Some of them were made in Germany. The goods were invoiced to the plaintiff.

Defendant: These are all German goods, especially cable and torchlights. I am trading with the enemy. He is a pure German.

Conway: Two-thirds of the goods are German.

Defendant said that owing to the war his business was ruined, but next week he meant to join the Army.

Judge Atherley-Jones said he must give judgment for the plaintiff. The law was clear, but whether it was the right law was not for him to say. An enemy alien carrying on business in this country was able to enforce any contract which he entered into, and plaintiff was in that position. He might be as great an alien enemy as he liked, but while a benevolent Government left him at large—

Defendant: God help us!

The **Judge** (continuing), he is able to carry on his trade and enforce his contracts, enforcing payments against British subjects. While I must give judgment for the amount claimed, it will be without costs as defendant had reasonable grounds for raising the question of the alien enemy. I will allow the Court fees.

Defendant: He is ashamed to put his foot into this Court.

WAR ITEMS.

As Others see us!—A New York dispatch to the *Evening News* quotes from *Collier's Weekly* some extracts from a series of articles on Germany contributed by Mr. Albert Beveridge, former U.S.A. Senator, who interviewed the Kaiser, leading savants, industrial magnates, and others in Germany. Herr Walther Rathenau, of the A.E.G., whose name and views are not unfamiliar to our readers, expressed himself in the following terms:—

"In considering the causes of the war, we must distinguish between powder and matches. The match that fired the powder was Russia. But the powder was the inevitable conflict between England and Germany. On the surface this is a mere struggle for commercial monopoly on England's part. But deeper down it is a struggle between two conceptions of life and duty. Take the chemical industry. There, 5,000 scientists, Germans, are glad to work for just a livelihood. Their real reward is their passion to discover Nature's truths. Also, there is their conception of duty. They are not only satisfying themselves by doing for its own sake what they love best to do, but they also feel that they are helping to build up Germany, and in a broader way to increase the sum of human knowledge.

"On the other hand, there are in England, let us say, 30 scientists of the same ability and skill. But they must be professors of Oxford or Cambridge, or other schools of learning. They would scorn employment and work such as our 5,000 scientists do. Here we have the explanation of our superiority. Among us the love of knowledge is part of the German character. We feel we cannot have too much of it. To make it plainer, let me say that in Germany it is fashionable to be well informed. In England, on the contrary, it is felt that it is ungentlemanly to acquire more knowledge after a certain point of education. Englishmen say they dislike 'walking dictionaries.' Apply the idea of duty to one's country to employés of industry—say an industrial company of 30,000 employés, or a great bank with 10,000 employés willing to work, not for food only, but also as a matter of duty for the building up of Germany. Contrast with this conception of life and labour the conception of the same class of men in England: as little work as possible, no more knowledge than is absolutely necessary, vacations, luxuries, and the mental and physical habits growing out of the same. These illustrations show why Germany has been able to sell her products in the foreign markets which England monopolised for so long. She thought they belonged to her as a matter of right. Conflict was inevitable. It is a difference of fundamental ideals of life and duty. That is the deep reason why the war must go on until it is proved which of these ideals is the true one. That is why we Germans are willing to die and suffer worse than death in order to win."

Petrograd Electric Lighting Co.—A certain amount of interest is attached to the report for 1914 of the Petrograd Electric Lighting Co. of 1886, in consequence of the threatened sequestration of the undertaking, as mentioned in this journal on several recent occasions, by the Russian Government on the ground of the company being, as is alleged, almost entirely owned and controlled by Germans. As now announced from Petrograd, the company's accounts for 1914 show net profits, on a rough conversion of roubles into sterling, amounting to £683,871, as compared with £603,569 in the preceding year, the figures representing the proceeds realised by the works in Petrograd and Moscow for the whole of the year, and those from the works at Lodz down to August 31st, as the directors have been without connection with the latter city since the date in question. It is proposed to place £33,900 to the reserve fund, as against £31,500 in 1913; to devote £142,500 to depreciation, as contrasted with £132,500, to pay a dividend of 11 per cent.

on the £900.000 of preference capital, as in the previous year, 8 per cent. on ordinary shares of £3,100,000 as in 1913, and 4 per cent. on £1,000,000 of new ordinary shares which were issued in 1914. In addition the taxes on capital and net profits absorb £70,000, benevolent funds £21,500, and directors' fees £21,436, the small balance remaining to be carried forward. It is, however, not intended to pay the dividends for the time being, but to transfer the sums available for these purposes to a dividend account to be created, and to leave to the directors the decision to fix a future date for the distribution. The latest information in relation to the proposed sequestration of the company is to the effect that the situation has not very materially changed, although no definite statement has been made.

A lively discussion is proceeding in the Petrograd Town Council on the question of buying up the electrical concessions in the town, including the business of the famous 1886 company. Opinions are sharply divided on the advisability of buying up all the electrical concerns, or only that of the 1886 company. Councillor Oppel insisted on the necessity of buying the electrical concerns in the near future. Both industry and private consumers, he said, had an interest in their transfer to the town. Technical experts had shown that the transfer of the electrical enterprises to the town would involve increased capital outlay, as it would be necessary to improve the equipment of the electrical stations. At present the stations of all three electrical concerns of the town include in their equipment a considerable quantity of old machinery of comparatively little value. When the moment comes to buy, namely, in 1918, even their auxiliary value will be gone. As to the revenue that may come to the town by exploiting these concerns, accountants value it at 3,000,000 roubles. But such an income is only possible if the price of energy is not reduced. As it must be reduced, the revenue will fall to 1,200,000 roubles. It will increase by-and-by probably, for the lower price will attract new consumers, and extend the field of operations. But in order that the number of consumers should become considerable, the price must be reduced considerably. A slight reduction would not greatly affect the number. In the cost of exploiting the electrical concerns of the town, 70 per cent. goes for fuel; therefore, the town should turn its serious attention to acquiring the cheapest possible fuel for the concerns to be taken over. For the immediate future he thought it would be sufficient to buy out the 1886 company, which would cost the town 22,000,000 roubles, and promised a profit of 2,645,000 roubles. But if all three concerns were bought the cost would be 41,000,000, and the profit would be less. Another councillor thought that the existing town electric stations which supplied the tramways with current should be enlarged to supply current for both lighting and industry. After the town had thoroughly consolidated its position, it would be better able to gather in all the other electrical concerns, and eliminate the private element. Councillor K. Ya. Zagorsky, whose views on the subject have been much discussed, said that Petrograd, like other large towns in Europe, should adopt the single electric station. In order to compete with the companies the town should construct a large power station. He considered it was impossible to formulate a definite plan for exploitation by the town owing to the rapid progress of the electrical business and modifications in its application.

Constantinople Telephone System.—The following circular letter has been issued from Broad Street Avenue, London, E.C., under date May 7th, by Mr. M. Webster Jenkinson, representative in the United Kingdom for the Constantinople Telephone Co.:—

"As possibly you are aware from statements in the Press, the Turkish Government have forcibly taken possession of the company's system in Constantinople. The general manager, Mr. Douglas Watson, and the British staff were expelled from the company's buildings, and on the advice of the American Ambassador left Constantinople, arriving in England last week. I have received a letter from Mr. Salem, the company's chief legal adviser in Constantinople, enclosing minutes describing the confiscation of the plant and property by the Turkish authorities, and a copy of the protest addressed by the Constantinople directors to the Turkish Government. It is hoped that it will soon be possible for the British staff to return, and for the company to resume possession of its plant, and of course endeavour will be made to obtain reparation for the loss inflicted by the action of the Turkish Government. The Turkish authorities have based their action on Article 23 of the Convention, which reads as follows:—

> The State have full power to inspect and supervise the service, and the concessionnaire shall do whatever is necessary to facilitate this inspection. The Government also reserves the right to assume control of the service on all or any part of the system when necessary for the public safety. The company shall have no right to demand compensation on this score.

The company has never interpreted this clause as giving the Turkish Government power to take physical possession of the company's plant and to expel the staff as they have done. The matter is receiving the most careful consideration of the European directors, and every possible step has been and will be taken to protect the interests of the shareholders and bondholders."

Italy.—We have received from the British Chamber of Commerce for Italy at Genoa List No. 15 of openings for British articles in Italian markets, from which we make the following extracts. Many of these firms formerly did business with German and Austrian houses and now seek British connections:—

No. 611.—Engineer at Rome requires further agencies for British technical and electrotechnical articles. R.A.D.B.

No. 622.—Commission Agent at Cantania requires electrical material, sunshades, fans. C.G.M.

No. 635.—Engineer at Florence wishes to represent on commission British manufacturer of iron plates, rails, steel, engines, cranes, machinery in general. F.P.P.

No. 639.—Merchants at Turin require fire-clay, china clay for paper mills, pig-iron, foundry articles, fire bricks, alloys. T.P.R.

No 642.—Commission agent at Padova wishes to take up British paints and varnishes, electric lamps, motor-cycles. P.N.

List No. 16, also received, contains the following:—

No. 652.—Commission agents at Turin are anxious to obtain agencies for British electrical machines, belting, oils, &c. T.F.B.

No. 657.—Merchant at Rome would take up British scientific instruments, machinery, electrotechnical material. R.A.O.

No. 664.—Commission agent at Genoa seeks agencies for seamless steel tubes, ship's auxiliary machinery, anchors, chains, machine tools, steel castings. G.F.M.S.

No. 675.—British firm at Rome inquire for addresses of manufacturers of copper and brass tubing, crude oil engines, machinery for flour mills, &c.

Dartford.—Fire Alarms Delayed.—In reply to a request from the Dartford T.C. that Messrs. Stuart & Moore should be allowed to proceed with their contract for the installation of the fire alarms, &c., in the town, the War Office have intimated that the firm (who are engaged on Government work) are in arrear with stores urgently required, and suggest that the Council might possibly see its way to arrange for the work to be carried out by some other firm not engaged on Government orders. The General Purposes Committee is of opinion that it would not be desirable to engage another firm to complete the installation, as suggested, but it is making temporary arrangements pending the completion of the contract.

Government Cable Contract.—Mr. Cecil Beck, in reply to Mr. Booth in the House of Commons, on 6th inst., said Siegfried Hirschmann was still a co-director of the Union Cable Co., but the Office of Works did not know where he was residing. Before the contract was made the First Commissioner of Works asked for the appointment of a supervisor under the Trading with the Enemy Act. Mr. Booth: Can the Office of Works not find out where this man lives, in view of the importance of an enemy getting knowledge of our cable contracts? Mr. Beck: I think you rather misunderstand the situation. The Office of Works has no responsibility beyond seeing that the contract given is carried out.—*Financier.*

We have received the following letter on this subject:—

"I have read the reply given by Mr. Beck, representing the First Commissioner of Works, regarding the contract given to the Union Cable Co., Ltd., in which it is stated that the managing director, Mr. Blackwood, was an Englishman, but the other four directors are Germans.

"I wonder if it has occurred to Mr. Blackwood what every one of us who have any idea of loyalty think of his continuing to hold such a position, and with such associates.

"It is at last beginning to dawn upon us what our enemies are capable of, and I shall be very much surprised if any British workman continues his employment in any business that has a single German, Austrian or Turk connected with it.

"When one raises the cry that the company is German, the palliative is offered—'Oh, yes, but British workmen are employed'—but, I ask, if the Union Cable Co. was closed down to-morrow, are there not other truly British Cable Manufacturing Companies who would gladly give employment to their employés?

"A. R. MUNDAY.

"Dublin, May 11th."

Victoria Falls Staff's Threat.—A Reuter dispatch from Johannesburg says that the majority of the men at the Victoria Falls Power Co.'s works at Brakpan, which supplies power to many mines on the Rand, sent an ultimatum to the manager declaring that unless all naturalised and unnaturalised Germans were discharged they would strike on Wednesday as a protest against the sinking of the *Lusitania.*

Electricity Staff Badges.—The Tonbridge U.D.C. has decided to supply "Public service badges" to the staff of the electricity works.

Board of Trade Publications.—The Board of Trade Commercial Intelligence Branch has issued a list of inquiries for sources of goods for the week ended May 1st.

Personal.—Included in the Committee appointed by Blackburn Chamber of Commerce to assist the Government in the matter of war munitions is Mr. S. J. A. Mills, consulting electrical engineer (Blackburn), and Mr. W. Lupton (chairman), engineer, of Accrington.

In the list of the survivors of the *Lusitania* we are pleased to see the names "Mr. and Mrs. Lines." Mr. S. L. B. Lines, of Toronto, is manager of the Canadian branch of Messrs. Chamberlain & Hookham, Ltd., of Birmingham. He left Canada at very short notice on a business trip to this country, and his wife who accompanied him is interested in Red Cross work. According to the Press reports, Mr. Lines was the last man to leave the ship, he having slid off the deck as the vessel went down. He grasped a raft, and eventually rejoined his wife at the Queen's Hotel, Queenstown. We offer Mr. and Mrs. Lines our hearty congratulations on their escape.

The Sales Engineer at the Walsall electricity works has enlisted for the duration of the war. The Engineer has been authorised to temporarily engage a man ineligible for military service.

Roll of Honour.—Private David Cousin Scott, 1st Royal Scots, was killed in action at Hill 60 on April 22nd. Private Scott in civilian life was an electrician under the Edinburgh Gas Commissioners.

Sergeant Farquhar Kennedy, of the 8th Divisional Signal Company, Royal Engineers, who has been awarded the distinguished conduct medal for showing great courage and resource in maintaining the lines of communication at Neuve Chapelle though exposed to heavy fire, has been for the last 15 years on the telegraph staff of the General Post Office, Glasgow.

BUSINESS NOTES.

Consular Notes.—CHINA.—The American Consul at Chefoo, in a recent report, states that the Chefoo Electric Lighting Co., after a long delay, has finally begun to supply electric current to users in Chefoo. The company was formed on January 16th, 1913, with a capital of £10,000, subscribed principally by Chinese. It was duly registered with the Board of Works at Pekin on May 27th, 1913, and received its charter on that day. The plant, as it is now established, represents an outlay of about £5,000, and includes the following machinery :—Two complete sets of 100-KW. alternators, consisting of two alternators three-phase, 50-cycle, 3,300 volts ; two Belliss-Morcom vertical compound engines ; three Babcock-Wilcox boilers, two Belliss-Morcom jet condensers and pumps, two boiler feed pumps, purifier and heater (combined), and the necessary switchboard. The managers are Chinese, but the chief engineer, his assistants and electricians, are Japanese. The company has spent about £5,000 in material and for erecting poles, &c., throughout the city, and has contracted a loan for £5,000 from the Bank of Industry and Commerce at Chefoo. By the summer of this year the company expects that the number of consumers will necessitate the further purchase of a 200-KW. alternator set. Chefoo is now splendidly lighted. The company estimates that about 1,000 poles will be necessary to fulfil its contract to light the city's streets. The lights on these poles are of 16, 25, 50, 100 and 200 C P. Outside the harbour there are to be three 1,000-C.P. lights, and the Japanese post office has contracted for one 1,000-C.P. light. Thus far the company reports 1,300 consumers, while a great increase is expected as soon as the company is able to install meters, which it hopes to do shortly. Consumers are classified as (*a*) meter consumers, (*b*) regular consumers on monthly contracts, and (*c*) occasional consumers. The charges are 9d. per KW.-hour with 1s. minimum charge per lamp per hour, and 1s. per meter per month. The charges per lamp monthly contract range from 1s. 3d. for 5 C.P., 2s. 6d. for 16 C.P., 5s. for 50 C.P. to £2 per 1,000 C.P.

NEW ZEALAND.—The American Consul at Auckland reports that very satisfactory progress is being made in connection with the plan of the Dominion Portland Cement Co. to harness Wairua Falls for the production of electrical power and the establishment of a modern cement works at Kekarangi, near Whangerei, New Zealand. To carry out the scheme will entail an expenditure of upwards of £200,000. The plan involves building a canal 1½ miles long, having a width of 23 ft. at the bottom and 66 ft. at the top. This canal will take water from the river immediately above the falls, and conduct it to steel pipes 5 ft. in diameter, which will convey it to the turbines at the power station. The total fall from the reservoir at the end of the canal to the river bed is about 140 ft., and sufficient water will be carried to generate 1,500 H.P. The company is developing two sets of this size, making a total of 3,000 H.P., but the station is being planned for four such units. The cables are of aluminium wire, and the voltage of the current will be 22,000. Arrangements are being made to furnish the city of Whangarei with electric light. Apparently American manufacturers are obtaining a substantial share of the contracts. It is said that one American company will furnish about £40,000 worth of machinery and another £25,000 worth of dynamos, generators, transformers and other appliances. The contract for the dynamos is the largest made in New Zealand thus far, and was secured against strong competition from Europe. A wharf is being built in connection with the plant. Apart from the United States furnishing a large part of the machinery an American engineer is erecting the mill.

CHILE.—The American Consul at Santiago reports that electric lighting is general in the cities of Chile, particularly in Santiago and Valparaiso. In steel and concrete buildings steel conduit is used, and in brick and adobe houses brass conduit or porcelain insulators are used in wiring. Steel conduits cost 9½d. per yard, and brass conduits are sold for 2d. One of the electrical contractors states that about 10 per cent. of the wiring is done with steel conduit, between 60 and 70 per cent. with brass conduit, and the remainder with porcelain insulators. Brass is used because it is cheap and easy to work. Practically all tubing, both brass and steel, has come from Germany. The steel tubing comes with the threads cut.

Most of the electrical business is controlled through European houses. One electrical contractor who buys all his supplies from European houses states that he would not be willing to buy supplies from American catalogues because of the fear that he would not get just what he required, as the conditions are quite different from those in the United States. The tubing or conduit generally use in Chile and recognised and accepted by the two light and power companies of Valparaiso and Santiago is what is known as Bergmann tubing. Any material used in electrical installations has to be accepted by the traction and lighting company. However, an inspector of electrical installations is employed by the Chilean Government, and it is suggested that manufacturers and contractors take up with this inspector the question of the use of their material.

It has been stated that dealing with American houses has proved unsatisfactory in a number of cases, because if not quite enough money is sent for the article the order is not filled, and if too much money is sent some additional article is forwarded to the purchaser which he does not want, or the balance is retained as a credit against future purchases. The criticism of the occasional increase in charge above that quoted is also made against American firms by one of the electrical contractors. They understand that quotations in the United States often vary for the domestic trade, and that it is quite possible for variation to occur between receiving the quotation and placing the order ; but inasmuch as the foreign business is sought, they feel that quoted prices should be maintained, at least until there is time for the order to be sent.

The regulations of the light and power company of Santiago require that persons desiring to make installations in houses where power is to be used must agree to submit to the regulations and conditions fixed by the company, and must use material approved by the company. These instructions also demand that 1,000 pesos (about £29 at the present rate of exchange) be deposited by the person desiring to make installations, and that the company have the right to change the installations for his account if they are not properly done from the company's point of view, and shall also have the right to impose fines against him up to 50 pesos (29s. 2d.) each for infractions against the regulations, deducting these fines or charges from the 1,000 pesos deposited. It has occasionally occurred that the company would not connect with house installations made by persons whom they had not authorised, but the company is now forbidden by law to refuse to make connections when the person making them has done the work in conformity with the law. Any fines imposed are to be for the benefit of the city, and are to be made in conformity with the report of the general inspection of electrical installations.

The Association of Fire Insurance Companies has no electrical code of its own. The tramway and light company, the National Government, and the Association of Fire Insurance Companies have inspectors of electrical installations.

It is obvious that the heavy American conduit, weighing 50 per cent. more than the samples sent, is superior, but the question as to the need of the heavy conduit is at least an open one in the minds of the consumers. The matter of first cost is very important in Chile, and it is necessary to quote very close to the ordinary prices before the question of quality becomes of much interest. This might not be true in a country where there were many wooden buildings, but wooden buildings with electric lights are rare throughout Latin America.

Most of the contractors or merchants who handle conduits are more or less familiar with English, but there would be absolutely no chance for error in corresponding in Spanish with anybody in Chile, and it probably would be pleasing to most of the people of the country.

Reyrolles and War Service.—Messrs. A. Reyrolle and Co., Ltd., of Hebburn-on-Tyne, are concentrating all their energies in producing their standard switchgear and accessories for war service. For the information of firms or companies who are engaged on orders for war materials and may perhaps be extending their factories for the production of such requirements, the firm have in stock completed articles, or parts which can be quickly assembled, for 12,000 and 6,000-volt armoured switchgear, and 3,000 and 500-volt armoured draw-out panels (two types). These are being held in reserve for Government work only, and as they are ready to be put together, quick delivery can be given. The firm are also holding in readiness for similar service ironclad distribution boxes up to 400 amperes per way, ironclad switch fuses, 50 amperes, and wall plugs for portable drills and lighting. Both the switchgear and accessories are made to comply with the Home Office Regulations. From time to time illustrated particulars of these manufactures have appeared in our pages, but firms interested can obtain a set of publications from Messrs. Reyrolle which cover the whole ground.

Metal Markets.—Quin's "Metal Market Letters," which have hitherto been circulated privately among large consumers of, and dealers in, metals, and among merchant firms, now appear under the title of the *Metal Bulletin*, published twice weekly, on Tuesday and Friday mornings.

Prices Advance.—The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silvertown, announce that, owing to the increased cost of production, both in materials and labour, consequent upon the war, prices in their List No. 27 (gutta-percha, india-rubber, silk and cotton-covered wires, &c.) were advanced by 10 per cent. from May 6th, with the exception of tool-boxes, tools, and jointing materials, the prices of which are withdrawn.

Book Notices.—"Advanced Theory of Electricity and Magnetism." By W. S. Franklin and B. McNutt. London : MacMillan & Co., Ltd. Price 8s. 6d. net.

"How to Cook by Electricity." By Amy Cross and Alys Waterman. London : Lake, Sison & Brown, Ltd. Price 9d.

For Sale.—Sheffield Tramways Department have for disposal a wheel boring and surfacing machine ; Wigan Corporation has for disposal a quantity of scrap copper. Particulars are given in our advertisement pages.

Bankruptcy Proceedings.—James Wm. Tattersall and Tom Whitaker Tattersall, lately trading as Tattersall and Tattersall, electrical engineers, at Kimberley Road, Willesden Lane, N.W.—An application for order of discharge was made on Tuesday to Mr. Registrar Linklater at the London Bankruptcy Court. Mr. Egerton S. Grey, Official Receiver, reported that the debtors failed last February, with provable debts £8,965 and assets that had realised £418; it was anticipated that a further £31 10s. would be received, and that a dividend of about 7d. in the £ would be paid. The debtors commenced business in August, 1912, as motor engineers, at 9, Regent Street, W. Their business, which consisted in the purchase and sale of carburettors, was successful; in August, 1913, they patented a self-starter, in connection with which they registered the trade mark, "T. A. T." In the following November they took works at Kimberley Road for the purpose of making these machines, and at the same time entered into an agreement with "The Imperial Motor Industries, Ltd.," under which that company were appointed their sole agents for the sale of the machines in Great Britain and the Colonies. The agreement further provided that the company should take delivery of 1,000 machines, at the rate of 60 a month, and at a price which would have produced a profit to the bankrupts of £10,000. To enable them to meet the initial expenses of setting up machinery for the manufacture of these machines, the company advanced them £3,600: to enable them to deliver the said machines to the company they entered into subsidiary contracts with different firms for the supply of the necessary parts; owing to delay in delivery of these parts they were unable to supply the company with the machines within the time allotted by the agreement; as a result of negotiations the company expressed their willingness to vary the agreement in their favour, but on the outbreak of hostilities in August last notice to terminate the agreement was given them by the company for breach of contract, and the losses sustained thereby had resulted in their bankruptcy. The only offence reported by the Official Receiver was insufficiency of assets to pay 10s. in the £ to the creditors, and his Honour granted orders of discharge to both debtors subject to a nominal suspension of three weeks, remarking that to a certain extent the war had brought about the bankruptcy.

Dissolutions.—West Lancashire Cinema Co., Golborne.—Messrs. R. Bond (electrical engineer) and C. Whelan (painter and decorator), have dissolved partnership. Mr. C. Whelan will continue the business under the same style.

Coleraine Manufacturing Co., electrical engineers and manufacturers, 63, Turnpike Lane, Hornsey, N.—Messrs. F. C. Grund, W. H. A. Butterfield, A. E. Frost, and T. B. Batchelor have dissolved partnership, only as far as concerns Mr. T. B. Batchelor. Debts will be attended to by the remaining partners.

Private Arrangement.—Allen & Grosse, Ltd., Queen Street, Belfast, electrical engineers.—An adjourned meeting of the creditors interested herein was held last week, when it was decided that the liquidation was to be continued with Mr. Kennedy as liquidator. The committee which looked into the value of the assets recommends the sale by the liquidator of the assets to Mr. Allen, one of the directors of the company, at, it is thought, such a price as will give the creditors a composition of 6s. 8d. in the £, or the greater part thereof.

Deed of Assignment.—A. Hartley & R. W. Leek, electrical engineers, Colne.—Particulars of claims for dividend must be sent by May 29th to the trustee, Mr. R. A. Hargreaves, 2, Albert Road, Colne.

Catalogues and Lists.—Trafford Park Estates, Ltd., Trafford Park, Manchester.—We have received a 60-page illustrated pamphlet giving very full information respecting Trafford Park and its excellent facilities as a manufacturing district. The important electrical and engineering works situated there have made the estates to our readers one of the most familiar industrial centres in the kingdom. Developments are constantly proceeding there, and a coloured map which accompanies the pamphlet shows the location of existing factories and indicates what land is still for sale or lease.

Armorduct Manufacturing Co., Ltd., Farringdon Avenue, London, E.C.—Four-page illustrated and priced leaflet relating to "Little Hustler" electric drills.

Edison & Swan United Electric Light Co., Ltd., Ponder's End.—8-page illustrated leaflet particularising and stating reduced prices of Ediswan ironclad switches and switch fuses.

Messrs. Alexander Duckham & Co., Ltd., Phœnix Wharf, Millwall, London, E.—Booklet giving information regarding their antiseptic "Immutol" cutting compound, and a list of users.

Messrs. Drake & Gorham, Ltd., 1, Felix Street, Westminster Bridge Road, London, S.E.—Folder illustrating their "El Grilstovo," an electric cooking set consisting of a circular heater, pan, and grill deflector, which they are pushing as a new summer selling line.

Messrs. Steel Tubes and Conduits Co., Alice Street, Keighley.—Priced leaflet relating to "Spring" inspection fittings.

Trade Announcements.—The Peninsular Engineering Co., Ltd., Suffolk House, Laurence Pountney Hill, London, E.C., inform us that they have been appointed sole agents for the firm of Luis Berenguer, en Cta. Barcelona, makers of high and low-tension porcelains for the electrical trade.

The Hoffmann Manufacturing Co., Ltd., of Chelmsford, have opened offices at Victoria Buildings, 21, Grainger Street, Newcastle-on-Tyne, which are under the control of Mr. T. P. Brady. Telephone: No. 3736 Central; telegrams: Hoffmann, Newcastle-on-Tyne.

LIGHTING and POWER NOTES.

Barford.—The Warwickshire C.C. has given permission for the Barford Electric Supply Co., Ltd., to use overhead transmission between the village and Forge Cottage on the main road.

Barrow.—The Corporation Electricity Committee is making considerable extensions to meet the establishment of works engaged on Government orders. The L.G.B. has sanctioned the borrowing of £500 for the provision of switchgear and connections for the new turbo-alternator at the works, whilst mains are to be laid to a former candle works at an estimated cost of £1,150, and switchgear and a transformer.

Birmingham.—Temporary Power Station.—Last week members of the Electricity Committee paid a visit to the temporary power station being erected at Nechells, at a cost of £97,000. The contracts for this plant were let at the end of last year, and it is expected that the station will be in use by the end of August. It will contain two 5,000-kw. turbine sets, with condensers, and six boilers, each of 33,000 lb. evaporation; five wooden cooling towers are being erected to deal with the circulating water. The installation is to be housed in a steel-frame building. At the present time the pile foundations of the permanent station are being put in.—*Birmingham Daily Post.*

Blackrock (Co. Dublin).—Loan Refused.—The Treasury has refused the Council's application for a loan of £15,000 for an electric lighting installation in the township.

Bradford.—Mains Extensions, &c.—The Electricity Committee proposes to extend the mains at a cost of over £7,000. The Committee's agreement with Messrs. Mitchell Bros. in regard to the bulk supply of current, is to be extended for a further period of 3½ years. Until further order the maximum price to consumers who are charged for electricity under the maximum demand rate, is not to exceed 4d. per unit. The Committee has decided to remit as from April 1st, the rental charges for such hired arc lamps as cannot be used by reason of the lighting restriction order, until such restrictions are removed. The amounts paid in advance as rental for the three months ending June 30th will be kept in hand and made to apply for the three months immediately succeeding the revocation of the order. If a customer desires to terminate the hiring agreement, the Committee proposes to enforce the usual six months' notice.

Brighouse.—Rate Relief.—A sum of £300 is being allocated from the electricity undertaking towards the relief of the rates.

Bristol.—New Plant.—The Electricity Committee recommends the provision of a 6,000-kw. turbo-alternator with the usual accessories, at a cost of about £26,949.

Burnley.—Borrowing Powers, &c.—The Corporation is authorised to spend £23,370 for h.t. alternating plant, and £5,750 for mains; of the former £15,000 has been borrowed, and £17,337 spent, and none of the second amount has been borrowed, but £2,646 has been spent.

In consequence of the L.G.B.'s circular the Electricity Committee has decided that no further sanctions be applied for in respect of any works not already commenced, or expenditure not already incurred, but that the L.G.B. be asked for permission to borrow money in respect of expenditure already incurred, and to which the department was already committed.

Bury.—Year's Working.—On the past year's working of the electricity undertaking there was a net profit of £2,038, being a decrease of £147; £1,038 is to go to reserve fund and £1,000 towards the relief of the rates.

The T.C. has, in consequence of existing circumstances, decided not to proceed with the extensions to the Chamber Hall power station.

Canterbury.—Restricted Lighting.—The charges for street lighting by electricity for the past quarter have been reduced by £249, owing to restricted lighting.

Carnarvon.—The T.C. has decided to take no action in regard to the suggested transfer by the National Electric Construction Co. of the electricity undertaking to a company by Act of Parliament, and the company's suggestion that the L.G.B. should be applied to for a suspension of its and the Council's obligation in the matter of the sinking fund instalments during the period of the war. A loan of £500 for the extension of the cables to the new tuberculosis hospital at Brynseiont has been applied for.

Chile.—The electric light and traction company of Valparaiso has demanded the rescission of its lighting contract with that municipality, owing to the non-payment of an account of a million and a half dollars for public lighting.—*Review of the River Plate.*

Chipstead (Surrey).—Prov. Order—The B. of T. has granted a prov. order for E.L. at Chipstead, which is in the area of the Reigate R.D.C., and also for a portion of the parish of Woodmansterne, in the area of the Epsom R.D.C.

Cuba.—The following persons have been granted permission to install electric power and lighting plant :—Senor Benito Cabrera, at Fomento, Province of Santa Clara ; Senor Francisco Frias, at Niquero, Province of Oriente ; Senores José F. Prieto and José Lores, at Real Campina, Province of Santa Clara, and also at Cartagena, in the Municipal District of Rodas. The *Gaceta*, which contains particulars regarding the installations to be carried out, may be consulted at the Commercial Intelligence Branch of the B. of T.

Dalkey (Co. Dublin).—E.L. Scheme.—The U.D.C. has under consideration a proposal to obtain from Kingstown a supply of electricity to light the town.

Darwen.—The net profit on the working of the electricity undertaking for the past year amounted to £279.

Dover.—War Bonuses.—The Corporation Electricity Committee has decided to pay the employés a war bonus from May 1st, and to apply to the Government for War Office badges for men of military age engaged at the works, on condition that they agree to join the Army if called upon.

The Council has decided to give notice to three clubs in the town that the existing contract for current for lighting will cease on June 30th, and that meters will be fixed to ascertain future consumption.

Dundee.—Loan Sanction.—The Secretary for Scotland has authorised the borrowing of a further loan of £29,000 in connection with the electricity department.

Enniscorthy.—A provisional order has been granted to the Council for the supply of electricity to the town.

Epsom.—Fuel Contracts, &c.—The U.D.C. has authorised the acting electrical engineer to order for trial 10 tons of Mexican fuel oil for use in the Diesel engines. The cost will be 15s. below the price of American oil, which is £4 per ton, with a tendency to advance.

Gillingham (Kent).—The T.C. has decided to renew, for a further five years, the contract for the supply of current to the Millitary Barracks, &c., subject to the charge for lighting being increased from 2¾d. to 3d. per unit. Owing to inability to obtain a loan for the capital outlay, the Electric Lighting Committee recommended that it could not accede to the request for a supply of current to Messrs. Goldsmith for the Rainham Cement Works. The Council has decided to ascertain whether the firm would pay the interest on the capital expenditure involved.

Ilford.—The U.D.C. has applied to the B. of T. for consent to erect a generating station on a site in Suffolk Road, Seven Kings.

London.—A conference on the subject of London electricity supply is to be held at County Hall on May 19th.—*City Press.*

Islington.—The B.C. has been recommended to increase the scale of pay of junior shift engineers in the electricity department from 30s. to £2 per week. The Lighting Committee has made a reduction of £380 in the charge for street lighting for the March quarter. The borough treasurer has reported on the question of loan sanctions and capital expenditure of the electricity department, and the Finance Committee recommends that application be made for loans of £1,566 for property and £4,975 for mains ; the construction of cooling towers, to cost £4,250 is in progress, and it is desired to borrow money to complete this work. As regards a scheme for extension of mains, boilers, &c., not sanctioned, estimated to cost £52,757, application for sanction has been made to the L.C.C., which is obtaining the views of the Treasury on the matter.

Leeds.—Loan Sanctions.—The L.G.B. has sanctioned the borrowing of the following sums in connection with the electricity undertaking, viz., £36,600 for buildings, &c. ; £12,290 for suction ash plant, coal-conveying plant and crane ; £8,066 for switchgear and foundations ; and £3,070 for motors and mains in generating station (these being further instalments of the £200.000 loan), also £22,500 for a new 6,000-kw. plant, £2,500 for building extensions for same, £65,000 for mains (excess and prospective expenditure) and £12,000 for sub-stations (prospective expenditure).

Leigh.—The T.C. has received a letter from the Director of Navy Contracts pointing out that the Anchor Cable Co. had recently experienced difficulty in obtaining sufficient electric supply for their works, and that in consequence the Government work which the firm have in hand had been seriously delayed ; the Town Clerk was instructed to send a copy of the letter to the L.G.B., with a view to expediting the application now before it for sanction to borrow money for further extensions to plant at the electricity works.

Maidenhead.—Restricted Lighting.—The E.L. Committee has offered the Corporation a rebate of 17s. 6d. per annum for each side street lamp extinguished, and 15s. per annum for each 100-watt lamp removed from the main street cluster lamps, or a total reduction of £263 per annum on the whole of the lamps supplied with current.

Nottingham.—Year's Working.—The accounts of the electricity department for the year ended March 31st last show a net profit of £13,402, of which £9,500 is to be contributed in aid of the rates, and the remainder carried to the reserve fund. The number of units sold during the 12 months amounted to 12,860.348, an increase of 229.508 as compared with the previous year. Of this amount 3,805,574 was used for lighting purposes, 3,248,085 for power purposes, and 5,806,689 for traction purposes.

Oulton Broad.—Restricted Lighting.—The U.D.C. has asked the Electricity Co. to allow an abatement of 50 per cent. in the charges on account of the restricted public lighting. The company had offered a 5 per cent. reduction.

Rotherham.—Year's Working.—The gross profit of the electricity undertaking for the year ended March 31st last shows a decrease of £2,201 as compared with the previous 12 months, due to the increased cost of production, which went up from ·651d. to ·700d. per unit. The demand for power is still on the increase and greatly exceeds the combined supply for lighting and traction. On account of the reduced price per unit to the tramways department during the year, there has been a saving to that department of £1,185, which represents nearly one-half of the fall of profits in the sale of electricity for 1915 as against 1914. The total units have increased from 4,797,221 to 5,547,149, and the total receipts from £25,944 to £26,889, or by 3½ per cent, The department has been further affected by increases in interest and sinking fund brought about through recent extension to the works. The net profit available for appropriation has decreased from £7,358 to £4,786.

Runcorn.—The B. of G. has decided to close down the electric light plant for the time being and use oil lamps. Some little time ago it was decided that the plant be overhauled, but this work is now deferred.

St. Anne's.—Year's Working.—For the year ended March 31st last, the Corporation E.L. department sold 1,944,703 units, as compared with 1,051,815 in the previous year. The number of consumers is now 1,632, an increase on the year of 182. The increase in the consumption for power purposes has, according to the electrical engineer, been stimulated by the reduced uniform price of 1d. per unit.

Saxilby (Lincs.).—E.L. Scheme.—Mr. C. H. Best, who is acting with Mr. Chas. Pullan, of Bradford, has approached the Welton R.D.C. respecting a scheme of E.L. for the parish of Saxilby, and has applied for the Council's formal consent to the scheme.

Sheffield.—Loan Sanctions, &c.—Mains are to be extended at a cost of about £12,620. Of this sum over £11,000 will be spent on an additional extra h.t. feeder from Neepsend power station to Tinsley. The L.G.B. has sanctioned the borrowing of £134,373 for the purposes of the electricity undertaking, made up as follows :—£20,000 for sub-station buildings and equipment, transformers and power factor rectifiers (being part of application for £50,000) ; £86,813 for additional plant at Neepsend ; and £27,560 for extension of buildings at Neepsend, and the purchase of 50-ton crane. Land is to be purchased in Forncett Street for use as a sub-station.

Southport.—The Electricity Committee has decided to inform the Finance Committee that it cannot see its way to contribute to the relief of the rates this year.

Occupiers who have given notice of intention to remove lamps outside their business premises, are to be asked to allow the lamps to remain on the understanding that no charge will be made for the hire of them.

The T.C. is to be recommended to approve a proposal to increase the price of electricity by 10 per cent.

Stanley.—Prov. Order.—The B. of T. has notified the Wakefield Corporation of its intention to issue a prov. order authorising the Electrical Distribution of Yorkshire to supply electricity in the district.

Sutton.—We understand that the South Metropolitan Co.'s electricity works at Sutton are to be shut down, and that it is proposed to lay duplicate mains from Wandsworth to the present station, where the current will be transformed to the existing pressure and distributed.

Torquay.—In view of the restriction put upon loans, the T.C. has decided to discontinue for the present the laying of new mains in streets where the supply is not already available. The L.G.B. has intimated that there is no necessity for the purchase of premises in Victoria Parade for new offices for the electricity department. The Council, however, has decided to adhere to the principal of acquiring the premises, and to proceed with the purchase on its own responsibility. The Council has offered a supply for E.L. to the Torbay Hospital at 3½d per unit.

Walsall.—Loan Sanction, &c.—With respect of the Council's application for sanction to a loan of £23,595 for the purposes of the undertaking, the L.G.B, has authorised the borrowing of sums amounting to £16,700.

A coal clause is to be inserted in all future agreements for a supply of alternating current in bulk. The lighting of the new road from Ablewell Street to Birmingham Road is to be carried out by lanterns suspended from the tramway span wires on both sides of the road.

Warrington.—A new turbo-alternator was formally started at the electricity works, at Howley, on May 6th.

Watford.—The T.C. has decided to defer all large extensions of the undertaking, and to make application for sanction for the money which has already been spent. The cost of any future house connections, &c., will be paid for out of revenue.

West Bromwich.—The T.C. has entered into an agreement to supply electricity up to a minimum of 80 000 units per annum for three years to the Mechanical Brake Co., and to give a supply for war purposes to Messrs. Ebenezer Parkes & Co, Atlas Works.

Wigan.—Proposed Loans.—Application is to be made to the L.G.B. for sanction to borrow £1,200 for a transformer, switchgear and cable required for the proposed supply of electricity to Pemberton Colliery Co., and £1,066 for a transformer, &c., to supply current to the Empress Spinning Co.

Wimbledon.—Street Lighting.—The E.L. Committee recommends a reduction in the charge for lighting the streets; in future one equal eighth part of the amount of instalments of loan, sinking fund and interest as shown in the net revenue account of the electric lighting accounts for the previous year, will be charged against street lighting, instead of one equal sixth part of the amount referred to as heretofore.

Wistaston.—E.L. Scheme.—The Crewe Corporation has received the Nantwich R.D.C.'s consent to its application to the B. of T. for an order authorising the supply of electricity to premises in Wistaston.

Wolverhampton.—The Electricity Committee proposes to lay a new feeder cable from the School Street sub-station to Lea Road, at a cost of £1,130, and to carry out mains extensions at a cost of £730. Of this amount £133 will be provided out of the reserve fund, and the remainder out of the capital account, for which latter the sanction of the L.G.B. will be required.

TRAMWAY and RAILWAY NOTES.

Accrington.—Year's Working.—The gross revenue of the Corporation tramways for the past year amounted to £27,850, and the gross expenditure to £16,438; after deducting £8,233 for interest on loans, dividends on stock, redemption of debt and income-tax, there was left a disposable balance of £3,179, as compared with £4,722 in the previous year. The contribution to rate aid was £2,013, a motor tower-wagon cost £598, and £568 was devoted to depreciation and renewals. During the year 4,637,303 passengers were carried, and 548,070 car-miles run.

Bradford.—The Tramways Committee has authorised the general manager to arrange such modifications in car services after 9 p.m. as may be deemed fit on consideration of traffic returns, and recommends that the North Park Road car service be discontinued, in view of the continued low receipts shown by traffic returns. The Tramways Committee has approved a scheme for a central terminus at Forster Square.

Bury.—Year's Working.—The net profit on the working of the Corporation tramways for the past year was £9,690, which will allow £5,600 to be paid to the rates, and £3,472 to be placed to the reserve fund.

Darwen.—Year's Working.—The tramway department made a net loss of £172 on the Darwen section and £557 on the Hoddlesden section during the past year. The mileage run was 267,670, against 266,912 in the previous year, and nearly 250,000 fewer passengers were carried.

Glasgow.—Female Labour.—This week an additional [illegible] women have begun their training as conductors, and next week over 100 women will be engaged in this duty in connection with the T.C.'s tramway department.

The tramway department's financial year ends on May 31st, and on Monday of this week the million pounds sterling of revenue, which is now looked for, was secured. Up till Sunday night the total drawings amounted to £999,494, and Monday's takings brought the gross to £1,002,624. The total at corresponding date last year was £1,010,792, this year's revenue so far working out at £8,168 less.

London.—The Standing Order Committees of both Houses of Parliament have been petitioned for special leave to deposit a Bill to authorise the City and South London Railway, the Central London Railway, the London Electric Railway, the Metropolitan District Railway and the London General Omnibus Co. to enter into agreements "for the purpose of providing increased facilities for the interchange and alternative routeing of traffic, the application of receipts and the appointment of a Joint Committee."

L.C.C.—The Highways Committee is considering the desirability of the Council again bringing before the Treasury the great public need of electrifying the tramways in Grange Road, Southwark Park Road, Raymouth Road and Rotherhithe New Road. The service has been discontinued since May 1st, owing to the dangerous state of the rails.

The Treasury has advised the postponement of the Burdett and Grove Road tramway reconstruction, and of the purchase of additional turbine plant for the Greenwich station.

Manchester.—The City Council has rejected a proposal brought forward by Councillor Cundiff, that special constables should be allowed free rides on the cars when going to or returning from duty.

Nottingham.—Year's Working.—There was a net profit of £28,664 on the working of the Corporation tramway undertaking, for the year ended March 31st last; of this sum £22,500 is to be contributed in aid of the rates. Traffic receipts showed an increase of £4,850 at the end of July, after which there was a general falling off to the end of the financial year, notwithstanding the additional receipts obtained from the three extensions, and a full year's working of the Notts. and Derbyshire Co.'s cars running between Church Street, Basford, and Parliament Street. The total receipts, including rent for the leased lines, but excluding interest on investments, amounted to £179,315, an average of 11·35d. per car-mile. This is an increase of £3 935 in receipts, but a decrease of ·52d. per car-mile, compared with the previous year. The working expenses amounted to £112,583, equal to 7·13d. per car-mile, compared with 7·45d. per car-mile. The consumption of energy for traction, car and depôt lighting, works machinery, permanent way repairs and renewals, and grinding out rail corrugations, was 5,806,688 units, costing £30,243. This is equal to 1·53 units per car-mile, compared with 1·51 units during the previous year. The number of passengers carried was 41,210,964, an increase of 675,000.

Oldham.—There was a loss of nearly £5,000 on the working of the tramways during the past year.

Plymouth.—Tramways Purchase Scheme.—At a meeting of the T.C. it was reported that the Devonport and District Tramway Co. was willing to selling its undertaking to the Corporation on Tramway Act terms at once, instead of in 1919, the Corporation to have immediate possession, and the price to be fixed by arbitration. These terms were approved, and it was resolved to enter into an agreement with the company. It was further reported that the Plymouth, Stonehouse and Devonport Tramway Co. was willing to hand over its undertaking to the Corporation at once, instead of in 1922, on terms to be agreed. It was resolved that an agreement be entered into accordingly, and in the event of a difference as to price, that the same be settled by arbitration.

Reading.—The net profit on the tramway undertaking for the year ended March 31st last amounted to £4,647, £3,000 of which is to go to the relief of the rates. The T.C. has decided to lay new feeder cables at a cost of £450.

Rotherham.—Year's Working.—During the past year the Corporation cars ran 815,547 miles, as against 852,869, in the previous year; the passengers carried decreased from 9,874,231 to 9,828,838. The gross profit of £14,901 was an increase on the previous year of £900, which, after deducting the usual allowance for redemption of debt and contribution to sinking fund and interest, leaves a net profit of £5,582, or an increase of £546 as compared with the preceding 12 months.

Salford.—Female Labour.—The Tramways Committee considered the question of the men's refusal to work with women tram conductors and the demand of the men for a bonus of 15 per cent. on wages, and ultimately decided to adhere to the decision to employ women conductors. In the matter of war bonuses, Salford had followed the lead of Manchester in giving a bonus of 2s. a week to employés earning 28s. a week or less and a smaller bonus to those earning between 28s. and 30s., and it was decided not to vary this to meet the men's request. At the T.C. meeting last week, the principle of employing women was approved, and the question of the conditions of such employment referred back for further consideration.

South Shields.—At a meeting of the T.C., on the 5th inst., Alderman Lawson, in moving the adoption of a report of the Sub-Committee on the Parliamentary Bill, said there had been left in the Bill the tramway clauses giving power to extend the tramways to the borough boundary and down Mile End Road, which was a rather important and valuable power; they had also got the electrical clauses, which turned out to be more important than they anticipated.

Wigan.—A profit of £900 was made by the tramway undertaking last year.

TELEGRAPH and TELEPHONE NOTES.

Retransmission of Cables.—The following official announcement was issued on Tuesday last :—

It has come to the notice of the Home Office that persons and business houses in this country are receiving requests to retransmit cables between traders in neutral countries, and that in some cases these requests are made with a view to avoiding interference by the Censor by letting it appear that the sender is a well-known British firm. In this way the transmission of messages connected with trade with the enemy may be secured. All persons in this country are therefore warned not to undertake to retransmit cables unless the request comes from a client for whom they have been accustomed to perform this service, and unless they are satisfied that, by forwarding the message, they are not assisting trade with the enemy.

United States.—An action is in progress between the American Marconi Co. and the Atlantic Communication Co., which operates the Telefunken system at Sayville, the former alleging infringement of its patents. Mr. Marconi has attended the trial to give evidence on behalf of the plaintiffs.

According to the report of the Census Bureau for 1912, the mileage of telephone wire in use was over 20 million miles; companies controlling 94 per cent. of the mileage reported 13,735 million calls, and that the capital of the above-mentioned companies was 991 million dollars. The net income was 51 million dollars, and the number of employés 183,000. The Bell system controlled 75 per cent. of the mileage and 58 per cent. of the telephones in use; the total number of telephones connected with public exchanges was 8,730,000. The number of independent rural telephone systems was 32,233. The number of telephones per thousand of the population rose from 30 in 1902 to 72 in 1907 and 91 in 1912; the messages per capita increased from 65 in 1902 to 122 in 1907 and 144 in 1912.

The mileage of commercial telegraph wire, including ocean cable, was 1,882,000, the messages numbered 109,663,000, and the capital employed was $232,000,000. The net income was $6,400,000, a reduction of one-third as compared with 1907, whereas the net income of the telephone companies increased 25 per cent. in that period. There were 38,000 telegraph employés. Six U.S. ocean cable companies owned 44,860 miles of cable, handling 2,845,000 messages, an increase of 20 per cent. over 1907. In addition, the Western Union Telegraph Co. operated 22,800 miles of cable and handled nearly 3,000,000 cable messages.

There were four wireless telegraph companies with 74 tower stations (117 in 1907), and a capital of $9,600,000 ($32,700,000 in 1907). The number of messages transmitted was 285 091, and the net income was $4,738 (deficit of $53,538 in 1907). The employés numbered 958.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—MELBOURNE.—May 18th. Four 250-K.V.A. three-phase transformers; 9,680 yards ·05 sq. in., three-core, lead-covered cable, for the City Council. See "Official Notices" April 30th.

May 19th. Victorian Railways. Meters, coasting recorders or other energy-checking devices, for train operation on the multiple-unit system, D.C., 1,500 volts. See "Official Notices" April 30th.

June 15th. City Council. Four mechanically-fired boilers, one turbine-driven boiler-feed pump, two fuel economisers, circulating water pumps. City Electrical Engineer. Specifications from Messrs. McIlwraith, McEacharn & Co., Ltd., London, E.C.

June 30th. Victorian Railway Commissioners. One 13-in. centre lathe for turning or grinding commutators for traction armatures; one 9-KW. motor-generator and battery-charging accessories; four electric motors.*

SYDNEY.—June 16th. Deputy P.M.G. 400 Morse sounders, American pony pattern. (Schedule No. 449.)*

July 19th. Municipal Council. One or two 12,000-KW. turbo-alternators (Contract No. 363).* A copy of the specification can be obtained from the City Electrical Engineer, Sydney.

July 19th. Steel towers for 33,000-volt transmission line. Specification (10s. 6d.) at E.L. Department, Town Hall.

July 21st. N.S.W. Government Railways and Tramways Department. One 250-K.V.A. turbo-generator.*

TOOWOOMBA.—June 7th. 480-volt D.C. electrically-driven centrifugal well-sinking pump, 30,000 gallons per hour, against a head of 200 ft. max. Deposit 2½ per cent. City Engineer.

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

China.—SHANGHAI.—May 20th. 2,600 yards of three-core E.H.T. armoured cable, and 79 three-phase induction motors, for the Municipal Council. See "Official Notices" May 7th.

Darlington.—May 20th. Corporation. Cast-iron condenser water pipes. See "Official Notices" May 7th.

Dover.—May 18th. Six electric vehicles, for the T.C. See "Official Notices" May 7th.

Dublin.—May 25th. Corporation. Underfed stoker. See "Official Notices" to-day.

May 20th. Corporation. Supply of coal for the Electricity Department, &c., for one, two or three years, a 12 months' supply being approximately 40,000 tons. Copies of specification from the Town Clerk.

Finchley.—May 31st. U.D.C. Wiring, for light, 100 workmen's dwellings. See "Official Notices" May 7th.

France.—The Administration des Chemins de fer de l'Etat, 43, Rue de Rome, Paris, will receive offers on Tuesdays and Fridays, from 3 to 5 p.m., for the following supplies :—Up to May 21st : six electric cranes (two of 60 tons, two of 40 tons, one of 25 and one of 20 tons); up to May 28th : six converter sets, a switchboard, and low-pressure mains.

Leeds.—May 26th. Corporation. Steam, feed and water pipes. See "Official Notices" May 7th.

Leigh (Lancs.).—May 21st. One vertical tube boiler, one 250 KW. rotary converter or motor converter, one switch panel, for the Borough Electricity Committee. See "Official Notices" April 30th.

Manchester.—June 2nd. Corporation. Coal-unloading crane, conveying plants, &c. See "Official Notices" May 7th.

May 18th. Tenders are invited for additions to accumulator house and laundry at Baguley Sanatorium. Particulars from the City Architect (one guinea, returnable).

May 19th. The Guardians invite tenders for the conversion of the hydraulic lift at their infirmary into an electric lift. Specifications, &c. (10s., returnable), from Mr. A. J. Murgatroyd, 23, Strutt Street, Manchester.

Portsmouth.—June 1st. Corporation. 100 tons of steel girder tram rails, five tons of steel fishplates, one ton of fishplates, three tons of 5-ft. wrought-iron tie-bars. See "Official Notices" to day.

May 26th. Electric lighting, &c., at Girls' Hostel, for the Education Committee. See "Official Notices" to-day.

Rochdale.—May 17th. Steam coal, for the electric power station, Dane Street. Mr. C. C. Atchison, Engineer and Manager.

Sheffield.—May 28th. Two natural draught cooling towers complete. For the Electric Supply Department. See "Official Notices" May 7th.

Spain.—The municipal authorities of Camporroble (Province of Valencia) have just invited tenders for the concession for the electric lighting of the town during a period of two years.

Tasmania.—LAUNCESTON.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Wigan.—May 29th. Corporation. H.T., three-core, paper and lead-covered, armoured feeder cable, transformer and switchgear. See "Official Notices" to-day.

CLOSED.

Aldershot.—The Electricity Committee recommends the acceptance of the following tenders for new plant :—C. A. Parsons, £3,858; Babcock & Wilcox, £1,115.

Bradford.—The Cleansing and Team Labour Committee has accepted the offer of the New Destructor Co., Ltd., to construct six cells and a combustion chamber, with multitubular boiler and all machinery and accessories (in lieu of existing 12 cells) for £2,977.

The Electricity Committee recommends the acceptance of the tender of the Brush Electrical Engineering Co., Ltd., for a 600-K.V.A. three-phase transformer, for the proposed electric supply to Dumb Mill, at £222; and the Tramways Committee that of Messrs. Hadfield's, Ltd. (£572), and Messrs. Edgar Allen & Co., Ltd. (£414), for points and crossings.

Burnley.—For the ensuing year the T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for motors, and that of Messrs. Ferranti, Ltd., for starters.

Dundee.—The Corporation Electricity Committee recommends acceptance of the following tenders in connection with the new pumping station at Carolina Port :—

Pumping plant.—W. H. Allen, Sons & Co., Ltd.
Pipe line.—John Wilson, Ltd.
Reinforced concrete pumping room.—Yorkshire Hennebique Co., Ltd.

Holmfirth.—The U.D.C. has accepted the tender of Mr. Robert Turner, for the erection of the electricity generating station.

Hong-Kong.—The Hong-Kong Electric Co., Ltd., have placed contracts as follows for their new power station :—

Steel structural work, &c.—United States Steel Products Co.
Boiler plant.—Babcock & Wilcox, Ltd.
Coal handling plant.—Babcock & Wilcox, Ltd.
Turbo alternators and switch gear.—Brit. Thomson Houston Co., Ltd.

Glasgow.—The Tramways Committee recommends acceptances of the following tenders for six months :—

Steel axles, tires and wheels.—John Baker & Co., Ltd.; Glasgow Railway Engineering Co., Ltd.; Brown Bayley's Steel Works, Ltd.

For 12 months :—

Chilled iron brake blocks.—Miller & Co., Ltd.
Fire-clay goods.—Glenboig Union Fire-clay Co., Ltd.
Springs.—L. Sterns & Co., Ltd.; G. Turton, Platts & Co., Ltd.

The Electricity Committee recommends that the following offers for 12 months' supply be accepted :—

C.I. boxes, section pillars, &c.—Carron Co.; W. Lucy & Co.; Falkirk Iron Co., Ltd.; M'Dowall, Stevens & Co.; Jas. Allan, sen., & Sons.
Fire-clay bricks and fire-clay.—Curaie & Co., Ltd; John G. Stein & Co., Ltd.
Single cables, concentric and triple-concentric cables.—Callender's Cable Co., Ltd.
Extra H.T. cables.—W. T. Glover & Co., Ltd.
Rubber-covered cables.—Craigpark Electric Cable Co., Ltd.
Flexibles.—Wm. Rickard, Ltd.
Arc lamp carbons.—C. W. Webster.
Electricity meters.—British Thomson-Houston Co., Ltd.; Ferranti, Ltd.; Chamberlain & Hookham, Ltd.

For six months :—

Wooden troughing cover.—Robinson, Dunn & Co., Ltd.

The Sewage Committee recommends that the offer (£4,325) of the Ames Crosta Sanitary Engineering Co., Ltd., for the supply and erection of distributors in connection with the alterations at Dalmarnock sewage works be accepted, the company having agreed to equip the machines with electric motors in the event of failure of the water-wheel drive.

Leith.—The Corporation has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for carbon-filament lamps for 12 months for the tramways.

London (L.C.C.).—The Highways Committee has received the following tenders for cables in connection with the extension of the Woolwich tramways sub-station and a temporary supply of power for working the Council's tramways—

Western Electric Co., Ltd.	(accepted)	£22,971
Callender's Cable and Const. Co., Ltd.		23,651
Johnson & Phillips, Ltd.		23,928
W. T. Glover & Co., Ltd.		24,102
W. T. Henley's Teleg. Works Co., Ltd.		24,990
Siemens Bros. & Co., Ltd.		24,994
B.I. & Helsby Cables, Ltd.		26,036

Estimate of chief officer of tramways £21,262. This estimate was prepared in March, but since that date the price of copper has materially advanced.

SOUTHWARK.—The following tenders for annual supplies have been recommended for acceptance by the B.C. :—

Cable.—Siemens Bros. & Co., Ltd.
Meters.—Reason Manufacturing Co., Ltd, five items; Electrical Apparatus Co., Ltd., five items; General Electric Co., Ltd., 12 items; Chamberlain & Hookham, Ltd, three items; Landis & Gyr, Ltd., three items.

Eleven tenders were received for the cable and the same number for the meters. The tender of the B I. and Helsby Cables, Ltd., is also recommended for a feeder pillar for £50.

In view of the prevailing conditions, and the satisfactory manner in which the contract has been carried out, the E L. Committee has agreed to a request from Messrs. Hinchcliffe & Co., contractors for coal, to be paid an extra charge of 1s. per ton for wagon hire. This additional charge is on account of coal purchased in the open market, outside contract prices.

PADDINGTON.—The Guardians have been recommended to accept the tender of Messrs. S. Hammond & Co. to reinstate the telephone instruments, wires, &c., and keep the instruments under repair for a period of 12 months, for £36.

BATTERSEA.—The B.C. Electricity Committee recommends the acceptance of the tenders of Messrs. Ferranti, Ltd., and Messrs. Chamberlain & Hookham, Ltd., for the supply of meters during a period of 12 months.

Maidenhead.—The T.C. has accepted the tender of the Anglo-Mexican Petroleum Products Co., Ltd., for a year's supply of fuel oil for the Diesel engines at the electricity works, at £3 3s. 6d. per ton, the contract to be determined at the end of three months if the oil does not prove satisfactory.

Meter Contracts.—Messrs. Chamberlain & Hookham, Ltd., have received contracts for meters from Colwyn Bay and Edinburgh. Messrs. Venner Time Switches, Ltd., have received a further repeat order from Cardiff for 99 time switches.

The Electrical Apparatus Co., Ltd., has received the following contracts :—

Bury St. Edmunds.—Corporation.—Sole supply of 3 and 5-ampere meters; 12 months.
Leyton.—U.D.C.—D.C. meters: 12 months.
Woking.—The Electric Supply Co.—60 single-phase meters per annum during the next two years.

Newport (Mon.).—The Corporation Electricity and Tramways Committee has accepted the tenders of Messrs. James and Emmanuel, and Messrs. Partridge, Jones & Co., each for 1 000 tons of coal, at 19s. per ton, subject to the electrical engineer endeavouring to obtain an option in favour of the Council to limit the order in each case to 750 tons.

North Ormesby.—Messrs. Clough, Smith & Co., Ltd., of London, have secured from the Grangetown, North Ormesby and South Bank Railless Traction Co. the contract for the construction of their overhead equipment and feeder system (a route length of 5 miles 61 yards).

Rochdale.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for Wotan traction and standard lamps for the Corporation tramways, for the ensuing 12 months, has been accepted.

Salford.—The Electricity Committee has accepted an offer by Messrs. Andrew Knowles & Sons, Ltd., Pendlebury, to supply and deliver about 250 tons per week additional of Clifton Hall washed slack during a period of two months ending July 31st, at 15s. 4d. per ton.

Stretford.—The D.C. has accepted the tender of the General Electric Co., Ltd., for cable amounting to £670. The four 100-KW. sets at the generating station are to be disposed of by the Council at a price approximating to £325 each.

Stockport.—The T.C. on May 5th accepted the following tenders for the electricity works :—

Herbert Morris, Ltd.—40-ton crane £756, and gantry £319.
Stewarts & Lloyds, Ltd.—Steam piping for new turbine and boilers £105 10s., less 2½ per cent.

Tonbridge.—The U.D.C. has accepted an offer by the Medway Coal Co. to supply before June 30th 200 tons of coal for the electricity works, at £1 2s. 9d. per ton, an advance of 3s. per ton on present prices.

Tunbridge Wells.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for supplying new steel sections and drums, with superheaters, to two boilers at the electricity works, at £1,289, with £50 for contingencies. The Council has also accepted the tender of Messrs. Witting & Partners for dismantling the existing cooling tower and building a new tower on the same site, at £1,085.

West Ham.—A T.C. Committee recommends the acceptance of the tender of the British Thomson-Houston Co. for the supply of 160 motors required in connection with the alterations to the equipment of the tramcars, together with the necessary gears, for £106 10s. each.

Winchester.—The T.C. has accepted the tender of Messrs. C. A. Parsons & Co., Ltd., for a 500-KW. turbo-generating set, with condensing plant and piping, at £3,991.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, May 14th. At 8 p.m. At Institution of Civil Engineers, Great George Street, Westminster. Paper on "The Distribution of Heat in the Cylinder of a Gas Engine," by Prof. A. H. Gibson and Mr. W. J. Walker.

Physical Society of London.—Friday, May 14th. At 8 p.m. At Imperial College of Science, South Kensington, S.W. Papers on "Precision Resistance Measurements with Simple Apparatus," by Mr. E. H. Rayner; "Some Novel Laboratory Experiments," by Mr. F. W. Jordan, "On Electrically-Maintained Vibrations," by Mr. S. Butterworth.

Royal Institution of Great Britain.—Saturday, May 15th, and Tuesday, May 18th. At 3 p.m. At Albemarle Street, W. Lectures (I) and (II) on "Advances in the Study of Radio-Active Bodies," by Prof. F. Soddy.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, May 17th. At 7.30 p.m At Mining Institute. Annual General Meeting.

Sheffield Electrical Social Union.—Monday, May 17th. At 6.30 p.m. At Stevenson's Restaurant, Castle Street. Tea and social. All electrical business men welcomed.

Foreign Trade. — THE APRIL FIGURES. — The following are the electrical and machinery figures given in the official returns for April :—

	Month of April.	*Inc. or dec.*	*Four months, 1915.*	*Inc. or dec.*
IMPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	£ 90,143	£ − 33,515	£ 283,712	£ − 269,675
Machinery ...	877,806	+ 128,159	2,651,831	− 66,031
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	238,899	− 43,713	959,632	− 86,489
Machinery ...	1,574,455	−1,419,884	6,114,239	−6,870,048

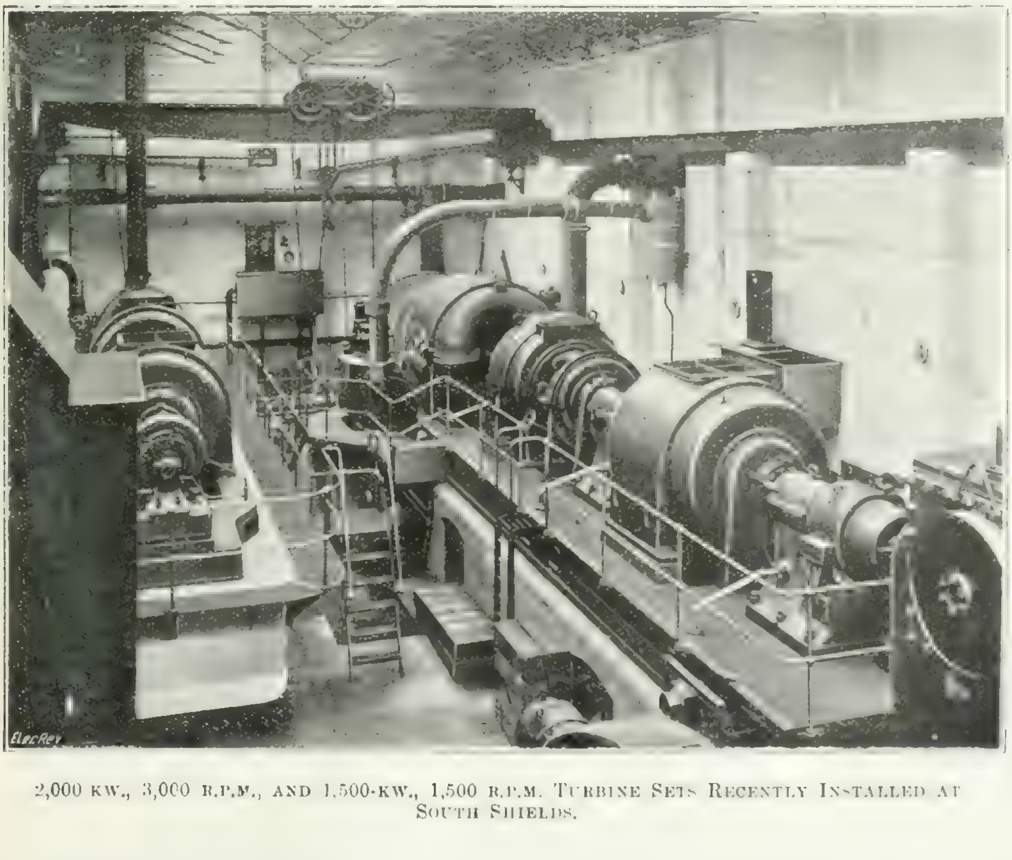
ELECTRICITY WORKS EXTENSIONS AT SOUTH SHIELDS.

During the last two or three years considerable extensions have been made to the plant installed at the South Shields Corporation Electricity Works, by the provision of turbine and rotary converter plant, also a new boiler house with water-tube boilers, bunkers, coal-handling plant, &c., the cost of the additions being some £39,000.

Through the courtesy of Mr. Harry S. Ellis, the borough electrical engineer, we are able to briefly describe and illustrate this plant, which will no doubt largely supersede the McLaren marine type sets and marine type boilers which have been a feature of this station in the past.

The South Shields undertaking was originally started in 1896, Mr. J. A. Jeckell being the first engineer, and two marine type boilers, two 100-kw. alternators coupled to marine type engines, and a small 15-kw. set, to take the day load, were provided; this plant has been added to until to-day some 5,800 kw. of plant is installed.

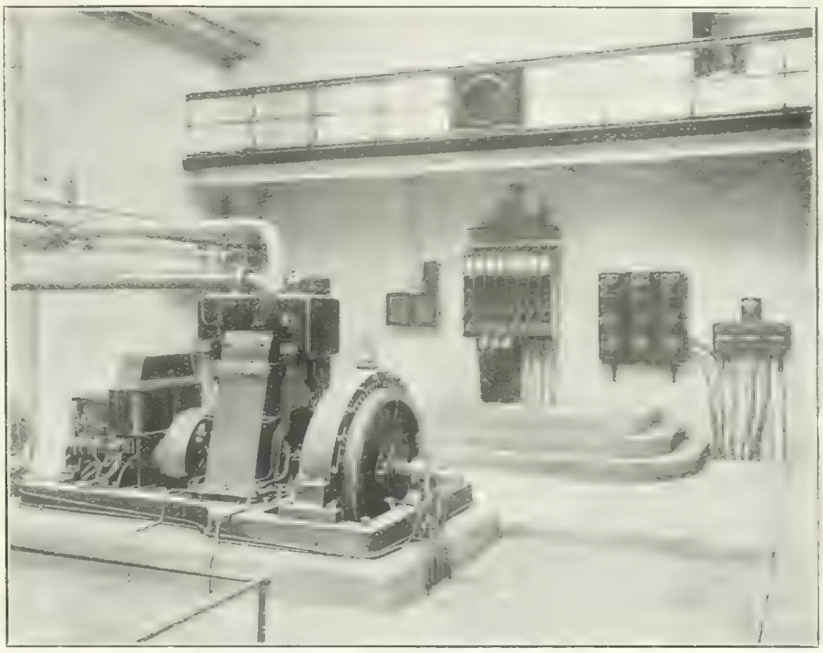
As regards the plant installed prior to the introduction of turbines and still available for use, what is known as the old boiler house contains six marine type boilers, three fitted with two furnaces and designed to evaporate 7,000 lb. of water per hour, and the other three fitted with three furnaces and designed to evaporate 11,000 lb. The coal used in these boilers is stored in a large brick walled bunker running the full length of the boiler house and capable of containing about 600 tons. The firing is all carried out by hand, three stokers being necessary on the even'ng shift when all the boilers are working.



2,000 kw., 3,000 r.p.m., and 1,500-kw., 1,500 r.p.m. Turbine Sets Recently Installed at South Shields.

There are five steam pumps at one end of the boiler house, four for boiler feed and one for lifting the condensate from the hot-well tanks to a Harris-Anderson oil-eliminating plant.

The circulating water for the condensers is lifted from the River Tyne into large storage tanks, capable of containing about 100,000 gallons, by means of five Worthington steam pumps, each capable of delivering 33,000 gallons per hour



Original Ferranti Switchboard and 15-kw. Set, Installed in 1896 at South Shields.

There is also a centrifugal pump coupled to a 50-b.h.p. Westinghouse d.c. motor which is capable of delivering 150,000 gallons per hour against a total head of 50 ft.

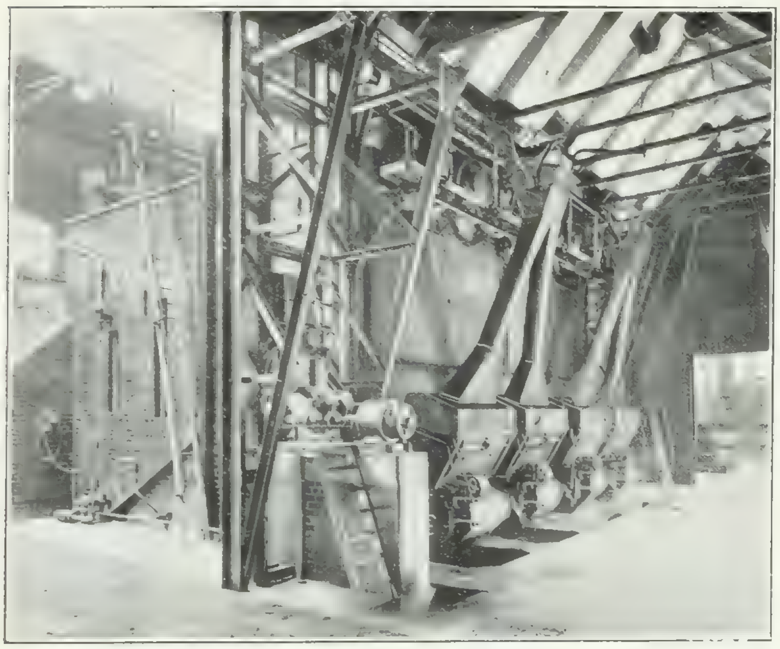
The engine room consists of two bays, each 100 ft. long, and the smaller one now contains, in addition to the new turbine sets, only one of the old 200-kw. Ferranti single-phase alternator sets coupled to a marine type engine—one 200-kw. and two 100-kw. single-phase sets having been displaced to make room for the new plant.

The Ferranti cellular type single phase switchboard at one end of the bay consists of the original cells with additions.

The larger bay contains two McLaren 1,000-i.h.p. engines driving 500-kw. Siemens and Richardsons, Westgarth single-phase alternators and two similar 1,100-i.h.p. engines driving 550-kw. Dick, Kerr direct-current machines, which were originally installed for supplying the tramways, but are now also used for supplying energy to large power consumers.

Working in conjunction with the direct-current supply there is a Tudor battery of 500-kw. capacity on a one hour rating, and an automatic reversible booster.

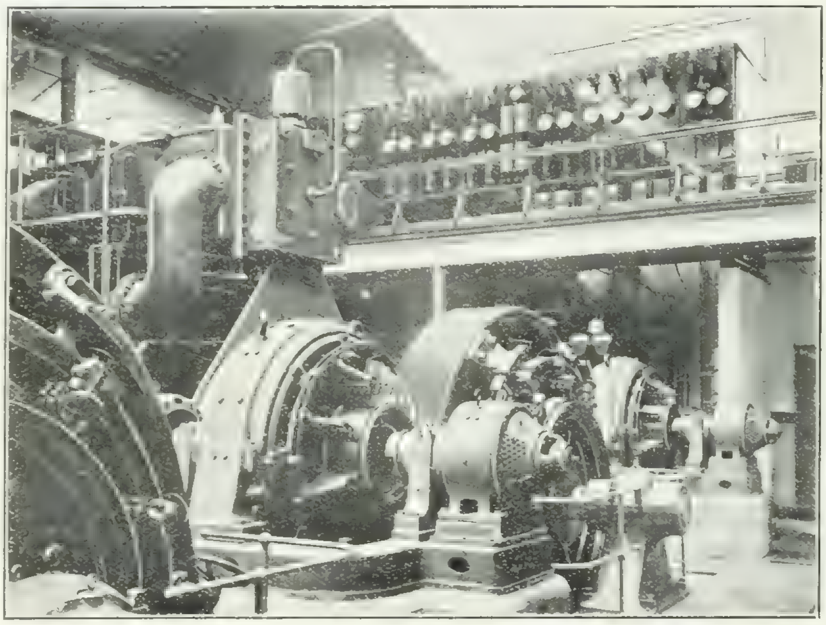
New Generating Plant.—This consists of two Westinghouse-Rateau high-pressure turbines of 1,500 and 2,000 KW. capacity respectively; the former is coupled to a 1,000-KW. 500/550-volt direct-current machine, fitted with a radial commutator, and a 1,100-KW. single-phase 2,100-volt 50-cycle turbo-alternator, the two machines being in tandem and running at 1,500 R.P.M.



New Boilers, with Chain Grates and Duplicate Motor Drive.

This set was installed in 1912 under the supervision of Mr. Ellis, but its installation was arranged for by his predecessor, the late Mr. J. H. Cawthra.

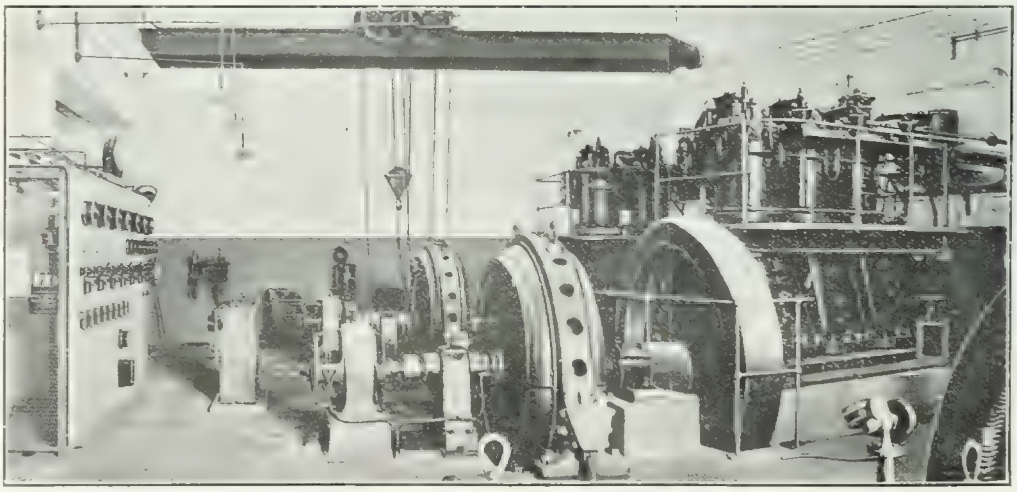
The second turbine, put into operation in 1914, drives two 1,500-KW. 2,100-volt three-phase 50-cycle turbo-alternators and an exciter in tandem at 3,000 R.P.M.



New Rotary Converters, D.C. Plant and Switchboard, South Shields.

The influence of high speed on the size of the later turbine is shown in our view, the higher powered set being much the smaller one.

Both turbines exhaust into Westinghouse-Le Blanc surface condensers, the air and extraction pumps for which are driven by a 30-H.P. D.C. motor. In the case of the three-phase machines, the arrangement of the switchgear allows of one phase being cut out, and the other two, in series, supplying single-phase current. The turbo-generators are cooled by forced air circulation, and, in connection with the latter, a Heenan rotary air filter, capable of dealing with 24,000 cb. ft. of air per minute, has been installed. This apparatus is similar in construction to the same firm's water coolers, but the functions of air and water are reversed, and in this case the air, in addition to being filtered, is lowered in temperature 15° or 20° in hot weather.



Three-phase Diesel electric Plant and Switchboard, Ahmedabad, India (see next page).

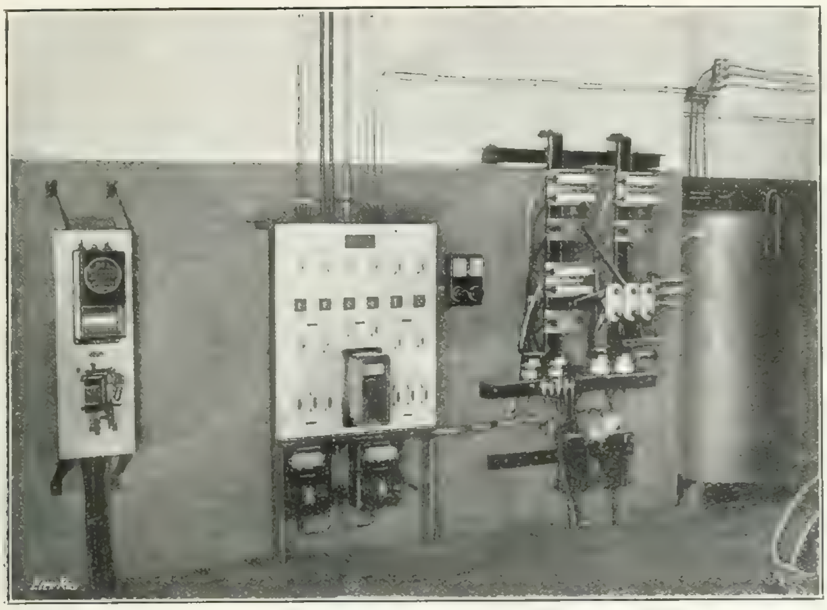
Two 600-KW. Westinghouse rotary converters are installed in the power station to link up the 2,100-volt alternating and 500/550-volt direct-current supplies for traction and power purposes. The transformers, by the same firm, are of the oil insulated self-cooling type; the rotaries are each equipped with a starting motor and exciter, and are arranged for the self-synchronising method of starting.

As regards the new boiler plant and coaling arrangements, coal is unloaded by a wharf crane into a hopper near the centre of the old bunkers; from the hopper it is carried by a belt conveyor, of 30 tons an hour capacity, to the overhead bunkers of the new boiler house, which have a capacity of 560 tons. Space for four boilers is at present available in the new building, which, however, can be increased in width to accommodate another four boilers.

Two Babcock & Wilcox land-type boilers, each of 5,346 sq. ft. heating surface and 22,000 lb. per hour evaporative capacity, are installed and working; these are fitted with integral superheaters and chain-grate stokers.

In connection with this plant there is a Green economiser of 288 tubes, two Weir steam feed pumps, each of 7,500 gallons an hour capacity, and a Lassen & Hjort water-softening plant, capable of dealing with 24,000 gallons a day of town's water, which has an initial hardness of from 25° to 30°, and is used for boiler feed purposes.

The new boilers are operated under induced draught, the flue gases being discharged by Musgrave fans into a new steel chimney, of the Thompson self-supporting type, 100 ft. high and 7 ft. 6 in. diameter. These fans, two in number, are flexibly coupled to Westinghouse variable speed 44-H.P. motors (360-450 R.P.M.), each fan being capable at the lower speed of handling the gases from two boilers, and producing a draught of 1½ in. water gauge. At the higher speed, one fan would deal with the gases from three boilers, giving a 2¼–2½ in. W.G. draught.


Transformer, L.T. and Auxiliary Switchgear.

Arrangements have been made to augment the supply of circulating water during the present year by means of two 12-in. Worthington vertical centrifugal pumps, which are to be erected on the jetty, and will deliver to an overhead tank, the total head of the pumps varying between 51 ft. and 34 ft. 6 in., according to the state of the tide.

Each pump will discharge 2,920 gallons a minute, working submerged, and will be driven by a vertical spindle 73-H.P. D.C. motor, running at about 800 R.P.M.

Overhead Distribution, Street Lighting, &c., Ahmedabad.

The site of the recent extensions is on a hillside, and some 2,900 tons of spoil were removed to level the site. This work, together with the foundations, brickwork, &c., was carried out under the direction of the borough engineer, while the new plant was, of course, installed under the supervision of Mr. Ellis, the borough electrical engineer, to whom we are indebted for these particulars.

ELECTRICITY SUPPLY AT AHMEDABAD, INDIA.

The city of Ahmedabad, which is one of the most important in the Bombay Presidency, with a population of approximately 250,000, has now been provided with a modern electricity supply undertaking.

The company was floated by Messrs. Killick, Nixon and Co., Bombay, to whom the population of Gujarat is indebted for the advantages of railway communications in many of the outlying districts. The contractors were Messrs. Callender's Cable and Construction Co., who carried out the whole of the cable work, whilst Messrs. Crompton and Co. were the sub contractors to them for the whole of the plant inside the generating station.

The buildings are constructed of brick, the roof being boarded with teak inside, and covered on the outside with corrugated asbestos sheets.

The plant installed consists of three 150-B.H.P. Diesel oil engines supplied by Messrs. Mirrlees, Bickerton and Day, each coupled to a three-phase Crompton-alternator of 94-KW. capacity, and capable of developing its rated output at 3,000-3,300 volts, 50 cycles; each alternator has a direct-coupled exciter.

The starting air bottles for the engines are interconnected, enabling any set of bottles to be charged up from another set, or an engine to be run off either set of bottles.

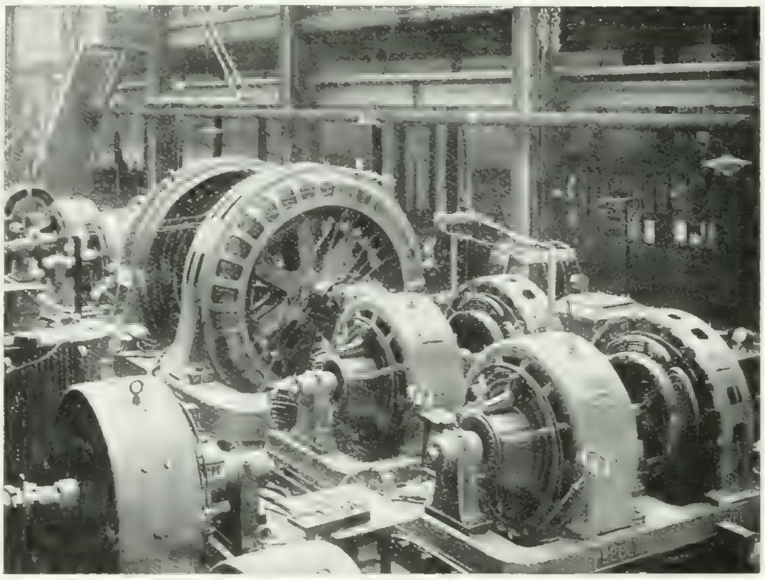
A 50-KW. 3-phase 3,000/3,300 to 400-volt step-down transformer of the oil-cooled type is installed in the station, and

Generating Station and Bungalow.

Laying H.T. Cables, Ahmedabad.

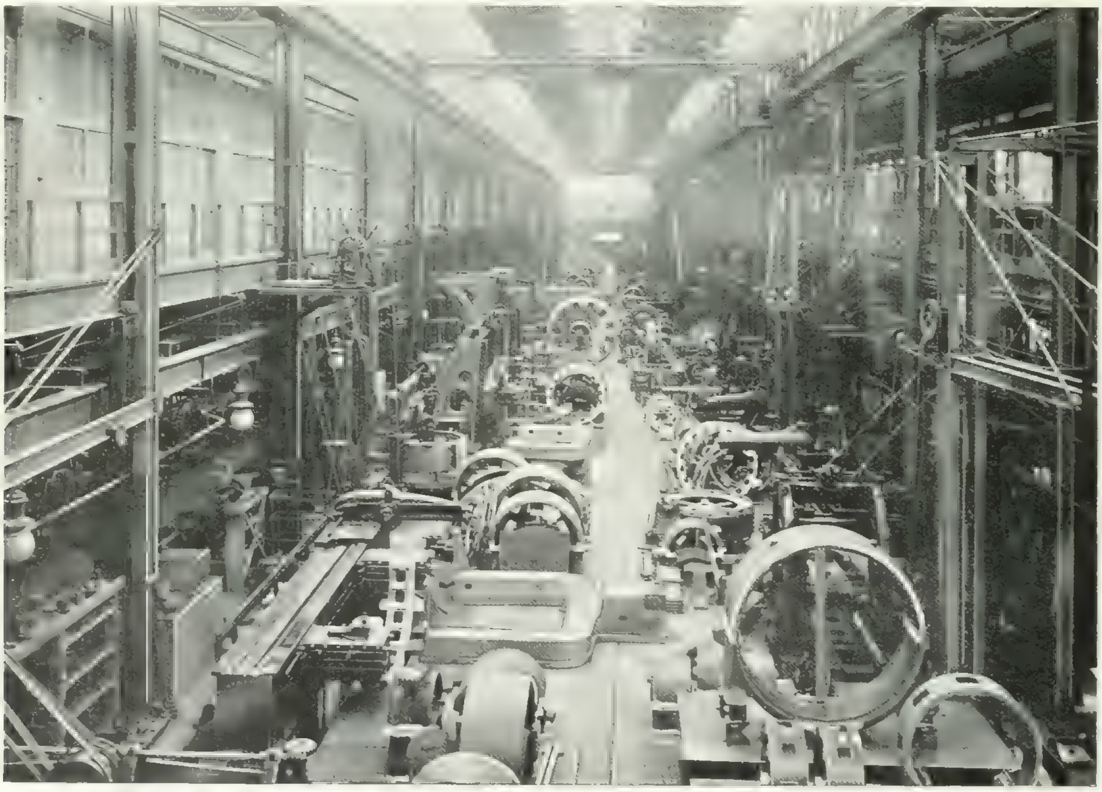
is provided with tappings and switchgear to enable the low-tension supply to be regulated to deal with an increased voltage on the bus-bars, to provide for pressure drop in the outgoing feeders.

Two Heenan & Froude water coolers are provided, each capable of dealing with the whole of the circulating water from two 150-B.H.P. engines running together at full load; these are driven by 7-H.P. motors, and the temperature of the water is reduced about 20°. This circulating water is taken from the town mains, and is supplied to the engines from a 1,500-gallon tank placed on the cooler house roof. A boiler of 5,000 gallons capacity has been provided for storing the oil fuel, which is pumped up from this to a 100-gallon tank in the generating station, and distributed to the supply tanks of the engines. The oil is supplied by the Anglo-Persian Oil Co., who have installed oil tanks near the city.



Messrs. Bruce Peebles' Works. Fig. 1.—Heavy Testing Department (see p. 697).

The high-tension switchboard is built of marble panels on a steel framework, with the H.T. gear behind, and the L.T. gear, which controls the L.T. side of the transformer and three outgoing distributors, on the front; an overhead 5-ton hand-crane has also been erected in the engine room. The H.T. transmission is carried out on the three-phase system, at 3,300 volts between phases, the cables being run to three transformer pillars in the town, two of which each contain one 25-KW. three-phase, 3,000/3,300 to 400-volt step-down transformer, and the third one a 50-KW. transformer of the same type. The underground cables in use are ·025 sq. in. three-core, lead-covered, steel-tape armoured H.T. mains; and ·05, ·05, ·05, ·025 sq. in. four-core, lead-covered, steel-tape armoured L.T. distributors.



Messrs. Bruce Peebles' Works. Fig 2.—Main Bay of Machine Shop (see p 697).

The distribution is carried out on the three-phase four-wire system, with 400 volts between phases and 230 volts between each phase and neutral, the neutral being earthed at the point of supply. Both overhead and underground mains are used, the former consisting of three No. 6 S.W.G. and one No. 8 S.W.G. hard-drawn copper wires. A special safety device has been fitted, which consists of rings of bare copper wire earthed and fixed at a distance of 2 ft. from the insulators, through which each live wire passes, leaving a clearance of 3 in., so that should a live wire break it immediately comes in contact with the earthed ring, and is rendered harmless.

Where possible, overhead bare copper wire services are run to the consumers' premises, but many consumers are being connected by means of lead-covered 4-core cable which is run along a row of buildings and tappings taken off; underground services are also in use in some places where the distribution cable is run underground.

An agreement has been entered into with the municipality to take a supply of electricity for street lighting for 15 years, the maintenance being carried out by the company.

The wires are run on the distribution system poles, and the lamps, which are of 100 C.P. and 50 C.P., are fixed in water-tight brackets at a distance of approximately 12 ft. from the ground and 40 yards apart. These lamps are controlled from three cast-iron control pillars, and arrangements have been made for switching off or on one-half of the lamps when required.

The present rates for the supply of electricity are 6 annas per unit for lighting and fans, and 2 annas per unit for power.

A considerable demand for electricity is expected from private residences, mosques, hospitals, flour and oil mills, offices, railway station yards, and fans, and for pumping purposes.

In conclusion, we are indebted to Mr. R. Forest Preston, engineer and manager to the Ahmedabad Electricity Co., Ltd., for enabling us to publish these particulars and views of an interesting plant.

THE WORKS OF MESSRS. BRUCE PEEBLES AND CO., LTD.

The name of Bruce Peebles at once suggests "motor-converters," owing to the great popularity achieved by these ingenious machines ; but the output of the large works on the Firth of Forth is by no means confined to this class of apparatus, the firm's manufactures including A.C. and D.C. motors of powers from 1 to 3,000 H.P., and generators of various types, for driving by steam and hydraulic turbines, and steam and gas engines, up to 5,000 KW. Some particulars of the works are given in an illustrated brochure recently issued by the company, from which we reproduce the accompanying views (on page 696).

The site of the works covers 10 acres, and is provided with excellent facilities for the transport of goods by sea and land, the works being connected with the Caledonian Railway system, which passes the premises, by means of sidings on which electric locomotives run. An artesian well provides a good supply of water.

The main building is 600 ft. long × 150 ft. wide, and is divided into five bays, of which the centre one (fig. 2) is devoted to the large machine tools and heavy erecting work. Power is supplied by a 500-KW. Peebles-Belliss set and a 250-KW. Peebles-Browett set, each engine driving two dynamos so as to feed a three-wire system at 230 and 460 volts, in conjunction with a Tudor storage battery. A gas producer for heating purposes and air compressors for pneumatic tools are installed, and the works are well provided with electric cranes and hydraulic hoists. Lighting is effected with metallic-filament lamps of high candle-power.

The heavy machine tools include a 20-H.P. planing machine, an 18-ft. side planer, and a 20-ft. boring mill, as well as a variety of smaller tools and automatic machine tools. Stamping and notching tools for accurate work up to the largest sizes of core plates are installed, and a special patented continuous process is employed for insulating and stoving the plates, which go into one end of an oven uninsulated and come out at the other end dry and ready for assembly.

The fitting and connecting-up of the windings are carried out by a separate department, great care being devoted to this work. The winding department is divided into separate sections for D.C. armatures, A.C. rotors and A.C. stators ; the larger machines, however, are wound at one end of the main bay, in order that they may be handled by the large travelling cranes.

Vacuum varnishing tanks are provided for impregnating the windings, together with drying ovens, which are fitted with doors opening into the main shop, so that the finished work need not be carried back through the varnishing room.

The foundry deals with castings of brass, gun-metal, aluminium, &c., and is also used for a patented process by which rings of special alloy are cast on the rotor conductors of the Peebles squirrel-cage induction motors, instead of riveted and soldered copper rings.

Testing departments are provided near the power house, but the heavier machines are tested in the main bay, under the cranes, as shown in fig. 1. In this view a number of Peebles-la Cour patent motor converters are shown, including the large set of 2,200 KW. for Manchester Corporation, which we illustrated in our issue of November 27th, 1914.

The offices are accommodated in a large building near the works, and exceptionally adequate provision is made elsewhere for the comfort of the employés, a large dining-room and kitchen being placed at their disposal, where excellent meals are supplied at low prices.

Needless to say, the firm are very busy with private orders as well as with Government work ; they are somewhat handicapped by the scarcity of labour, some 150 of their employés having joined the Colours, but every effort is being made to cope with the demand.

BRITISH INDUSTRIES FAIR.

The Board of Trade British Industries Fair, which has been organised by the Commercial Intelligence Branch of the Board as one part of the programme for assisting firms to capture enemy trade, was opened last Monday. Her Majesty the Queen, with whom we observed Mr. Runciman, President of the Board, Sir H. Llewellyn Smith, and prominent members of the staff who have taken an active part in organising the exhibition, made a tour of the Hall, and stopped at many stands to take an interest in particular exhibits. There are some 600 stands, and the exhibition, which has been arranged purely for trade buyers, will remain open until May 21st.

Invitations to Continental buyers were issued some time ago, and we understand that many of these, as well as some from Canada, America, and other distant countries, have already visited the Fair. The trades to which it was found necessary to restrict the Fair are :—China, earthenware and glass, cutlery, electro plate, printing, stationery, jewellery (including drapers' jewellery and haberdashery), toys and games, and fancy goods—all trades in which a large proportion of the goods hitherto consumed in this country have been imported from abroad. All of the exhibiting firms are manufacturers, and they, consequently, represent British industry more thoroughly than would be the case had factors and wholesale dealers been included in the total.

The support which manufacturers have given to the movement may be gathered from the fact that the 600 exhibitors have only been allotted space by considerably reducing the sites applied for in the majority of cases. The Board of Trade are endeavouring to assist buyers as far as possible, and interpreters have been engaged, special Inquiry Offices organised in each of the trade sections, and a branch of the Commercial Intelligence Branch of the Board of Trade established in the Hall, so that the fullest information on such matters as commercial statistics, Customs tariffs, shipping and transport, commercial products, and similar matters may be at the disposal of exhibitors and visitors. Any buyer who has not received a ticket and desires one should communicate at once with the Branch, at 32, Cheapside, E.C.

The following are among the exhibitors :—

Arctic Light Co., Ltd. ...	Artistic lighting for tables, rooms, &c.
Bassett-Lowke, Ltd.	Model electric locomotives and electric motors.
Baxter, T.	Electrical novelties.
J. Bourne & Son	Insulators, battery jars, electrical goods.
British Glass Wool Co. ...	Glass wool for electrical trades.
Burge, Warren & Ridgeley, Ltd.	Small vulcanite turnery for electrical instrument trade.
J. Burns	Vulcanised fibre insulating parts for electrical toys.
Burkes, Tate & Co.	Glass globes for electric lighting.
Chance Bros. & Co., Ltd. ...	Glass for scientific instruments.
A. & R. Cochran	Glass for electric lighting.
Corbett & Co., Ltd.	Glass tube, cane and bulbs for electric lighting.
F. Darton & Co.	Small electric motors and dynamos.
A. & J. Davies, Ltd.	Glassware for electric lighting.
Economic Electric, Ltd. ...	Small electric motors, amateur electrical material, &c.
Efandem Co., Ltd.	Pocket lamps, dry batteries, motor-car lighting sets, &c.
Electro Galvanisers, Ltd. ...	Electro-galvanising, electro-deposition, &c.
Endolithic Manufacturing Co., Ltd.	Ivory, metal and other nameplates.
Fleming, Joseph, & Co. ...	Electric light glass shades.
Henry Harvey & Co.	Electric light reflectors.
Houghton-Butcher Manufacturing Co., Ltd.	Engineers' drawing boards.
Improved Solidite Co. ...	Material for moulded insulators for electrical purposes.
Leeds Fireclay Co., Ltd. ...	Firebricks.
Maxfield & Sons (Silversmiths) Ltd.	Electric kettles.
Molineaux, Webb & Co., Ltd.	Electric light globes and shades.
New British Ever-Ready Co., Ltd.	Dry cells, pocket lamps, electrical specialities.
F. and C. Osler, Ltd.	Electric light shades, glass electroliers, and metal E.L. fittings.
Pilkington Bros., Ltd. ...	Glass shades, electric storage battery cells, &c.
Pitkin, Jas., & Co.	Clocks, electric batteries and lamps, recording instruments, &c.
Pytram Manufacturing Co. ...	Electric lighting fittings.
Richardson, H. G., & Sons ...	Glass electric fittings.

Silent Electric Clock Co., Ltd.	Electrically-controlled clocks.
Stevens & Williams, Ltd. ...	Electric light glass shades.
Stoeal Enamelled Tile and Iron Co., Ltd.	Electric light reflectors.
Storer, T. N., Sons & Co. ...	Electric lamp shades.
Surrey Electrical Co., Ltd. ...	Pocket lamp batteries and lamps, electric toys, wireless instruments, &c.
Synchronome Co., Ltd. ...	Electrically-controlled clocks.
Syrolit, Ltd.	"Erinoid," a British substitute for "Galalith," for electrical and telephone fittings.
Technical Engineering Co., Ltd.	Toy vertical steam engines.
Ward & Goldstone	Pocket, hand and portable lamps, magneto machines, dry batteries, instruments, model motors and dynamos, wireless apparatus, &c.
Wiggin, H., & Co., Ltd. ...	Electrical resistance wires and strips.
Wolff, Henry, & Co.	Electric lamp shades.
Wood, F. G.	Dials for electric meters.

NOTES.

Institution and Lecture Notes. — Institution of Electrical Engineers.—The report of the STUDENTS' SECTION for the past session shows that there have been six general meetings in London, nine at Manchester, and four at Newcastle. Visits and social functions had been arranged at the close of last session, but owing to the outbreak of war it was found necessary to cancel the whole of the arrangements. It was not found possible to commence the session in London until January, and since that date a somewhat curtailed programme has had to be followed. The Manchester Section was able to carry through a full sessional programme, and the Newcastle Section found it necessary to suspend a portion of its programme. The Scottish Section decided to suspend all the meetings for this session on account of the depleted membership.

At the meeting of the YORKSHIRE LOCAL SECTION, on Wednesday last, Mr. J. H. Rider's paper on "The Power Supply of the Central Mining-Rand Mines Group," was read and discussed.

The Textile Institute. — Sir William Mather, of Messrs. Mather & Platt, Ltd., Manchester, was elected President of the Textile Institute at the annual meeting in Manchester last Friday. He remarked that the double aspect of our duty at the present time was to beat the enemy at the front and to prepare for the future so as to avoid a fearful accumulation of debt and difficulty that it might take a generation to overcome. The time had come when we must throw overboard all those old-fashioned notions of ours that England was a favoured nation by the grace of God, and that Englishmen had, as a birthright, a higher position in the world than the people of any other nation. England could improve on the past in many ways. What they needed to do was to bring the light of science and higher education to bear more than they had done.

Institute of Marine Engineers. — The Hon. Secretary announces that the Institute has been removed from the premises in Romford Road to those on Tower Hill, and all communications should therefore be addressed as follows :—The Secretary, the Institute of Marine Engineers, the Minories, Tower Hill, London, E.

Educational.—A new edition of the University College, London, "Pro Patria" is in course of preparation, and will be issued shortly. Past and present students, or their relatives and friends on their behalf, are invited to send full particulars of the capacity in which they are serving the country at the present time. In the case of the Army, rank and regiment should be given ; in the case of the Navy, rank and ship. These particulars should be addressed to the Publications Secretary, University College, London (Gower Street, W.C.).

GIFT TO SHEFFIELD UNIVERSITY.—The *Times* states that Sir Joseph Jonas, chairman of the Applied Science Committee of the University of Sheffield, has given the University £5,000 to found, endow and equip a testing laboratory in connection with the Applied Science Department. The laboratory is to be equipped with the most modern applances for testing metals and minerals, especially those used in the production of steel, and is to be called the "Jonas Testing Laboratory."

Electrical "Evaporation."—Prof. Owen Richardson delivered the Friday evening discourse at the Royal Institution on May 7th, his subject having to do with the electron theory, to which he has devoted a great deal of special study. He pointed out that when electrified bodies were heated they lost their power of retaining an electric charge. The importance of this phenomenon was only just being realised, although the phenomenon itself had been known for a long time. Under certain conditions this ionic emission was positive in character, under others negative, and under others, again, was both positive and negative. When, however, a metal was heated in a vacuum, like the filament in a lamp, it was found that under all conditions of temperature only negative charges were emitted ; the heated filament gave off no positively electrified particles. Prof. Richardson went on to develop a theory that the emission of streams of electrons from heated metals was a process closely analogous to evaporation. It seemed to him to be the electrical analogue of evaporation, or, to put it more simply and daringly, the actual evaporation of electricity. There were some remarkable parallels between the evaporation of a liquid and the emission of electrons from a lamp filament, and the lecturer proceeded to demonstrate experimentally that the electrons were able to flow against an opposing electric field, and in effect to jump a certain number of volts. There was a possibility that minute chemical products might be sufficient to account for the electrical effects in a large number of cases. Fortunately, however, there was one case in which it had been found possible to demonstrate electrical effects of this kind out of all proportion to the chemical effects. This was the instance in which the metal employed was tungsten, which could be heated in a tube for so long a time, and carried to so high a temperature, that all known impurities were eliminated, and, by using specially prepared tungsten lamps, it was shown conclusively that these effects were strictly electrical emissions, and were not to be explained on the ground of chemical action. In conclusion, Prof. Richardson expressed his belief that these emissions of electrons from heated bodies were large enough to have very considerable practical importance in the future.

Stowmarket Explosion.—An explosion took place on Monday last at a Stowmarket factory, resulting in the death of four men. At the inquest on Tuesday Major Aston Cooper Key, one of H.M. Chief Inspectors, advanced the view that one of the men, who wore rubber overshoes, had become charged with static electricity by friction with certain bags, and that a spark passing from his body to some earthed object had caused the explosion. To prevent a recurrence of the accident a metal stud would, in future, be inserted in the sole of the shoe, so that the worker would always be earthed. No fatal accident had previously occurred at the factory since it was started, 17 years ago. The jury returned a verdict of "Accidental death."

British Electrical Trade in Belgium.—A Belgian correspondent now in this country, who has had 16 years in connection with the electrical industry, wants to assist in the defeat of German competition in Belgium after the war is over, and to help to encourage a large volume of British electrical trade there. He wishes to become the general representative for some English manufacturers of motors, dynamos, wire, cable, lamps (arc and incandescent), dry batteries, &c. We shall be pleased to forward any communications that may be received addressed to "Belgian Correspondent," care of ELECTRICAL REVIEW.

Fatalities.—Owing to the heavy rainfall and the flood on the railway near West Kensington, last week, an employé of the District Co., named A. J. Lawrence, lost his life. The man, a gateman, in stepping from a train into the water received a severe electric shock and died an hour later.

At the inquest on Tuesday it was stated that the conductor warned Lawrence not to get into the water on account of the electric current, but later he did so. A passenger who jumped into the water to help him received a shock, but was able to rescue the deceased. Artificial respiration was tried for 2½ hours without success. The medical evidence showed that death was due to shock and not to drowning, and a verdict of accidental death was returned.

The Manchester Meeting of the B.A.—The meeting of the British Association will open on Tuesday, September 7th, and close on Saturday, September 11th.

Inquiries.—Makers of Mascolite pads for absorbing vibration are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Wolverhampton T.C. has been recommended to increase the salaries of the under-mentioned officials in the electricity department :—MR. T. SMITH, distribution engineer, from £245 to £270 a year ; MR. E. FORDER, engine-room superintendent, £150 to £165 ; MR. C. BELLHOUSE, boiler-house superintendent, £150 to £165 ; MR. E STUBBS, chief assistant, from £200 to £225 ; MR. J. H. ROTHWELL, chief clerk, £170 and £185. The increases are to take effect as from April 1st last, with no further increases for four years as regards the chief assistant, distribution engineer, chief clerk, and for two years as regards the two superintendents.

The Newport (Mon.) Electricity and Tramways Committee has recommended that the salaries of MESSRS. E. G. ILLINGWORTH and C. B. BRIGGS, senior engineers in charge at the electricity works, be increased to £123 10s. per annum.

MR. A. B. ADAMS, draughtsman and general technical assistant at the Newport (Mon.) Corporation Electricity Works, has secured an appointment with Messrs. Guest, Keen & Nettlefold, Ltd.

MR. R. S. GREGG has resigned his position as assistant in the mains department of the Sheffield electricity undertaking.

Tramway Officials.—MR. C. BEECH, rolling stock superintendent in the Derby Corporation tramways department, has been appointed car-shed superintendent at Bolton, at £200 per annum. There were 93 applicants.

General.—After nearly six years in the East, during the last nine months of which he has been officiating as electrical inspector to the Government of Burma, Mr. Harry W. Nimms was to leave Rangoon for home by the ss. *Leicestershire* on April 29th.

Mr. George Hutchinson, chief electrician of the *Lusitania*, interviewed at his home at Frodsham, Cheshire, stated that he had just given his life-belt to a young woman when he saw Mr. Vanderbilt struggling in the water. The millionaire's lifebelt was wrongly adjusted, and Hutchinson, who was treading water, tried to put it right, but could not. "I am Vanderbilt," the struggling man remarked to him. He did his best to keep both of them afloat, but they drifted apart.

The Bacup Town Council recently accepted the resignation of Mr. W. E. Lloyd, borough treasurer and manager of the electricity department, who has been appointed borough accountant of Hampstead, at a commencing salary of £450 per annum. The Mayor said that after Mr. Lloyd was appointed treasurer he was appointed manager of the electricity department, and received some additional salary for it, and they would probably proceed on similar lines in regard to a successor. Ald. Maden said that as regards the electricity department, it had made rapid strides since Mr. Lloyd went to Bacup.

On March 25th, at St. Augustine's Church, Doornfontein, Mr. J. H. Dobson, general manager of the gas, electric supply, and tramways department of the Johannesburg Corporation, was married to Miss Kathleen Florence Cherrington, third daughter of Major and Mrs. Cherrington. The ceremony was performed by Canon Harrison Thompson. A reception followed at the County Club, 500 guests being present. Mr. and Mrs. Dobson were the recipients of many presents, including a massive silver punch bowl from the chief officials of the department, a grandfather's clock and silver fruit epergne from the staff and employés, a silver fruit stand and silver vases from the motormen and conductors, and a silver rose bowl and case of carvers from the traffic inspectors. The Mayor and Mayoress sent a silver tea service.

Obituary.—Dr. F. S. Pearson.—We deeply regret to record that Dr. F. S. Pearson, who was so prominently identified with a large number of important Mexican, Brazilian and European electrical undertakings, was among those who were lost in the *Lusitania* on Friday last. He had also brought his brilliant organising powers and financial knowledge to bear upon several non-electrical enterprises, but our readers will remember him as president of the Brazilian Traction, Light and Power Co., Rio de Janeiro Tramway, Light and Power Co., Mexican Light and Power Co., the Mexico Tramways, and the Barcelona Traction, Light and Power Co. He was a director of the Sao Paulo Tramway, Light and Power Co. and the Mexico Electric Tramways. As will be seen from a report appearing in our "City Notes," he was on his way to this country to attend a meeting of the Barcelona company mentioned above.

Mr. Audley Drake.—We are also grieved to learn that amongst the *Lusitania* victims was Mr. Audley Drake, aged 24, the elder son of Mr. Bernard Drake, Copyhold, Cuckfield, Sussex, chairman of Drake & Gorham, Ltd., with whom widespread sympathy will be expressed by his friends in the electrical industry. Mr. Audley Drake was educated at Eton, and King's College, Cambridge, where he specialised in science. After four years at Cambridge he went last June to America to study an electrochemical process, which is being worked on a large scale near Detroit. Whilst there he obtained a responsible appointment with the United Alkali Co., of Liverpool, who are now putting down a large plant, having acquired the British rights for the above invention. Mr. Drake was to have returned later, but owing to the fact that the products were urgently wanted by the Government in connection with the manufacture of explosives, he received a cable to come back as quickly as possible, hence his unfortunate inclusion amongst those lost on the *Lusitania*. His father tells us that he had little hope from the first, as he was certain his son would never leave the ship as long as there was anyone there to whom he could render assistance.

Mr. G. Maurice.—It seems from what we hear that Mr. G. Maurice, of the General Electric Co., Ltd., has likewise been lost in the *Lusitania*, but in the hope that there may yet be good news, we refrain from referring to the matter further this week.

The electrical world also suffered a further loss through this infamous outrage of the enemy, Mr. Gober, a director of Venner's Cookers, Ltd., being among the drowned.

Mr. H. F. Friedrichs.—The death occurred on Sunday night of Mr. H. F. Friedrichs, the borough electrical engineer at West Hartlepool. Mr. Friedrichs first went to West Hartlepool in 1889 as Sir Alex. B. W. Kennedy's representative in connection with the initiation of the Corporation electricity undertaking, and later was appointed borough electrical engineer, a position he has since filled. His work in connection with the installation of the waste heat plant, by means of which the waste steam from the Seaton Carew blast furnaces is utilised for the generating of electric current, was specially valuable. Mr. Frederichs was 50 years of age, and was born at Penang, in the Malay Peninsula. He leaves a widow and five children.

Mr. J. S. Naylor. The death is notified, at the age of 72 years, of Mr. Jas. Smith Naylor, who was a director of the Keighley Electrical Engineering Co., Ltd., from its formation.

Mr. Harry Croxon Hawkins, for 25 years a member of the staff of Crompton & Co., Ltd., electrical engineers, died at his residence at Chelmsford on May 6th, from cerebral hemorrhage. Deceased, who was 53 years of age, became the firm's chief accountant at both the Chelmsford and London offices.

The death is announced of Mr. D. Fall, manager since its inauguration of the Portrush and Giant's Causeway Electric Tramway.

NEW COMPANIES REGISTERED.

Tyneside Alloys, Ltd. (140,245).—This company was registered on May 7th, with a capital of £10,000 in £1 shares, to carry on the business of extracting metals and their compounds from ores and other substances, making alloys of all kinds, including tungsten, molybdenum, vanadium, chromium, and ferro-alloys used in the manufacture of steel and other industries, manufacturing heavy and fine chemicals and enamelling, colouring, and dyeing substances, manufacturing, treating, distilling and refining tars, coal tar products, and other substances, manufacturing and dealing with gases, extracting, refining, and hardening oils of all kinds, prospecting, mining, etc. The subscribers (with one share each) are: W. Jones, Ingleside, Gosforth, Newcastle-on-Tyne, metallurgist; A. Y. Jones, Netherhoys, Gosforth, Newcastle-on-Tyne, brick manufacturer; D. S. Jones, St. Bedes, East Boldon, brick manufacturer. Private company. The first directors are W. Jones, A. Y. Jones, and D. S. Jones. Qualification, 100 shares. Remuneration as fixed by the company. The directors may borrow up to £10,000 without the sanction of a general meeting. Solicitors: Wilkinson and Marshall, 1, Mosley Street, Newcastle-on-Tyne.

Francis Polden and Co., Ltd. (140,231).—This company was registered on May 7th, with [illegible] £1 shares, to carry on the business of electrical and mechanical engineers, manufacturers of machinery of all kinds, tool makers, founders, metal workers, etc., and to adopt an agreement with F. C. Polden. The subscribers are: F. C. Polden, 56, Cannon Street, E.C., electrical and mechanical engineer, 2,500 shares, C. J. Polden, 56, Cannon Street, E.C., electrical engineer, 10 shares. Private company. The number of directors is not to be less than two or more than five; the first are F. C. Polden (permanent chairman and managing director) and C. J. Polden. Qualification, £10. Registered office: 56, Cannon Street, E.C.

Anglo-Burmah Wolfram Syndicate, Ltd. (140,174).—This company was registered on May 4th, with a capital of £500 in £1 shares, to carry on the business of dealers in and treaters and smelters of wolfram ore, etc. The subscribers (with one share each) are: E. Boundy, 5, Fen Court, Fenchurch Street, E.C., merchant; C. C. Nichols, Ocean House, 24 and 25, Great Tower Street, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered office: Ocean House, Great Tower Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Autolectric Transmission, Ltd.—Debenture, dated April 15th, 1915, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: A. A. Knight, 2, Corfton Road, Ealing, W., and H. L. Mocatta, 39, Edwardes Square, Kensington.

Jarrow and District Electric Traction Co., Ltd. (78,680).—Capital, £50,000 in £1 shares. Return dated March 15th, 1915. All shares taken up. £1 per share called up; £49,961 15s. paid (including £16 15s. paid on 55 shares forfeited), leaving £38 5s. in arrears. Mortgages and charges, £14,800.

North-Eastern Electric Smelting Co., Ltd.—Mortgage, dated April 16th, 1915, to secure £6,250 any further moneys which may be advanced or become owing, charged on premises in Wallsend and the company's undertaking and property, present and future, including uncalled capital. Holder: Secretary of State for War.

Melton Mowbray Electric Light Co., Ltd. (53,018).—Registered June 18th, 1897. Capital, £25,000 in £5 shares. Return dated March 19th, 1915. 4,000 shares taken up; £20,000 paid. Mortgages and charges, £19,500. Registered office: 35, Regent Street, Melton Mowbray.

Electric Zinc Co., Ltd. (127,838).—Capital, £2,000,000 in £1 shares (400,000 pref. and 1,600,000 ord.). Return dated [illegible] 1914. Seven shares taken up; nothing called up. Mortgages and charges: [illegible]

G. H. Turner and Co., Ltd.—Issue on April 21st, 1915, of £80 debentures, part of a series of which particulars have already been filed.

Newcastle and District Electric Lighting Co., Ltd. (28,022).—Capital, £300,000 in £10 shares. Return dated March 19th, 1915. All shares taken up; £297,500 paid, leaving £2,500 in arrears. Mortgages and charges: £320,780.

Kensington and Knightsbridge Electric Lighting Co., Ltd. (26,196).—Capital, £350,000 in £5 shares (50,000 ordinary, 10,000 1st pref. and 10,000 2nd pref.). Return dated March 18th, 1915. 21,000 ord., 10,000 1st pref., and 10,000 2nd pref. shares taken up; [illegible] 15,968 ord., 10,000 1st pref., and 10,000 2nd pref. [illegible] £179,840 [illegible] £25,160 considered as paid on 5,032 ordinary shares. [illegible] £115,000. Stock issued [illegible] Electric Co., Ltd., £231,000.

British L. M. Ericsson Manufacturing Co., Ltd. (79,061).—Capital, £200,000 in £1 shares (100,000 pref. and 100,000 ord.). Return dated March 31st, 1915. [illegible] 50,000 [illegible] £170,000 paid; £30,000 [illegible] Mortgages and charges, £50,000.

Mather and Platt, Ltd. (60,387).—Capital, £1,000,000 in 40,000 pref. shares of £10 and 600,000 ord. shares of £1 each. Return dated March 15th, 1915. [illegible] 99,200 pref. [illegible] 25,000 [illegible]

Hellyar and Sons, Ltd.—Second debenture, dated April 24th, 1915, to secure £100 [illegible] property, present and future [illegible] £136 [illegible]

Resisto Electrical Manufacturing Co., Ltd.—Particulars of £5,000 debentures, created April 1st, 1915 [illegible] £100 [illegible]

Oriental Telephone and Electric Co., Ltd.—[illegible]

British Electric Automatic Machines, Ltd.—Debenture [illegible] to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: [illegible] 20, [illegible] Street, E.C.

CITY NOTES.

Barnsley and District Electric Traction Co., Ltd.

The report, submitted at the annual meeting held on Tuesday at the Electrical Federation Offices, W.C., showed that the revenue for the year was £27,586. After providing for all expenses chargeable to revenue, including £1,756 for debenture and loan interest, and setting aside £3,500 to the renewals account, there is a surplus, including £376 9s. 4d. brought forward, of £4,066. The dividend on the 6 per cent. preference shares absorbs £1,320, 6 per cent. on the ordinary share capital requires £1,202, and £1,544 is to be carried forward. The capital expenditure during the year was £7,520, mainly for additional motor omnibuses and further garage accommodation.

	1913.	1914.
Passengers carried	2,462,557	2,950,335
Average receipts per passenger ...	1.65d.	2.12d.
Average expenditure per passenger ...	1 00d.	1 51d.
Proportion of expenses to receipts	60 p.c.	71 p c.
Cars in stock	14	14
Motor omnibuses in stock	10	20

British Thomson-Houston Co., Ltd.

Mr. Geo. Franklin presided on Wednesday, at 83, Cannon Street, E.C., over the annual meeting of the company.

The Chairman, in moving the adoption of the report, said it was so complete in the information about the company's affairs that only very little remained for him to say. The year past had been a most difficult one, and if they were able to put before the shareholders a satisfactory balance sheet, it was greatly due to the loyal and efficient way in which the whole of the staff had done their work; and, on behalf of the Board, he tendered to them, one and all, their most sincere thanks, feeling sure that the shareholders would join cordially in this sentiment. As mentioned in the report, a great many of their employés had joined His Majesty's Forces, and they had made suitable provision for their families during the time they were serving their King and country. With regard to the disposal of the net profit for the year, which showed an increase of about £11,000 over 1913, they had, after consultation and in agreement with the most important shareholders, decided to utilise the same as shown in the balance sheet, and thereby further strengthen the position of the company.

Mr. W. C. Lusk (manager, commercial department) seconded the motion, which was carried without discussion.

Callender's Cable and Construction Co., Ltd.

In their report for 1914, the directors state that the accounts show a balance at the credit of profit and loss of £98,692, plus £124,591 brought forward, making £223,284. Interest on debenture stock absorbs £13,500, dividend on preference shares £10,000, depreciation of buildings, plant and machinery £9,968, depreciation of office furniture £397, leaving an available balance of £189,419. It is proposed to pay a dividend on the ordinary shares at the rate of 10 per cent. per annum, less income tax, being 10s. per share, whereof 5s., less income tax, was paid on November 2nd, 1914, and 5s., less income tax, will be paid on May 21st, 1915, to pay a bonus of 5s. per share, less income tax, and to carry forward £163,169. The directors consider this result to be satisfactory. It has been arrived at in spite of the disorganisation of business by the war during five months of the year, in which period operations were carried on with great difficulty and at considerably increased cost. All the departments of the company's factory were profitably engaged to their utmost capacity up to the end of July last, but on the declaration of war much of the business in hand was stopped, and it can easily be understood that the position thus created caused the gravest anxiety to the directors and management. Several of the contracts secured in the early part of the year were postponed, and others were only partially completed, but after three months' uncertainty it was found possible to reorganise the factory to meet the altered conditions of the trade, with the result that the works at Erith are now busy in some of their departments and well occupied in the others. Considerable trouble has recently been experienced in regard to labour, and the situation still remains unsettled. The curtailment of facilities for transport by land and sea has added materially to the difficulties of satisfactory manufacture. Shortly after the outbreak of hostilities special orders of some importance were placed with the company by the Admiralty and the War Office. Owing to the re-arrangement of plant and machinery necessary to execute this work, comparatively little of it was completed at the expiration of 1914, and practically no profit has yet accrued to the company through these war contracts. As was inevitable with the widespread interests of the company, heavy expenses and great inconvenience were caused in connection with the oversea business hitherto carried on, but, considering the unprecedented circumstances, this trouble has been less than might reasonably have been anticipated. Every opportunity has been taken to extend the company's operations wherever possible, and the directors feel confident that, when peace is again restored and commerce has resumed its normal course, a large and increasing business may be looked for, not only in those countries in which the company is already established, but also in several new localities. Important contracts in connection with the British telephone system, to which reference was made in last year's report, were placed in this company's hands in the early part of the year, and, in order to deal efficiently therewith, some expenditure on contract plant was incurred. The war has for the moment caused a suspension of all telephone extension, but this work will without doubt be resumed when the war has ceased. As usual, all plant and appliances have been thoroughly maintained and kept up-to-date, and the expenses so incurred have been charged against the year's accounts. The Anchor Co., in which this company holds a large interest, has again had a prosperous year, and continuous progress is being made in the various electrical undertakings in which this company is concerned. The company has arranged to make allowances to the dependents of its employés engaged on active service, and a new item therefore appears in the accounts. The amount for the current year will, however, be much larger than that shown in 1914, as the number of recipients is constantly increasing.

Annual meeting: May 20th.

Peterborough Electric Traction Co., Ltd.

The annual meeting was held on Tuesday at Electrical Federation Offices, W.C. The report submitted showed that the revenue for 1914 was £10,967. After deducting expenses, £8,608 16s. 10d., chargeable to revenue and debenture interest £945, there remains £1,413, plus £106 brought forward. £1,263 is to be applied to renewals fund, leaving £257 to be carried forward. £979 was expended on capital account during the year, mainly upon the purchase of motor omnibuses and on garage accommodation. Mr. R. J. Howley has been appointed a director of the company.

	1913.	1914.
Tickets issued	1,478,805	1,508,947
Average receipts per passenger	1.19d.	1.16d.
Average expenses per passenger	78d.	84d.
Proportion of expenses to receipts	65 p.c.	72 p c.
Cars in stock	14	14

Amalgamated Wireless (Australasia), Ltd.—The second report of the above company, covering the six months ended December 31st, was published in March in the *Sydney Morning Herald*. Satisfactory trading is reported, although certain departments have been much disturbed since the commencement of the war. The ships' message traffic, owing to censorship, naval restrictions, and the use of some of the subsidised ships for Imperial purposes, has been reduced to a low ebb. The subsidy ships have slightly increased, and now stand at 80 passenger and cargo steamers. New business is periodically coming along. Since the outbreak of war over 70 men have been sent away to carry out naval and military work of various descriptions on the battlefields of Europe and Egypt, as well as on transports and special-service Government vessels. The net profit for the six months was £7,812, which, with £16 brought forward, makes £7,828 available. The directors recommend an interim dividend of 2½ per cent., absorbing £3,500, leaving £4,312 to be carried forward. Comparison of the six months with the 12 months ended June 30th, 1914, may be made thus:—

	Year ended June 30th, 1914.	Half-year ended Dec. 31st, 1914.
Net profit	£8,616	£7,812
Dividend per cent.	4	5†
Amount of dividend	5,600	3,500
Patent reserves...	3,000	—
Carried forward	16	4,312
Liabilities—		
Capital paid up	£140,000	140,000
*Reserves	3,793	8,248

* Reserves include depreciation, June 30th, £3,129; December 31st, £4,319. † Per annum.

Penarth Electric Lighting Co., Ltd.—The annual meeting was held at Electrical Federation Offices, W.C., on Monday. The report submitted showed that the capital expenditure at December, 1914, stood at £44,557. The total revenue for the year was £5,439, and the working expenses were £2,402. After paying interest on loans and on debenture stock, £750 is placed to renewals fund, £250 to reserve, 1 per cent. is to be paid on the ordinary shares, and £283 carried forward. Equivalent of 8-c.p. lamps:—

	Lighting.	Power.	Total.
1913	28,226	3,740	31,966
1914	31,231	4,487	35,718

The number of consumers increased from 529 to 606. Mr. W. L. Madgen has resigned his seat on the board.

Anchor Cable Co., Ltd.—The directors report that the profit for 1914 amounted to £31,778, plus £15,850 brought forward. It is proposed to pay a dividend of 16 per cent., carrying forward £32,129.

Shawinigan Water and Power Co.—The *Financial Times* quotes an American paper to the effect that early in June this company will issue a new block of stock, the proceeds to be used to reimburse the treasury for additions made in the last year or so, and for additional working capital.

W. T. Glover & Co., Ltd.—A petition has been presented and will be heard before Mr. Justice Neville on May 21st, asking for alteration of the articles of association by adding various powers relating to the acquisition, holding and working of lead, copper, and coal mines, the smelting and working of ores, the production, refinement and treating of lead copper, &c., and many other matters.

West Coast of America Telegraph Co., Ltd.

Sir J. Denison Pender, K.C.M.G., presided on May 11th over the annual meeting held at Electra House, E.C. He said that the revenue for the year had amounted to £61,129, an increase of £7,483. The working expenses, compared with those for 1913, showed a decrease of £4,532. Ship repairs to cables, a most important part of their expenses, were lower by £2,686, but, as he had so often pointed out, that was an item which at any time might be a heavy one. The future could not be foreseen, and all they hoped was that the repairs would be light, thus benefiting the expenses account. The cable had to be manufactured in England and sent out, so it was an expensive item, especially at the present time, and every repair, however small the fault might be, necessitated important expenditure on cable to rectify it. The duration of interruptions for 1914 was 112 days, against 97 days in the preceding year, and taking into account the state of things which existed in August and for some months afterwards, owing to the presence of German cruisers after the outbreak of war, that was very satisfactory, and it was due to a great extent to the vigilance of their staff on the coast that so little delay occurred in carrying out the repairs to their cables. A considerable part of the capital of the company was in stocks which matured at an early date, and therefore such provision must be made, if not to the full extent, as would enable the directors to deal with the financial position when the time came. That was the reason why they were unable to recommend any dividend on the ordinary capital this year; more especially as there was also a considerable depreciation in the value of the securities in the reserve fund. As they all knew, that depreciation was by no means confined to their company, but was universal, but it was all the heavier when the reserves were invested in gilt edge securities such as theirs were.

Sir **Albert J. Leppoc Cappel**, K.C.I.E., seconded the motion, and the report was adopted.

Rhondda Tramways Co., Ltd.

Mr. L. B. Schlesinger presided, on May 6th, over the annual meeting, held at the offices, Lawrence Pountney Hill, E.C. In moving the adoption of the report, he said that the balance to the credit of the revenue account was £25,417. From this figure various items had to be deducted, including debenture interest, £11,470; sinking fund, £2,930; and rent to the Rhondda Council, which left a balance of £8,190; and that, together with the sum brought forward, gave them £8,783. After giving effect to the directors' recommendation to increase the reserve and renewals account by £2,000, bringing that account up to £16,000, there remained a balance of £6,783 to be carried forward. This sum was more than sufficient to pay the full year's preference dividend, but the directors did not recommend any distribution. Three causes had contributed to that decision. In the first place, there was the decreased receipts, amounting to £1,430; secondly, the anticipated increase in expenses due to the extra wages for employés and the increased cost of materials; and the third reason was the fact that the expenditure of £17,000 on the railless system had proved, for the first time, non-revenue producing. The railless system was approved by the Board of Trade and opened for traffic in December last, but the services had to be suspended in March owing to the state of the roads. The matter was receiving the attention of the road authority, who were asking the Local Government Board to sanction a loan for the purpose of reconstructing the roads. It had not been ascertained whether the application had been successful, but they anticipated that the necessary sanction would be obtained. An important factor was the want of travelling facilities in the colliery district, and this was a matter which might prove an inducement to sanctioning the loan. The company had obtained the consent of the Local Government Board to the issue of its remaining debentures. Until the outbreak of war, the undertaking had been quite satisfactory, and there had been an increase in the receipts of £2,014. But it had since decreased to £702. The company had been affected more so than other places. A large number of men, estimated at 17,000, had left Rhondda to join the Forces, and that had naturally affected the receipts. The passing of the dividend was a matter of great regret to the directors, but they felt, in view of the facts, that the shareholders would agree it was the wisest course. Turning to the accounts, the Chairman said the share capital remained the same as last year. The debenture capital now stood at £228,000, as against £231,000, a further £3,200 having been redeemed. A further £10,000 debentures had been issued. The reserves and renewals fund stood at £11,000, as compared with £10,000, and there had been added £2,000 recommended by the directors out of the year's profits. The special loan of £2,000 had been paid. The sundry creditors amounted to £7,107, as against £6,412. On the credit side, the capital account had been increased by a few pounds. The discount on the debentures was £15,000, as compared with £18,000. The extensions to date, including the railless trolley system, amounted to £16,645. With regard to the revenue account, the principle item was the traffic expenses, which were £13,530, compared with £12,632. The wages of conductors and other little items showed an increase. The net cost of the current was arrived at by deducting from the £12,462 the item of £2,000 for the credit side, which left £10,462, as compared with £10,325, a small increase. The repairs and maintenance had entailed an expenditure of £10,001, as against £7,488, an increase due to capital expended on the permanent way and mains. That item would always be a considerable one, owing to the heavy rainfalls and the mining character of the district. On the credit side, the revenue account showed an increase of £876 on the traffic receipts, of which £740 was attributable to the trolley system. In conclusion, the Chairman paid a warm tribute to Mr. Holliday, the new manager, who took up his duties last May.

The report, which was adopted, stated that there was no doubt that when the war was over the company could look forward to a return of prosperity owing to the continued development in the coal-mining industry.

	1912.	1913.	1914.
Gross receipts	£[illegible]0,854	£[illegible]5,241	£66,365
Traffic receipts (Tramways)	£49,775	£63,721	£64,425
Railless	nil	nil	£174
Profit before providing for interest, reserves and depreciations, etc.	£[illegible],680	£27,6[illegible]	£27,4[illegible]
Passengers carried	[illegible]974	11,[illegible]250	11,[illegible]
Car miles run … … … ..	1,093,584	1,311,408	1,413,638
Average receipts per car mile …	10.92d.	11.66d.	10.97d.
Average receipts per passenger …	1.32d.	1.31d.	1.29d.
Percentage of operating costs to traffic revenue .	64.67	[illegible]8.94	63.39
Percentage of operating costs to total revenue .	63.26	[illegible]7.56	61.7[illegible]

The annual meeting of the Rhondda Tramways Electric Supply Co., Ltd., followed, Mr. L. B. Schlesinger again presiding. The proceedings were purely formal. The report, which was adopted, stated that, under an agreement dated August 6th, 1907, the Rhondda Tramways Co., Ltd., agreed to take from the company all current for the working of the tramways during the period of the lease—namely, 42 years—in consideration of which the Tramways Co. has the control and management of the undertaking, and is responsible for all working expenses, debenture interest and premiums on the sinking fund policies for the redemption of the debentures. The Rhondda Tramways Co., Ltd., is entitled to all profits made, and, in accordance with this arrangement, the profit of £2,000 to the credit of the revenue account has been transferred to the Tramways Co.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The annual meeting was held on May 11th, at Electra House, E.C., Sir J. Wolfe Barry, K.C.B., presiding.

The Chairman, in proposing the adoption of the report, said that the gross receipts amounted to £819,000, against £738,000 for 1913, showing an increase of £81,000. This satisfactory result was partly due to their having had to transmit the whole of the Australasian traffic for nearly two months, when the Government Pacific cable system was interrupted by the attack made upon the Fanning station by the German cruiser *Nurnberg*, on September 7th last. The working and other expenses amounted in round numbers to £379,000, against £365,000 in 1913, showing an increase of £14,000. The net profit for the past year was, roundly, £411,000, and, including £30,000 brought forward, there remained an available balance of a little over £441,000. The usual quarterly interim dividends of 2s. 6d. per share each had already been paid for the past year, and it was now proposed to distribute a like amount, making a total dividend of 5 per cent. for 1914. It was also proposed to pay a bonus of 4s. per share, or 2 per cent., making a total distribution to the shareholders, free of income tax, of 7 per cent. for the past year, and to carry forward £31,000, against £30,000 for 1913. After making the usual additions to the maintenance, ships', insurance, and depreciation funds, £200,000 had been transferred from the revenue balance to the general reserve fund. On the other hand, the fund had been debited during the past year with £273,000—for the balance of cost of the Penang-Singapore-Hongkong cables £194,000, for partial cable renewals £35,000, for loss incurred on the sale of investments during the year £44,000. Those operations depleted the general reserve fund by £73,000, and left it at the end of the year at £656,000. When he last addressed the shareholders he indicated that the loss created by the sale of investments during the past year would be deducted from the provision shown in the balance sheet of £200,000 for investment fluctuations, but, seeing that the war had very materially affected the value of all classes of investments, the directors had considered it to be a wiser policy to charge the whole loss against the general reserve fund, and leave the £200,000 intact. The reserve fund investments had been carefully re-valued on the basis of the official prices quoted at the end of last year and on March 31st last, from which it was found that the provision already made was sufficient to cover the existing depreciation. With regard generally to the changed conditions brought about by the war, the shareholders would readily understand that with their extensive cable system, and their repairing steamers having to move about in waters more or less frequented by hostile vessels, the directors and the staff had necessarily had an anxious and somewhat difficult time since the conflict began. Their chief duty and endeavour had naturally been to efficiently maintain telegraphic communication, and although they had had a good deal of repairing work to carry out from time to time, they had, so far, been fortunate enough to be able to carry on the traffic without a single interruption of any [illegible]. This, of course, was mainly due to the associated companies having so many different cable routes to the chief centres of commerce, and possessing a large fleet of cable steamers and other repairing facilities. The shareholders would not, however, be surprised to learn that considerable dislocation in the traffic arrangements had been caused by the war, especially in the early days before the altered conditions were fully established and provided for, but the directors had done everything in their power to meet the requirements and minimise the inconvenience caused to the telegraphing public by the new situation, while, at the same time, fulfilling their duties to the State. They were doubtless aware that under the landing licences controlling the relations between the cable companies and the governments concerned, governments, in time of war, had the right to take possession of the companies' offices and control the traffic. This right was exercised by the British Government on Sunday, August 2nd last, and, on the following day, the transmission of all public code and cipher telegrams was suspended, and the public were only allowed to send their telegrams in plain French or English language at full rates. Seeing that Government telegrams were entitled to precedence over all the companies' cables, and keeping open the lines of communication for the transmission of this class of traffic was a matter of the first importance, it was decided to suspend the transmission of deferred and week-end telegrams to enable them to provide as efficient a commercial service as was possible under the altered circumstances. Nevertheless, considerable delay resulted in the transmission of public telegrams, and the telegraphing public complained of the inconvenience, and also of the additional expense which they were consequently incurring. For some years past the associated companies had been in favour of charging for plain language telegrams exchanged with extra-European countries by grouping the letters so as to count ten to each word, but, although at one time they hoped to be able to carry this innovation, at the last Telegraphic Conference held at Lisbon, the proposal was not officially sanctioned. With a view, however, to assist in meeting the war requirements, it was thought that an arrangement of this kind might be introduced, and thus relieve the public from having to pay full rates for plain language messages, and, after entering upon negotiations on the subject, the ten-letter system of counting was introduced on September 23rd. Some of the Colonial Governments, however, found objections to the arrangement, and, after the system had been in operation for a few weeks and was giving satisfaction to the telegraphing public, it was withdrawn, while, as an alternative, coding was again allowed to be introduced with certain limitations. On October 1st the Eastern and Eastern Extension Companies found themselves in the position of being able to resume the transmission of deferred messages. The financial result to the telegraphing public of the ten-letter counting, while it lasted, was that they were charged about one-half of the ordinary rates, or about the same as for deferred telegrams, and the associated companies had done everything in their power to quicken the transmission of the deferred telegrams, in order that the public might have a good and trustworthy service on these favourable terms. The companies were unable, as yet, to resume the acceptance of week-end telegrams, owing to the necessity of keeping the lines free to meet eventualities, but the telegraphing public might rest assured that, as soon as it was possible—with due regard to the prompt transmission of Government and ordinary commercial telegrams—week-end telegrams would again be accepted for transmission over Eastern cables. Having regard to the heavy traffic which they had at times to transmit, it was very fortunate that the new cables laid by the Eastern and Eastern Extension Companies between Suez and Hong-Kong, *via* Colombo, were completed and opened for traffic before the outbreak of war. The shareholders would be interested to learn that they arranged some time ago for the free transmission over their lines of messages sent by Government departments relating to the killed and wounded amongst the British Empire Forces, and also for the acceptance at quarter rates of telegrams exchanged between soldiers, sailors, or nurses of the Expeditionary Forces and their relatives in different parts of the world. As the shareholders were aware from the graphic accounts given in the newspapers at the time of the occurrence, the company's Cocos station suffered considerable damage from the attack made upon it, on November 9th last, by the notorious German cruiser *Emden*. Knowing that hostile vessels were actively at work in the Far Eastern waters, they had taken the precaution soon after the outbreak of war to prepare the staff for all contingencies. Consequently, when the *Emden* suddenly appeared off the islands in the early morning of November 9th, the staff were on the alert, and, before the landing party could reach the station, they had communicated by cable with the naval authorities as arranged, and also sent out wireless signals in the hope that they would be picked up by one of the British warships believed to be in the neighbourhood. Fortunately, the Australian Contingent, with its convoys, was passing not far off the station at the time and, picking up the signals, the naval officer in charge at once dispatched the Australian cruiser *Sydney* with all speed to engage the enemy. The result was that the *Emden* was attacked before the landing force was able to finish its work of destruction, and, after severe fighting, the *Emden* was driven ashore in a hopeless condition. They would be gratified to learn that the staff's action on this occasion was much appreciated by His Majesty's Government. The Admiralty presented handsome gold watches, suitably inscribed, to the superintendent who was responsible for sending out the wireless signals, and to the company's doctor, who helped to succour the *Emden's* wounded. Appreciative letters had also been received from the Colonial Office and from the Committee of Lloyd's complimenting the staff on their action. The directors lost no time in conveying to the staff at Cocos the board's appreciation of their services, together with the marks of approval of the Admiralty, Colonial Office, and Lloyd's Committee. The shareholders would be pleased to learn that although the landing party entirely destroyed the instrument room, with its working apparatus, by axes, the Cocos station was able, thanks to the arrangements previously organised and the efficiency and energy of the staff under their trying ordeal, to resume working within 24 hours of the *Emden's* raid. This raid might easily have been attended with serious loss of life, but he was thankful to be able to say that no personal injury was inflicted on the Cocos staff. Unhappily, a very different state of things resulted from the deplorable mutiny that broke out at Singapore in February last, when, among the killed and wounded, three valued members of their staff, together with the wife of one of them, were murdered, and two others seriously wounded. The directors had expressed their sympathy and appreciation of the services of the Singapore staff, and he was sure that it would be endorsed by the meeting. Before concluding, he wished to record his appreciation of the patriotic devotion and the high sense of duty shown by the staff on shore and afloat in all parts of their system, and also at the head office, during a time of such great anxiety to them all. The ships' staff had done valuable work in maintaining communication, sometimes under trying and risky conditions; and the shore staff had dealt with the traffic as expeditiously as possible under the conditions of censorship imposed by the Government. They had been working long hours on weekdays, Sundays, and holidays, and all, both on board ship and on shore, had cheerfully given up their periodical furlough in order to meet the demands of their country. It being impossible to speedily replace their highly trained and technical staff, the authorities did not desire them to enlist, and, although many of them would have liked to take some active part in the war, they had, with some few exceptions, accepted the ruling of the Army Council, who expressed the view that, having regard to their special qualifications, they were better serving their country by remaining at their posts than by joining the fighting forces. As many, however, as could be safely spared were allowed to enlist, and their places were not only being kept open for them, but they were at present being granted full pay. It would also interest them to know that two of the directors, the Hon. George Peel and the Hon. Arthur Brodrick, had been serving with His Majesty's Forces since the outbreak of war.

Sir John Denison Pender, K.C.M.G., seconded the motion, and the report was adopted.

Barcelona Traction, Light and Power Co., Ltd.

A meeting of the holders of the 5 per cent. bonds of the above company was held on Wednesday, at the Cannon Street Hotel, for the purpose of considering a series of resolutions to alter the trust deed in certain particulars in order to raise funds to carry out the uncompleted work of the undertaking.

Mr. W. E. Rundle, general manager of the National Trust Co. of Canada, who occupied the chair, said that among the passengers carried to their death by the sinking of the *Lusitania* was Dr. F. S. Pearson, the President of the Barcelona Traction Co. Dr. Pearson had been over to America, where he had succeeded in placing a large amount of the prior lien bonds which it was proposed to issue, and he was coming over to England expressly for the purpose of attending the meeting. His loss was deeply regretted by all who had been brought into contact with him, either in personal or business relations. Proceeding to deal with the business of the meeting, the Chairman said his company occupied an entirely independent position in the matter. They were not financially interested in the Barcelona Co., but, as trustees for the bondholders, they were very much interested in anything that was done that might affect their security or their interests. The committee which had been at work for some time had prepared a report, copies of which had been circulated, and after a careful and exhaustive study of the proposals made by the committee he had no hesitation in recommending their acceptance to the bondholders. The report of the committee was largely based on the report of Dr. Parshall, who emphasised the fact that the company's undertaking was in an uncompleted state and that it was of paramount importance that the enterprise should be carried through to completion.

Dr. Parshall then formally moved a series of resolutions to give effect to the report of the committee.

Replying to a bondholder, Mr. E. R. Peacock, a member of the committee, said that it had not been found possible at the present, at all events, to locate the company in England. One of the reasons which weighed very heavily with them in coming to that decision was the fact that of the £8,000,000 of bonds outstanding, more than half were held on the Continent, and a further very substantial amount was held in Canada. Those bondholders would naturally not be prepared to support a scheme which would locate the company in England, and so make its earnings subject to the present heavy income tax.

The resolutions were carried unanimously.

General Electric Co., U.S.A.—The report for 1914 shows gross income of $90,467,692, against $106,477,439 for 1913. Costs, which include expenses of development, manufacturing, selling, administration and patents, and also depreciation in factory and plants, amounted to $81,496,728, against $96 207,834. Profit from sales amounted to $8,970,963, against $10,269,605. Total income was $11,855,383, against $14,065,789. Net profit amounted to $11,287,827, which is equal to 11·12 per cent. earned on $101,485,700 capital, as against $13,489,357, which is equal to 13·2 per cent. earned on $101,381,200 in 1913. Surplus, after dividends had been paid, was $3,145,000, as against $5,340,153. The directors state that, while there was a decrease of about 25 per cent. in the value of orders received, the total number of transactions was practically that of the previous year. The unfavourable relation between the number of orders and their value, characteristic of periods of depression, has operated to increase materially the cost of securing and handling business.—*Financial Times.*

Stock Exchange Notice. — The Committee has been asked to allow the following securities to be quoted in the Official List :—

Calcutta Electric Supply Corporation, Ltd.—Further issue of 6,220 ordinary shares of £5 each, fully paid, and 3,780 ordinary shares of £5 each, £4 paid (within Nos. 250,001 to 260,000) ; and 6,308 5 per cent. cum. pref. shares of £5 each, fully paid, and 3,692 5 per cent. cum. pref. shares of £5 each, £1 paid (within Nos. 200,001 to 210,000).

Gell Telegraphic Appliances Syndicate, Ltd.—Mr. Justice Astbury, in the Chancery Division on Tuesday (May 11th), on the petition of Gell Telegraphic Appliances Syndicate, Ltd., confirmed the reduction of capital of the company by cancelling 10s. of the £1 shares. Counsel for the company said the capital was £40,000, of which £37,700 was issued. That would be reduced by £18,850, the amount of capital lost. The object of the company was to acquire certain patents for a machine in connection with sending telegraphic messages, and a great deal of money was spent in experimental work. Further patents had been taken out. There was evidence of the loss.

STOCKS AND SHARES.

Tuesday Evening.

Every class of the community has been deeply stirred by the unspeakable infamies perpetrated so rapidly one on top of the other by the enemy within the short space of one week. The Stock Exchange, of course, has shared to the full the horror which thrilled the civilised world at the latest revelations of German barbarity. In Capel Court, business came to something like a standstill. Stock Exchange men clamoured for immediate action to be taken by their Committee, for turning out of the markets those members who, although naturalised, have Germany or Austria as their fatherland ; and the Committee, genuinely alarmed for the bodily safety of those naturalised members, sent them a strong warning not to enter the markets at present.

A slight demonstration, unduly magnified by most of the newspapers, occurred on Saturday morning, when, for the first time since the war started, the Stock Exchange partially lost its mental equilibrium and became a shade hysterical in its burning indignation at the murder launched at the *Lusitania*. The last few business days have been completely overcast by the shadow of this tragedy ; the immediate effect upon prices was comparatively small, but the springs of investment and speculation have been frozen, and business marched to a halt.

Prices gave way not from any selling that took place, but by reason of the numbness produced by the all-prevailing cause. Markets are, in a sense, asphyxiated by the poisonous gas of such wanton wickedness. A few quotations are a little lower, but Telegraph issues as a whole are firm, and, amongst industrials, improvements have occurred in Edison & Swan fully-paid shares and in General Electric Preference.

In calculating the yields derivable at the present time from certain Telegraph and other stocks, the dividends on which are paid free of income-tax, we have hitherto based the returns upon the dividends as though they were paid in the ordinary way—that is, less tax. To do this, however, seems scarcely fair ; and, accordingly, we have amended our list in such cases as those where companies distribute their dividends free of tax. To put the matter clearly : it is obvious that a dividend of 8 per cent. less 2s. 6d. in the £ for income-tax, really amounts to a net return of 7 per cent. to the shareholder, and therefore 7 per cent. free of tax is precisely equal to 8 per cent. less the deduction. It will be noticed that the yields on Eastern Extensions, Eastern Telegraph Ordinary, Globes and Western Telegraphs are enhanced in no small degree by this recalculation, which we have made simply in order to bring the comparative figures into their correct perspective when viewed alongside other securities. Our method of working the sum is to take the yield in the ordinary way, and then to multiply it by eight and divide by seven, because the income-tax is now 12½ per cent.—2s. 6d. in the £.

There is a steady demand for the Eastern Telegraph group, and Western Ordinary have improved to 13⅞. Last week's substantial rises in Great Northerns and Indo-Europeans have been well held, but the Anglo-American issues are slightly lower in sympathy with the prevailing sentiment elsewhere, which affected acutely the market in railroad shares in New York, although its effects were shorter-lived than those in the London market. One or two of the South American Telephone shares were a little easier ; and Marconis slipped back to 33s. 9d., Canadians being 5s. 3d. and Americans 10s. 3d. The American Company has just issued its report, in which it is stated that the company's ship and shore equipments are 20 times greater than those of three years ago. No dividend is paid, but a surplus of $150,000 is carried forward. The Eastern Telegraph report shows good progress, and the net profit of £752,000 (after all deductions) is £73,000 higher than that of a year ago. The West African Telegraph is paying 4 per cent. for the year. There is little or no market in the company's shares. West Coast of America shares are supposed to be somewhere about 5s., as against 20s. when war broke out. The board have decided not to pay a dividend, because of the necessity for making a provision of £10,000 against depreciation in investments. The 4 per cent. Debentures, guaranteed by the Western Telegraph Company, stand about 93.

The Home Rail market shows an amount of firmness rather surprising in the circumstances. There are buyers about of Central London stocks, and the Underground group as a whole is very steady. Income bonds fell a point, and in this case also it will be noticed that we have corrected the yield in the same way as indicated above, because the interest on these bonds is paid free of tax. The Bill which has been prepared for authorising closer working agreement between the City and South London, the District, Central London, London Electric and London General Omnibus Companies, is being discussed with languid interest, and is expected to meet with a certain amount of opposition.

Mexico issues, as a whole, are better, and a rise of 10 points carried Mexico Trams to 40, the Company's 6 per cent. bonds at 37 being 2 points up. Mexican Light and Power shares are steady, but the First Bonds are a point higher at 51, and the prevailing impression appears to be that the worst of the Mexican trouble has been surmounted, with the future showing at least a gleam of possibility that matters may yet straighten out. The same subdued optimism has been felt so frequently on former occasions that its revival leaves one rather cold, although we suppose that in the mere nature of things the day will dawn when Mexico is once more at peace, and her people free to pursue commerce and industry. Meanwhile, the attempt made upon the life of the present provisional President of the Republic, Senor Roque Gonzales Garza, has not looked as though the revolution had been settled, and an all-round decline in Mexican Railway stocks shows how the outlook is regarded in other quarters.

Brazil Tractions have gone back a little to 55, though the Rio exchange keeps pretty steady at 12⅝d. There is little doing in the shares at the moment. Anglo-Argentine Tramways 5 per cent. Debenture stock has hardened to 90½, at which the yield of £5 10s. 6d. per cent. still looks tempting. Calcutta Electric Supply Ordinary shares improved to 6⅞ on the issue of the report this week, showing an increased profit for the year of £13,500. The final dividend of 5½ per cent. makes 9 per cent. for the year, the same as for 1913 ; and the carry-forward of £11,500 is £4,000 better than it was 12 months ago. Calcutta Tramways stand at 6½, but they are *ex* dividend, whereas the Supply shares are cum. 5s. 6d. per share.

In the Industrial market, Edison & Swan fully-paid shares have recovered to 2, a rise of 5s., and this is the principal alteration on the week. Callender's are firm at 12, on the issue of the report, which states that all the departments of the company's factory were profitably engaged to their utmost capacity up to the end of last July, but on the declaration of war much of the business in hand was stopped. Reorganisation of the factory to meet altered conditions of trade has resulted in some of the departments now being busy, while others are well occupied. The Admiralty and War Office placed special orders with the company shortly after the outbreak of hostilities. The directors state that the war has for the moment caused a suspension of all telephone extensions, but that this work will without doubt be resumed when the war has ceased. Rubber shares are quiet, with a dullish tendency in some of the leading issues, and not much business in progress. Nor is there any further activity amongst armament shares, prices keeping just steady.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 weeks).	Receipts for the month.		[illegible]	Total to date.		Route miles open.	
		£	£		£	£		[illegible]
Blackpool-Fleetw'd	May 1	1,929	−1,227	17	[illegible]	[illegible]	[illegible]	.
Bristol	April 30	[illegible]	−1,719	17	[illegible]	[illegible]	[illegible]	..
Chatham and Dist.	May [illegible]	[illegible]	+ [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	..
Cork	April 29	2,001	— 98	17	7,655	[illegible]	[illegible]	.
Dublin	" 30	[illegible]	+ [illegible]	17	94,353	[illegible]	9·89	..
Hastings	" 29	3,793	7[illegible]			[illegible]	19·8	..
Lancashire United	May 5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	..
Llandudno-Col. Bay	April 30	1,431	+ 1[illegible]	21	[illegible]	[illegible]	[illegible]	..
Tyneside	" 21	2,264	[illegible]	16	8,231	[illegible]	11	..
Anglo-Argentine ..	" 29	[illegible]	−13,213	17	[illegible]	[illegible]		
Auckland	" 9	20,216	1,[illegible]	[illegible]	[illegible]	+ [illegible]	[illegible]	[illegible]
Calcutta	May 1	16,534	−1,064	..		[illegible]		.
Kalgoorlie, W.A. ..	Feb.	2,[illegible]		[illegible]	[illegible]			..
*Madras	April 30	1,024	+ [illegible]	17	[illegible]	[illegible]	..	..
Montevideo ..	April	[illegible]	−2,864	[illegible]	[illegible]	[illegible]	.	..
Dublin Lucan R'y.	April 30	627	+ 12	1[illegible]	[illegible]	[illegible]	7	..

* Two weeks.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend, 1914.	May 11, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	8¼	—	£6 1 8
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4½	—	5 11 1
do. do. do. 4½ Pref.	4½	4⅛	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	14¼	— ⅛	6 6 4
do. do. 6 per cent. Pref.	6	12¼	—	4 18 0
do. do. 5 Deb.	5	112	—	4 9 3
do. do. 4½ Deb.	4½	98	—	4 11 10
County of London	7	11½	—	6 1 9
do. do. 6 per cent. Pref.	6	11	—	5 3 6
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	95 xd	—	4 14 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1¾	—	6 18 0
do. do. 6 per cent. Pref.	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	3½	3⅛	—	5 12 5
do. 4½ per cent. Pref.	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	75	—	4 13 4
St. James' and Pall Mall	10	8		6 5 0
do. do. do. 7 per cent. Pref.	7	6⅜	—	5 9 10
do. do. do. 3½ Deb.	3½	75	— 5	4 13 4
South London	5	8	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7½	—	6 0 0
do. 4½ Pref.	4½	4⅞	—	4 12 4

TELEGRAPHS AND TELEPHONES.

	Dividend, 1914.	May 11, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	106½ xd	—	5 12 8
do. Def.	1½	22⅝	— ⅛	6 12 10
Chile Telephone	8	6¼	— ⅛	5 18 5
Cuba Sub. Ord.	5½	8¾	—	6 5 9
do. Pref.	10	16	—	6 5 0
Eastern Extension	7	13	+ ⅛	*5 17 5
do. 4 Deb.	4	92	—	4 7 0
Eastern Tel. Ord.	7	136	—	5 17 9
do. 3½ Pref.	3½	74	—	4 14 7
do. 4 Deb.	4	98	—	4 7 0
Globe Tel. and T. Ord.	6	11¼	—	*6 2 0
do. Pref.	6	12	—	5 0 0
Gt. Northern Tel.	22	32	—	6 17 6
Indo-European	65/-	56	—	5 16 1
Marconi	20	1 11/16	—	11 17 0
New York Tel. 4½	4½	98 xd	—	4 11 6
Oriental Telephone Ord.	10	[illegible]	—	5 0 0
do. Pref.	6	1 3/16	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 8
United R. Plate Tel.	8	6⅝	— ⅛	6 8 1
do. Pref.	5	5	—	5 0 0
West India and Pan.	1	1 5/16	—	3 16 2
Western Telegraph	7	13¾	+ ⅛	*5 16 5
do. 4 Deb.	4	91	— 1½	4 6 6

HOME RAILS.

	Dividend, 1914.	May 11, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented	4	78½	+ ½	5 2 0
Metropolitan	1¼	29½	—	4 4 9
do. District	Nil	17	—	Nil
Underground Electric Ordinary	Nil	1 3/16	—	Nil
do. do. "A"	Nil	5/6	—	Nil
do. do. Income	6	80	—	*8 11 6

FOREIGN TRAMS, &c.

	Dividend, 1914.	May 11, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref.	5½	[illegible]	—	6 4 0
do. 2nd Pref.	5½	3⅞	—	7 2 0
do. 4 Deb.	4	83	—	4 16 5
do. 4½ Deb.	4½	88	— 1	5 2 3
do. 5 Deb.	5	90½	+ 1	5 10 6
Brazil Tractions	6	55 xd	— ½	10 18 2
Bombay Electric Pref.	6	10⅜	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	40	+ 10	Nil
do. 5 per cent. Bonds	—	58	—	Nil
do. 6 per cent. Bonds	—	37	+ 2	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	42	—	Nil
do. 1st Bonds	—	51	+ 1	—
Adelaide Sup. 6 per cent. Pref.	6	5¼	—	5 14 3
do. 5 Deb.	5	103	—	4 17 1

MANUFACTURING COMPANIES.

	Dividend, 1914.	May 11, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	52/-	—	5 7 8
British Aluminium Ord.	5	20/6	—	4 17 7
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	11½	—	6 10 5
do. Pref.	6	6⅛	—	5 0 0
British Westinghouse Pref.	7½	1 15/16	—	7 15 0
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	99	—	6 1 3
Callenders	15	12	—	8 6 8
do. 5 Pref.	5	5	—	5 0 0
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	8¼	— 1/16	4 12 6
Edison & Swan, £3 pd.	Nil	13/3	—	Nil
do. do. fully paid	Nil	2	+ ¼	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	5	13/6	—	7 5 6
do. do. Pref.	7	1	—	7 0 6
Gen. Elec. Pref.	6	10 3/16	+ 1/16	5 17 8
Henleys	20	14½	—	*7 17 8
do. 4½ Pref.	4½	4⅞	—	4 12 4
do. 4½ Deb.	4½	97	—	4 13 9
India-Rubber	5	9⅛	—	5 9 7
Telegraph Con.	20	87½	—	5 8 6

* Allowance made for dividends being paid free of income-tax.

Wellingborough Electric Supply Co., Ltd.—The annual meeting was held on Monday at Electrical Federation Offices, W.C.—The report showed that the total capital expenditure at December, 1914, was £32,522. The total revenue was £3,493, and the working expenses £2,475, leaving £1,018. After providing £141 for interest on loans, and £334 for debenture interest, there is a surplus of £543, which reduces the balance at the debit of net revenue account to £567. The units sold were 358,459, as compared with 340,581 in 1913.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 12th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	4/6	..
a	" Nitric	"	19/-	..
a	" Oxalic	per lb.	..	..
a	" Sulphuric	per cwt.	..	..
a	Ammoniac Sal	"	£49	..
a	Ammonia, Muriate (large crystal)	per ton	£40	..
a	Bleaching powder	"	£9	..
a	Bisulphide of Carbon	"	£21	..
a	Borax	"	£22	..
a	Copper Sulphate	"	£29	..
	Lead, Nitrate	"	£35	..
a	" White Sugar	"	..	..
a	" Peroxide	"	..	..
c	Methylated Spirit	per gal.	..	..
a	Potassium, Bichromate, in casks	per lb.	7d.	..
a	Potash, Caustic (88/90 %)	per ton	..	..
a	" Chlorate	per lb.	1/6	..
a	" Perchlorate	"	1/6	..
a	Potassium, Cyanide (98/100 %) (for mining purposes only)	"	Nom.	..
a	Shellac	per cwt.	65/-	..
a	Sulphate of Magnesia	per ton	..	..
a	Sulphur, Sublimed Flowers	"	£11 10	..
a	" Recovered	"	£8	..
a	" Lump	"	£8 10	..
a	Soda, Caustic (white 70/72 %)	"	£10 2 6	..
a	" Chlorate	per lb.	10½d.	..
a	" Crystals	per ton	45/-	..
a	Sodium Bichromate, casks	per lb.	3⅛d.	..

	METALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
b	Aluminium Ingots, in ton lots	per ton	£90	..
b	" Wire, in ton lots (1 to 14 S.W.G.)	"	£120	..
b	" Sheet, in ton lots	"	£120	..
p	Babbitt's metal ingots	"	£50 to £221	..
c	Brass (rolled metal 2" to 12" basis)	per lb.	1/- to 1/0½	..
c	" Tube (brazed)	"	1/0½	..
c	" " (solid drawn)	"	1/0⅛ to 1/0⅜	..
c	" Wire, basis	"	1/0½ to 1/0½	..
c	Copper Tubes (solid drawn)	"	1/1½ to 1/1¾	..
g	" Bars (best selected)	per ton	£100	..
g	" Sheet	"	£100	..
g	" Rod	"	£100	..
d	" (Electrolytic) Bars	"	£89	£3 inc.
d	" " Sheets	"	£107	£3 inc.
d	" " Rods	"	£95	£3 inc.
d	" " H.C. Wire	per lb.	11½d.	½d. inc.
f	Ebonite Rod	"	3/-	..
f	" Sheet	"	2/6	..
a	German Silver Wire	"	1/9	..
h	Gutta-percha, fine	"	6/10	..
h	India-rubber, Para fine	"	2/7	1d. inc.
j	Iron Pig (Cleveland warrants)	per ton	64/7	11d. dec.
j	" Wire, galv. No. 8, P.O. qual.	"	£20	..
g	Lead, English Pig	"	£21	..
m	Manganin Wire No. 28	per lb.	..	..
g	Mercury	per bot.	£12	..
e	Mica (in original cases) small	per lb.	4d. to 2/6	..
e	" " " medium	"	3/- to 5/-	..
e	" " " large	"	6/6 to 10/6 & up.	..
o	Nickel, sheet, wire, &c.	"	Nom.	..
p	Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p	" " rolled bars & rods	"	1/2 to 1/3½	..
p	" " rolled strip & sheet	"	1/3½ to 1/5½	..
o	Platinum	per oz.	185/-	..
d	Silicium Bronze Wire	per lb.	1/1	2⅜d. inc.
r	Steel, Magnet, in bars	per ton	£70	..
g	Tin, Block (English)	"	£166	..
n	" Wire, Nos. 1 to 16	per lb.	2/8	..
p	White Anti-friction Metals	per ton	£52 to £194	..
k	Zinc, Sh't (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Lewes and District Electric Supply Co., Ltd.—The capital expended during 1914 was £388, making the total £34,163. The revenue was £4,068, and the expenses were £2,410, leaving £1,659. To renewals fund £600 is placed, to reserve £200, 2 per cent. is paid on the ordinary shares, and £199 is to be carried forward. The demand for energy for lighting and power continues to increase satisfactorily. The number of installations connected has increased from 419 to 448. The units sold aggregated 279,048, as compared to 248,408 in 1913. The annual meeting was held at Electrical Federation Offices, W.C., on Monday.

Yorkshire (Woollen District) Tramways, Ltd.—The annual meeting was held at Electrical Federation Offices on Tuesday. The report, to which we referred briefly last week, showed that the capital expended during 1914 was £3,378, making the total £338,735. The passengers carried, with the same route mileage, cars and omnibuses, was 11,003,293 in 1913, and 11,532,764 in 1914. The proportion of expenses to receipts remained unaltered at 61 per cent.

THE POWER SUPPLY OF THE CENTRAL MINING-RAND MINES GROUP.

By J. H. RIDER, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 15th*, 1915.)

(*Continued from page* 672.)

The most general form of depth indicator used on winders on the Rand is the dial pattern. The dials are usually about 5 ft. in diameter, and are mounted on high cast-iron pillars facing the driver's platform.

When the old steam winders were converted to electric driving the original depth indicators were kept in use, and the electrical instruments, being of a small size, had to be mounted on or close to the driver's platform so that they could readily be seen.

It appeared to the author that it was a wrong principle to make the driver have to watch two sets of indicators, one mechanical and one electrical, in such different positions and at such different distances, and that the eye strain must be detrimental. He therefore endeavoured to bring all the indicators to one place, at a distance of about 6 ft. in front of the driver, and decided to use a depth indicator of the dial pattern, of the type in which the pointer moves through a very wide angle, covering at least 1¾ turns, in a circular path of constantly and regularly increasing (or decreasing) radii. So far as he is aware this type was first designed and used by Mr. Roberts, of Knights Central, Ltd., Germiston.

The final arrangement is shown in fig. 6, from which it will be seen that the electrical instruments and the air pressure gauge for the brakes are mounted between the two dials. The indicator pointer is carried in a rectangular groove at the front end of the pointer spindle, and is guided in its circular motion by a small roller on the underside, which engages in a roller path formed in the depth of the dial face. A small screen is fixed at the outer end of the pointer, which covers up the markings on the inner ring when the pointer is indicating on the outer ring.

The dials are of only 27 in. diameter, and the end of each pointer can move through a total path of about 116 in. This, with only an 8-ft. diameter drum, will serve for a depth of 2,900 ft., on the basis of 1 in. of movement for each revolution of the drum.

The complete indicator set is mounted on two pillars immediately in front of the driver's platform, with the tops of the dials at a height of about 4 ft. above the platform level. The driver is thus able easily to see over the top, to watch the drum marks, ropes, etc., when necessary.

The driving spindles for the dials are connected by gearing to the drums in the usual way.

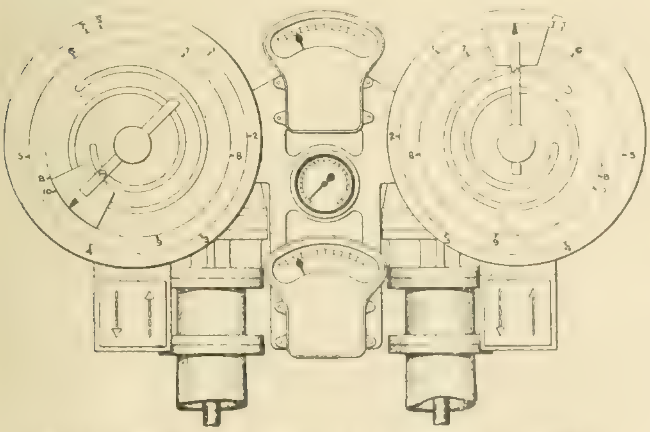


Fig. 6.—Combined Indicators for Electric Winders.

Immediately beneath each dial in fig. 6 will be noticed a small square box, with two arrows on the front side. Each box is divided into two vertical compartments, with an incandescent lamp inside each. The arrows are stencil cut through the cover, each right-hand arrow being covered by red glass and each left-hand arrow by green glass. A small control switch is connected to the operating lever, so that when the skip in the left-hand shaft compartment is being raised (and the skip in the right-hand compartment being lowered), the right-hand arrow (red) under the left-hand dial, and the left-hand arrow (green) under the right-hand dial are illuminated. The reverse action takes place when the skip in the right-hand shaft compartment is being raised. The driver has therefore an instant indication as to which skip is being raised, and follows the movements of that dial indicator pointer which has the red arrow under it.

Next to winding, the most important duty of the electric motor on a mine is probably that of underground pumping. Motor-driven geared ram pumps for heads up to between 2,000 and 3,000 ft. were the common practice until 1912, when, on the advice of the engineers of the group, it was decided to use high-speed, multi-stage centrifugal pumps, with direct-coupled motors, at the South Rand shaft of the Crown Mines, Ltd., and at No. 1 Shaft, Durban Roodepoort Deep, Ltd. Each plant consists at present of two pumping units, each of which comprises a high- and low-pressure 8-stage Sulzer pump, with the motor arranged between the two pumps, and lifts 375 gallons of water per minute to a height of 2,400 ft. The sets run at 1,470 r.p.m. and take about 500 b.h.p.

A little trouble was experienced at first owing to the nature of the water, which was slightly acid and contained a large amount of finely-powdered rock in suspension. A scheme of settling sumps was then arranged, in which the acidity of the water is removed by lime treatment and the suspended matter is allowed to settle. Since these sumps have been provided the plant has worked with great success, and is now being extended.

The importance of reliable underground mining pumps, and particularly of the electric supply to the motors of such pumps, cannot be over-estimated. A stoppage of less than 24 hours would be sufficient in some cases to flood the lower levels of the mines, which would not only drown out the pump chambers, but involve bailing in the shafts by means of tubs and the winding plant before the pump chambers could again be entered. For the lowest level of the South Rand Shaft of Crown Mines, Ltd., the pump motors will be operated at 200 volts from oil-immersed transformers, and the rotors will be of the squirrel-cage type. They will be started with the primary windings of the transformers connected in star, which will be changed over to mesh connection when full speed is reached. The object of this is to render the motors less liable to breakdown should the pump chamber become flooded. There will be no switches between the transformers and the motors.

The other classes of pumps used on the mines are generally electrically driven by belts. Nearly all the motors are of the slip-ring type, in which the rings are short-circuited and the brushes lifted at full speed. Belt driving has been found to have many advantages over direct coupling, as the pumps are often in positions, such as pits which are liable to be flooded, where a motor could not be placed, and, owing to the increases in the reduction plants from time to time, it is very convenient to be able to alter the speeds and lifts of the pumps merely by altering the sizes of the pulleys.

The stamp mill is a feature of all gold mines. The Californian type of stamp is in universal use; it consists of a circular steel weight, about 9 in. diameter, and 4 ft. long, fixed at the lower end of a steel rod called the "stem." The rod and its stamp are lifted by means of a cam, which, by rotating, engages on the underside of a tappet on the stem, lifts it for a distance of about 8 inches, and then allows the whole to fall by gravity on to a steel block at the bottom. Double-armed cams are employed, and the stamps are generally set in blocks of five or ten, and worked from a common cam shaft, the cams being arranged so that the stamps fall, one after the other, in a regular sequence. The ore is fed with water under the stamps, which weigh from 1,200 to 2,000 lb. each.

The cam shafts of the different stamp groups are driven by belts. Each stamp requires 5 h.p. on the average. The whole of the work is done by the motors in lifting the stamps, and is therefore the same whether any rock is being crushed or not.

The cams are double armed, and therefore the cam shafts revolve at only 49 r.p.m. This is a low speed and entails the use of a countershaft to enable a standard motor to be used. The largest pulley which is practicable on the cam shaft is of 7 ft. 2 in. diameter, and even with this the belt speed is only 1,100 ft. per minute. Very wide belts have to be used, with a jockey pulley to keep them tight owing to the nearly vertical drive. Between the motor and the countershaft a belt speed of 2,630 ft. per minute is obtained.

Although the existing type of stamp mill is really a crude device and has apparently so many mechanical defects, it has survived and will continue, because of its extreme simplicity and consequent reliability.

The modern practice is to crush the ore more coarsely in the stamp mill and to complete the process in tube mills. By this means the output capacity of the plant is considerably increased and a much finer product obtained.

A tube mill takes a considerable amount of energy to start it rotating, as the whole of the weight of the material lies at the bottom. It is also very sensitive to overloading, and many tube mill motors have been burnt out from this cause. Motors of 100 h.p. have been generally used, but these are gradually being replaced by motors of 125 h.p. and 150 h.p. for this reason.

A number of attempts have been made to drive tube mills by direct gearing from the motor shaft, but so far on the Rand [illegible] with no great success. [illegible] 365 r.p.m. were used, with "Citroen" single-reduction gears, consisting of a pinion on the motor shaft and a spur wheel bolted on the outside of the tube mill at one end. The gear ratio was about 15 to 1. The end movements of the tube mill were sufficient to do away with all the benefits of the high-class gears, and even with a flexible motor coupling caused great gear wears and trouble at the motors.

The present standard practice is to use a motor running at

580 R.P.M., to belt this to a pulley on a pinion shaft running at 120 R.P.M., and to use straight toothed gearing with a ratio of about 4.3 to 1. The mechanical efficiency may be slightly less, but the commercial efficiency is decidedly greater.

Four of the mines in the group do not obtain their supply of compressed air from the air mains of the power company, but use electrically-driven compressors on their own property.

The rope-driven compressors are all of the horizontal 2-stage type, and in each case have been converted from steam driving by removing the steam pistons and replacing the fly-wheel by a rope pulley, on to which the motor drives. The direct-coupled compressors are, with one exception, of Messrs. Belliss & Morcom's standard vertical 2-stage pattern.

Intercoolers are used between the different stages of all the compressors. The driving is by 3-phase constant-speed motors.

The Belliss compressors were purchased under efficiency guarantees, and it is interesting to note that their testing was the means of converting the makers from their practice of stating the output on calculations, to the more accurate method of actually measuring the output. The difference shown by the two methods, as the result of tests, was that the measured efficiencies were about 10 per cent. below those guaranteed. The volume of free air (at atmospheric pressure) delivered by reciprocating compressors is generally not more than 88.5 per cent. of the piston displacement, and is very often less. Calculations from indicator cards generally show from 99 to 95 per cent.

The power company bears the whole cost of operating the above compressor plants, including the electrical energy, and the mines pay for the air through meters in the ordinary way.

Small electrically-driven compressors, of capacities from 3 to 5 lb. of air per min., are used in conjunction with the brake gears of the electric winders, as stand-bys in the event of failure of the power company's air supply. They are hardly ever used.

Electric power is employed underground for hauling the broken ore from the stopes to the ore bins adjacent to the shafts, both by main and tail rope haulages and by electric locomotives. The former are operated by fixed 3-phase motors and the latter from overhead wires.

Main and tail and continuous rope haulages are used on the surface to convey the ore to the mills, the sands and waste rock to the dumps, etc. Belt conveyors are also frequently employed. The application of electric motors to these services presents no special features.

The only difficulty in using motors for driving crushers is caused by the great amount of fine dust which always accompanies dry crushing operations. Even though the motors are generally placed in separate houses, the dust manages to find its way through the necessary belt and shaft openings, and in time seriously chokes the ventilating passages of the motors and gets into the bearings.

The work of the crushers is very variable and intermittent, and the R.M.S. loading of the motors is very low, when a separate motor is used for each crusher. Notwithstanding this, it is better practice to use a separate motor for each crusher than one larger motor for several crushers, as it not infrequently happens that the maximum crusher loads occur at the same time. There are not enough crushers employed at the individual stations to give anything like a levelling-out of the load.

As a rule all motors of 50 H.P. and below are wound for 525 volts, and all motors above 50 H.P. for 2,100 volts. Those below 15 H.P. are of the squirrel-cage type, and those above of the slip-ring type.

The small squirrel-cage motors are started by switching the stator directly on to the mains. In the future it is intended to use motors with squirrel-cage rotors for much larger sizes, and these will be started by means of compensator transformers.

The slip-ring motors use a water tank with three dipping plates in the rotor circuit for starting purposes. The stator is switched directly on to the mains with the plates raised, and they are then gradually lowered until they are short-circuited at the tank. The rings are then short-circuited on the motor and the brushes raised. The usual short-circuiting arrangement is generally so defective that in many cases it has been removed, and the motor run with the brushes always down on the slip-rings.

In order to avoid a high pressure across the slip-rings on starting up, either a small (high value) resistance is connected between the dipping plates, or the level of the liquid is so arranged that the tips of the plates are always immersed.

Maximum-current and no-volt trip coils are used on the oil switches of all slip-ring motors, and of larger squirrel-cage motors which are started by compensators. For small squirrel-cage motors, which are self-starting when the stator is switched on, fuses only are used.

(*To be continued.*)

DISCUSSION AT BIRMINGHAM.

Mr. N. B. ROSHER said the paper differed from most others, in that it admitted that there had been troubles and failures of the plant. The author was to be commended for having made these admissions; it was from records of failure and troubles experienced that frequently most was to be learned. Some rather astonishing particulars were given of bad design and workmanship in the plant installed. It would be interesting to know where the plant was made: he would be surprised to hear that it came from this country. When he was in Cape Colony some years ago a large proportion of the electrical apparatus was purchased from the United States on account of the exceedingly low freights by comparison with those quoted for goods from Europe. As regarded British products, he could not agree with the author that flimsiness of design was the usual characteristic of three-phase motor brush gear. Neither did he believe that it would be easy to find British-made motors in which the stator frames became distorted under load, or in which a 6-ft. rotor had a radial air gap of only 1 mm., a more usual figure being at least double that amount. With regard to the author's formula for minimum radial air-gap, it would appear that the figure obtained by this formula for the 6 ft. diameter rotor was cutting it rather fine. A rough approximation for the air gap, which he had found to agree very closely with the gap as measured on a large number of motors of various makes and sizes, was to take the gap as being 1/500 of the rotor diameter. This formula gave rather too large a gap for motors having rotors of such large diameters as the one in question. He would ask the author why the drills were not electrically operated, as was being done with success in this country, instead of by compressed air. The efficiency of a compressed-air system did not as a rule exceed 30 per cent., whereas the efficiency of the electric system might be taken at 80 per cent. Assuming that compressed air must be retained for blowing out the workings, would it not on the whole be more advantageous to install electrically-driven compressors at each mine?

Dr. C. C. GARRARD said there was no doubt that for large power consumers the system of having three separate meters in series was a very good one. He asked whether each was provided with its own current and potential transformers. With regard to fig. 5, it appeared to him that this diagram had a very serious fault in that should the apparatus go wrong in any way, warning was not given, and an accident might happen. For example, a break in the battery connection would prevent the warning hooter sounding. Any such apparatus should be so constructed that in the event of its going wrong it gave the danger signal and prevented an accident. Mr. Rider took up the thorny subject of the alleged inability or unwillingness of manufacturers to supply what the customer wanted. He trusted Mr. Rider would not think he was referring to him when he said that in the majority of cases the manufacturer knew very much better what the customer should have than the customer did himself. This was only to be expected, as the manufacturer devoted his life to manufacturing, say, a particular article and knew everything about it from A to Z; whereas probably the purchaser had a superficial acquaintance with the article in question. The fine art of salesmanship, of course, was to conceal this fact and, while letting the customer believe he was getting what he asked for, to sell him what he should have. In this way future trouble was avoided which, if it did occur, the manufacturer was bound to get blamed for, whether it was his fault or not. The very fact that these disputes could occur showed the great need which existed for an increased standardisation of electrical apparatus. The state of manufacture of electrical oil switches was at the present time quite chaotic. Mr. Rider apparently had specified a rating of 800 amps. 15,000 volts for his 2,000-volt switches. This, however, was quite an arbitrary figure. The Verband Deutscher Elektrotechniker about a year ago laid down a rule that the rating of an oil switch must correspond to the maximum current which it would have to break on short circuit in the situation where it was used.* This was undoubtedly right.

Mr. F. GREENHALGH asked, with reference to the operation of oil-immersed stator switches or liquid controllers, if the plain butt-contact switches which had been used to such a large extent, had withstood arcing satisfactorily, and whether they required much more attention than the open type carbon-break switches illustrated in fig. 4. While the liquid controller gave a particularly smooth acceleration, serious objection appeared to be taken to the manual labour required to operate it. Had Mr. Rider had any experience with the type of liquid controller in which the dippers were lowered into the water by a float in a small chamber controlled by a gate valve, which could be adjusted to give any depth of immersion in somewhat the same manner as that adopted in the standard liquid winding controller? Several of these controllers were already employed on small mine hoists in this country, and they would appear to have largely overcome the objection referred to, as the volume of water to be handled was much smaller than in the other case.

Mr. J. M. WALSHE said that in referring to the tests of the motor-driven air compressors the author gave figures showing a discrepancy of 10 per cent. between the maker's guarantee and the results of a test on site. The larger part of the difference he considered to be due to the method of estimating the output of air. The efficiency stated was so much lower than was usually obtained with this class of compressor that he doubted very much whether the method used was reliable on those particular tests.

Dr. M. L. KAHN said that in view of the unique experience of Mr. Rider with three-phase induction motors used for main and tail haulage gears, he was particularly interested in his remarks about this point. The three-phase winders were compared with winders controlled on the Ward Leonard system.

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* See ELEC. REV. January 2nd and 16th, 1914.—EDS.

The latter required for each winder an induction motor, a direct current generator, and a direct-current motor. The last two machines introduced two large commutators into the working of the system. The haulage gears as installed in most mines on the Rand only employed slip-ring-type induction motors, which offered advantages in cost of installation and in maintenance, and reduced the possibility of trouble by decreasing the number of units required. In spite of this apparent simplicity, Mr. Rider seemed to favour the Ward Leonard system, apparently due to the fact that in the Ward Leonard system the whole speed control was effected by shunt regulation, while in the single-motor system, large weirs of liquid starters had to be moved by hand.

Dr. **Kapp** said a debt of gratitude was owed to Mr. Rider for having given so eminently practical a paper; but this feeling of satisfaction was overshadowed with a feeling of uneasiness when they read of the failures recorded, not unavoidable failures, but failures due to dishonest work. That any firm should send out faulty work patched up so as to hide the faults was bad enough, but that the work should be sent knowingly to a place where the lives of men depended on honest work was nothing short of scandalous. The author had not disclosed the makers' names! but he would be glad if the author in his reply gave an assurance that these particular examples of commercial dishonesty did not come out of British workshops. The author stated that a temperature rise of only 35° C. was allowed, making the absolute temperature, with an air temperature of 35° C., only 70°. This was considerably lower than the Engineering Standards Committee allowed, even for untreated cotton insulation. The air-gap in asynchronous motors by the author's formula was smaller than generally allowed. He suggested that it would be safer to allow a larger air-gap and counteract its worsening effect on the power factor by using phase advancers. This would also have the incidental advantage of reducing the great variation in voltage mentioned in the paper.

THE BOMBAY HYDRO-ELECTRIC SCHEME.

By ALFRED DICKINSON, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 29th*, 1915).

(*Concluded from page* 661.)

The present installation covers two transmission circuits on one line of towers. The conductors consist of 7-strand hard-drawn copper wire, the area of each wire being 0.095 sq. in.

For the creek-crossing spans a 7-strand hard-drawn silicium bronze conductor is used, having an area of 0.169 sq. in. The mechanical tests are a breaking stress of 14,000 lb., an elongation of 1¼ per cent. in 6 in. and an elastic limit of 10,500 lb. A torsional test of 5 twists in 6 in., and a wrapping test of six times round its own diameter unwrapped and re-wrapped.

For jointing up on the site a twisted-sleeve mechanical joint is used, which is made by passing the two ends of the conductors in opposite directions through a copper sleeve, then clamping the wires and sleeve together with two clamps and rotating the clamps in opposite directions until the joint is made in several complete twists.

The conductors are spaced 10 ft. 6 in. apart, and in the case of the intermediate towers are arranged delta fashion on either side of the tower, suspended on 6-unit insulators. In the case of the anchor towers the conductors are arranged vertically on either side of the tower and are suspended on 6-unit insulators. For the creek-crossing towers 7-unit insulators are used, the conductors being arranged vertically over one another on either side.

The suspension insulators (fig. 25), which are 10 in. in diameter, are of two types, viz., of the metal hooded type with ball joints for using vertically on intermediate towers, and of the link type for using horizontally on anchor towers. They are made from the best-grade non-absorbent porcelain, highly vitreous, of uniform hard glaze, dark grey in colour, with metal hoods of malleable cast iron and suspension links of galvanized mild steel, the threaded parts being sherardized and a special non-hygroscopic cement being used for cementing up the parts. The arrangement for attaching the suspension insulators consists of a sleeve in which the conductor is clamped, and for the anchor insulators a gripping sleeve through which the wire is passed and fastened with a split nut, all the parts being galvanized.

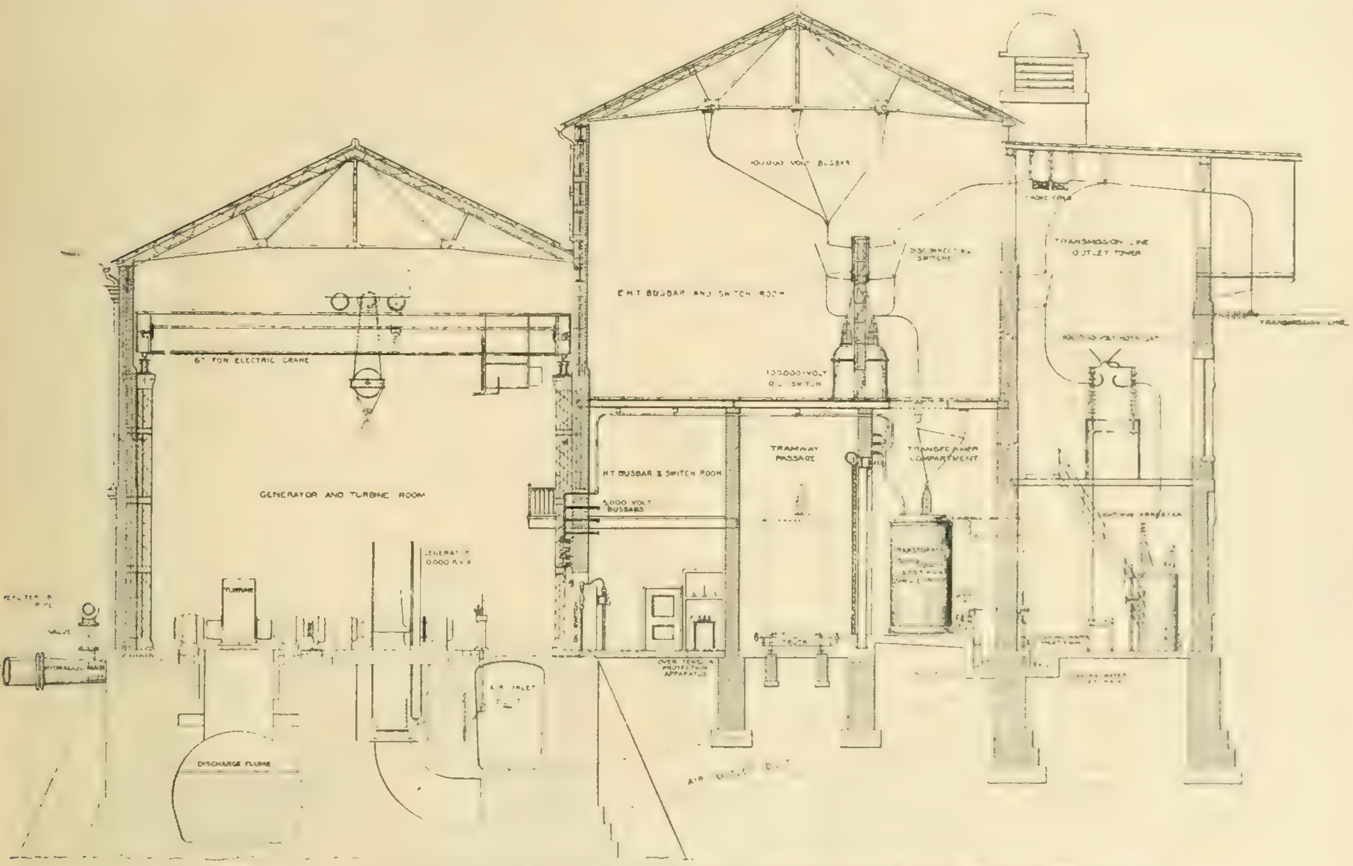


Fig. 24.—Bombay Hydro-electric Scheme: Sectional Elevation of Power House, Khopoli

Each unit with fittings in place is subjected to a mechanical test of 1½ tons tensile stress for the suspension type, and 1¾ tons for the strain type, the stress being applied for 10 seconds in a tension testing machine. The completed units are subjected to an electrical dry test of 60 kilovolts for 5 minutes and 70 kilovolts for one minute, the pressure being obtained from a transformer giving a 50-period sine-wave single-phase supply, and the insulators have to withstand such tests without flashing over or showing any defects.

The towers are of Siemens-Martin steel and are built in two sections, a superstructure and a base riveted to the former on site. Three types are used, viz., suspension, anchor, and special towers at creek crossings, about 500 in all being required. The design of all towers is based on a wind pressure of 25 lb. per square foot, the sag of the wires being regulated to give a factor of safety of 4 at the [illegible] temperature of 50° F. The suspension towers are designed to withstand any two conductors breaking, and the anchor towers to withstand all the conductors breaking on one side. In addition to the stress due to wind, the anchor towers are designed for a change in direction of 30° from the straight, up to an angle of 150° between the circuits, in the vertical or horizontal direction.

Fig. 25 illustrates the three types of towers used. The ordinary towers are 52 ft. high from the ground and are spaced

500 ft. apart. The creek-crossing towers are 160 ft. high from the top of the caissons, in order to comply with the Government requirement that no part of the transmission line shall be within 80 ft. of the water at high tide, and are spaced 1,185 ft. apart. Each creek-crossing tower is carried on four caissons, consisting of cast-iron cylinders, 6 ft. in diameter, filled with concrete.

One tower of each type was tested to destruction at the maker's works. Such tower was erected complete on the foundations, and was loaded gradually under the conditions for which it was designed. The external loading was applied by steel hawsers to represent the stress-diagram conditions. Under these tests the towers showed the required factor of safety of 4.

The telephone equipment consists of two circuits of No. 14 S.W.G. copper-clad wire having a conductivity of 45 per cent., a resistance of 17.38 ohms per mile, a breaking stress of 44 tons per square inch, and a weight of 103 lb. per mile. On the land portion of the line the telephone circuits are arranged below the power circuits, one on each side of the towers, and are carried on transposition pin-type insulators, intermediate telephone poles being placed midway between the towers; whilst where the transmission line crosses the creeks the telephone circuits are placed above the power circuits. The instruments consist of water-tight, high-tension, terminal telephones, which are installed at the power house, switch towers, and receiving station, and are mounted on marble panels with protective devices. A transformer is interposed between the speaking and ringing apparatus and the line, and hearing takes place through a rubber tube, which provides for safety in the event of the telephone lines becoming crossed with the power circuits.

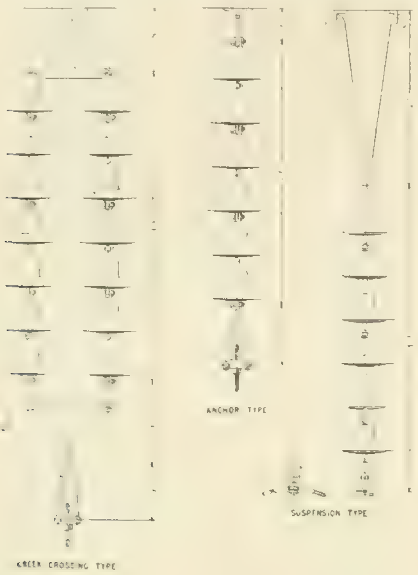


Fig. 25.—Transmission-line Insulators.

For removing static disturbances in the telephone line in the event of a fault on a power circuit, a special type of drainage coil is used. Portable telephone sets are also provided.

A guard wire for protection against lightning is arranged over each power circuit, and consists of a 7-strand steel cable, 0.295 in. in diameter, 0.188 lb. per foot maximum weight, and 6,400 lb. minimum breaking strength for the land portion of the line, and 0.378 in. in diameter, 0.309 lb. per foot maximum weight, and 11,000 lb. minimum breaking strength for the creek crossings. These cables are double galvanized and are boiled in linseed oil.

The equipment at the change-over stations in the line consists of four triple-pole, single-throw, 100,000-volt, bolt-type, out-of-door, disconnecting, air-break switches, which are mounted on 7-unit insulators fixed on wooden supports on the towers and are operated by rods from the ground through bevel gears and rack.

Each of the present circuits will transmit a load of 15,000 kw. at 0.8 power factor with a regulation of 11 per cent. and a line efficiency of 93 per cent., and a load of 20,000 kw. with a regulation of 14 per cent. and a line efficiency of 91.5 per cent.

The receiving station is situated at Parel on the Island of Bombay. It has been designed for an ultimate plant capacity of 74,880 k.v.a. in eight 3-phase step-down transformer banks of 9,360 k.v.a. each, and four incoming lines with the necessary switchgear and station auxiliary apparatus, of which five complete units and two incoming lines are now being installed.

The building is capable of extension as required, and the arrangement of the inlet tower, transformer compartments, and high-tension switchgear is the same as for the power house.

Each step-down transformer bank consists of three General Electric oil-immersed, water-cooled, single-phase transformers, delta-delta connected. These lower the pressure from 85,800 to 6,600 volts, 50 periods; the guarantees are practically the same as for the step-up transformers, the latter being of the same design, dimensions, and weights.

For the water-supply service to the transformers a system of cooling towers with water pumps, hot and cold well, and piping is installed. These are duplicate towers, each capable of cooling 18,000 gallons of water per hour from an inlet temperature of 107° F. to an outlet temperature of 87° F. with a wet-bulb temperature of 80° F. They are built of teak frames and posts, with bars and laths of jungle wood, and are treated with preservative compound.

There are three pump sets, each consisting of a self-regulating low-lift centrifugal pump, direct-coupled to an 8-h.p. 220-volt 50-period 1,450-r.p.m. 3-phase induction motor, and having a capacity of 20,000 gallons per hour against a total head of 45 ft. One pump circulates the water to the transformers from the cold well, which is situated beneath the tower, and another pump lifts the water from the hot well to the top of the tower, the third set being a spare.

The full-load requirements with five banks of transformers in circuit are 18,000 gallons per hour.

For improving the power factor and regulation of the system, duplicate synchronous-condenser sets are provided, each consisting of a 6,600-volt, 50-cycle, 500 r.p.m., 3-phase synchronous motor with a 125-volt exciter on the overhung part of the shaft.

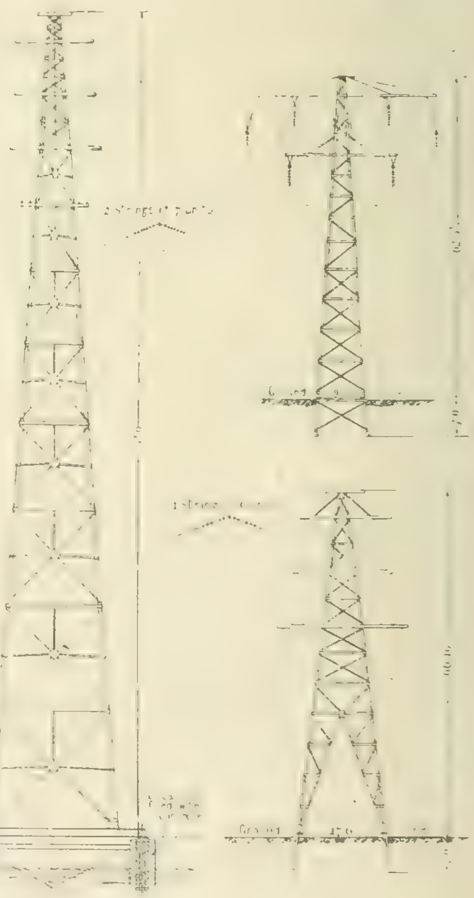
The motors are rated at 3,000 k.v.a. full-load input with a temperature rise of 60° F. for the armature, and 80° F. for the field, the atmospheric temperature being taken at 110° F., and the motors are capable of running at 20 per cent. overload for 10 hours without injury. The exciters are interpole, shunt-wound machines, rated at 25 kw. each.

The motors are started up direct from the 6,600-volt bus-bars through compensators, the starting current not exceeding full-load current; and the total running losses, including the power taken by the exciters, do not exceed 153 kw. at full load and 167 kw. at 20 per cent. overload.

The switchgear equipment consists of remote-control electrically-operated oil switches and other apparatus, which are operated from a benchboard, together with an auxiliary board for the station power and lighting circuits.

The equipment on the high-tension side is similar to the power-house equipment, except that the oil switches between the bus-bars and the transformer banks are automatically protected by the same relays as the low-tension oil switches.

The equipment on the low-tension side of the banks consists of triple-pole, motor-operated, automatic oil-switches in cell compartments, and current transformers and disconnecting switches, with similar equipments in the feeder circuits. In the former case the oil switches are provided with inverse time-limit, overload, secondary relays for automatic protection, and in the latter case with instantaneous, overload, secondary relays.


Intermediate Tower.

Creek-crossing Tower. Anchor Tower.

Fig. 26.—Transmission Line Towers.

The low-tension 6,600-volt bus-bar system consists of copper bar, carried on insulators, in concrete compartments, sectionalised by means of disconnecting switches, whilst an auxiliary bus-bar is provided for the synchronous condensers and the station transformer. The plant is connected up on the low-tension side by varnished cambric-insulated, fireproof-treated cable.

Each phase of the motor-operated oil switches is contained in separate oil vessels, which can be readily removed from the cells.

The station transformer bank is connected to the 6,600-volt bus-bar through a triple-pole, motor-operated oil switch with series, instantaneous, overload relays and disconnecting switches.

The control system is operated at 220 volts from a 60-ampere 8-hour battery, or from the 18 KW. charging set which also operates the series motors of the motor-operated oil switches.

Dividing boxes on the wall of the 6,600-volt bus-bar room connect the varnished cambric, single-conductor feeder cables to the armoured three-core cables which are run out of the building in an alley way to a cable chamber, where they are connected to the feeder distribution-system.

The feeder distribution-system from the receiving station to the mills is designed for a 6,600-volt 50-period 3-phase supply with an unearthed neutral. The cables are of the 3-core paper-insulated, lead-covered type, in standard sizes (viz., 0.1, 0.15, and 0.2 sq. in. section) and are laid on the solid system in bitumen in earthenware troughing in trenches 18 in. deep below the footway and 24 to 30 in. below the surface in side and main streets They are designed for continuous operation at a current density of 1,050 amperes per square inch for the 0.2 sq. in. size, 1,240 amperes per square inch for the 0.15 sq. in. size, and 1,560 amperes per square inch for the 0.1 sq. in. size, with a reduction of 5 per cent. in the carrying capacity when two, and 15 per cent. when four cables are laid side by side. The mills are arranged in groups, each group having a feeder to each mill, with an emergency ring-feeder connecting up all the mills of the group.

The problem presented by the Bombay Mills was the conversion of mechanical to electrical drive utilising the present shafting, the change being effected with as little interference as possible with the production of the mills. The problem was thoroughly investigated, and after due consideration group driving with direct-coupled motors was adopted as being best suited to the requirements.

Standard speeds of 265, 290, and 365 R.P.M. were adopted.

The motors are of the slip-ring induction type, wound for 2,000 volts 3-phase 50-periods and provided with brush-lifting and short-circuiting gear, and are in standard sizes ranging from 30 to 500 H.P. They are designed for full-load rating with a temperature rise of 70° F. above air at 100° F., and for 50 per cent. overload for half-an-hour without undue heating. The full-load efficiencies range from 87 to 92.5 per cent., and the full-load power factors from 0.74 to 0.84.

The starting switches are of the liquid type, the electrodes being operated through slow-motion gear and the motors being designed to start up against the full-load torque with a starting current not exceeding the full-load current. In the case of callender machines special starters are required in order to meet the conditions of the service.

The mill transformers are of the 3-phase 6,600/2,200-volt 50-period oil-insulated, air-cooled, core type, are star-connected on both sides, and are provided with an earthing device. They are supplied in four sizes, viz., 500, 600, 700, and 900 K.V.A., from which the power requirements of each mill are met. They are designed for full-load rating at 0.8 power factor with a temperature rise of 70° F. above air at 100° F., and for 50 per cent. overload for half-an-hour without injury, and they have at full load a power factor of 0.8, an efficiency of 98 per cent., and a regulation at 0.8 power factor of 2.5 per cent.

The mill-lighting transformers are 6,600/240-120-volt 50-period single-phase, of the same type as the power transformers, and are in 10, 20, 30, 40, and 50-K.V.A. sizes, being designed for the same temperature rating. They have full-load efficiencies ranging from 96 to 97.65 per cent. and a regulation ranging from 1.95 to 1.2 per cent. at unity power factor.

A sub-station is provided at each mill for the transformers and switchgear, the feeders being connected up to the high-tension bus-bars through trifurcating boxes, single-conductor cables, a triple-pole oil emergency switch, and disconnecting links. The high-tension sides of the transformer circuits are connected to the bus-bars through similar disconnecting links, and the low-tension sides to the low-tension bus-bars through disconnecting links. The motor circuits are run from the low-tension bus-bars as 3-core paper-insulated, lead-covered and armoured cables to the switch pillars, and single-conductor cables of a similar type are run from the pillars to the motors.

The pillars are of the ironclad type with an interlocking design, and are fitted with a triple-pole, automatic oil-switch provided with an overload and no-voltage release, an ammeter, and an isolating plug box. The operating lever has to be in the "off" position before the switch can be opened for overhaul, thus preventing accidental contact.

The whole of the electrical equipment was subjected to insulation tests at the maker's works at a pressure three times in excess of the working pressure.

The present electrification contract covers 30 mills, requiring 63 transformers aggregating 39,500 K.V.A. and 199 motors aggregating 37,525 H.P., the power requirements of individual mills ranging from three motors aggregating 325 B.H.P. to 19 motors totalling 2,400 B.H.P.

All the mill engines were indicated for maximum and average indicated horse-power and tachograph tests were made of the loads on the shafts, the steam-driven rope drivers being replaced by direct-coupled motors which are installed in most instances in the rope races, on stagings built up of rolled-steel joists, the motor feet being fastened to the steelwork by means of foundation bolts.

In certain cases the motors are placed on steel-tower structures outside the buildings and are roofed in.

The terms of the agreement between the company and the mill-owners cover the supply of energy for power purposes in Bombay at 0.55 anna per unit in the case of mills where the company supply the complete equipment, and at 0.5 anna per unit in the case of mills which provide their own motor equipment, the company providing and maintaining the mill transformers. Energy for lighting is supplied at 1.25 annas per unit. The agreement is for a period of ten years.

The principal contractors for the work here described are as follows:—

Hydraulic works, Pauling & Co., Ltd.

Pipe line and headgear, Escher, Wyss & Co.

Power-house and receiving-station transformers and switchgear, General Electric Co., New York.

Turbines and generators, Siemens Bros. Dynamo Works, Ltd.

Transmission towers and insulators, Bullers, Ltd.

Mill equipments, British Westinghouse Electric and Manufacturing Co., Ltd.

Street distribution system, Callender's Cable & Construction Co., Ltd.

The following are the principal members of the engineering staff:—

Engineer in charge of hydraulic section, R. B. Joyner, C.I.E.

Resident engineer on hydraulic works, B. D. Richards.

Resident electrical engineer and general representative in India, H. P. Gibbs.

Chief of electrical staff, E. S. W. Moore.

Consulting engineer, Alfred Dickinson.

Discussion at Manchester

Mr. J. S. **Peck** said the paper dealt with one of the largest undertakings in the world, and in view of the enormous expenditure involved in preparing dams and making the surrounding country sufficiently tight to hold the water, none but the most daring financiers and engineers would have made the attempt. The transmission voltage, *i.e.*, 100,000 volts, appeared very high for such a comparatively short length of line. Regarding the regulation of the generators, 22 per cent. at 0.8 power factor seemed rather low seeing that automatic regulators were used; 30 per cent. would appear more satisfactory. The cooling water was taken from the main pipe line, and it would seem more economical in view of the power value of such water to install a small pump to circulate the cooling water at lower pressure. The transformers were connected delta to delta, whereas the usual practice was delta to star; the latter arrangement gave a safer construction and permitted the neutral point to be earthed if desired.

Mr. S. L. **Pearce** referred to the very striking fact that the whole of the water was collected during the monsoon period; whilst the monsoon season occurred with appalling regularity, the amount of water could not be ensured, and it might appear possible for an exceptionally dry season to produce a shortage. Much value would have been attached to figures giving the cost of the hydraulic works and generator end. A Canadian engineer had remarked that whilst people thought power would cost next to nothing if derived through the agency of a hydro-electric company, the Britishers with large steam turbines were far ahead. The remark supported the view that large hydro-electric schemes could not compete with the large steam turbines in this country as regards turning out power cheaply. The transfer bus-bar, whilst usual at the present day, could be dispensed with by treating the step-up transformer and generator as one unit; the scheme would be cheaper, less complicated, and on the whole more reliable, and it was probable that the future development of large high-tension schemes would be along these lines. It seemed most striking that whilst energy was sold at 0.5 anna to the customers' own motor equipment, the additional price in the case of equipment supplied by the company was only 0.05 anna; calculations showed that the figure of 0.05 was little more than half what it should be if the cost of the mill equipment had to be written down in ten years.

Mr. **Bristow** stated that during the three months' monsoon season the rainfall in the district, which was 40 miles from the coast, was between 24 and 30 ft. The monsoon season up country failed much more frequently than near the coast, but it was possible even where this scheme was situated that a total failure might occur one year and be followed by a partial failure in the succeeding year. The monsoon varied sometimes to the extent of 50 or 60 per cent. in consecutive years, but when the scheme was laid out allowance was made for a complete failure succeeded by a partial failure. There was great diffidence with regard to the scheme at the commencement owing to the variable monsoon conditions, fissures in the rocks and lack of electrical knowledge amongst people who were expected to be chief customers. The chief thing which popularised the scheme was letting the mills have motors with the current. Roughly there were 30 mills supplied, and in practically every case it meant scrapping the entire steam plant. It was very doubtful whether any one of the mills would have done this and laid out fresh capital for new motor equipment. The price 0.55 anna was fixed for current and motor equipment, and when some enterprising mill owner came along and asked what reduction would be allowed if he supplied his own motor equipment, the company fixed .05 anna. Motor equipment salesmen were soon on the spot to convince native proprietors that a saving could be effected by putting in their own motors and buying energy at .5 anna.

Dr. Bowman said that a case had occurred in Yorkshire where a dam which covered about an acre and was absolutely free from leakage showed a difference of level of 4 in. during one week-end due entirely to evaporation.

Mr. Fennell said that in an installation of this kind the greater part of the charge for energy would represent standing charge, and it was of interest to know whether the promoters had considered the question of charging on the Hopkinson basis, having a fixed amount per H.P. to cover standing charges plus a small covering charge to cover running expenses. Periods of bad trade were sure to arise when the financial position of the scheme might be jeopardised.

Mr. Moore, in reply to Mr. Peck, said that the 22 per cent. regulation at 0.8 power factor had been adopted as a middle course in the calculations, and so far there had been no reason to regret the decision. Concerning the present state of the scheme, one of the pipe lines was through and working one or two turbines; operation commenced during the past month, so that it was too soon to give operating experiences, although it might be said that in starting up the 100,000-volt plant nothing abnormal had occurred. Regarding the question of regulation, experience was somewhat limited and complexity was introduced by the number of banks of transformers in circuit. Ultimately it was decided to regulate up to the high-tension bus-bars automatically, using a Tirrill regulator for the purpose. A stand-by was considered desirable, and for that reason the Tirrill was placed on one side of the system and a Brown-Boveri regulator on the other side; the two were not operated together. The ventilation of the large fly-wheel generators presented a problem which was ultimately solved by putting in a large air duct from end to end of the building, with inlet and outlet towers well remote from each other. Automatic gates were used, controlled simultaneously with the generator field, so that when the field was excited the air was passing and *vice versa*. The question of cooling water from the pipe line was very carefully considered, having in view the economy of using a motor pump, but it was decided to start with a static supply from a ball valve tank. The oil was passed through coils, and water was also circulated from tanks through the bearings. The delta connection of the transformers was also decided after lengthy consideration. Regarding the question of rainfall raised by Mr. Pearce, the scheme was based upon charts and data carefully accumulated for many years. It was interesting to note that the large area of water had the effect of increasing the rainfall over the catchment area. The elimination of the transfer bus-bars was very attractive and simple if it could always be carried out, but in this particular case it was desirable to have means of transferring transformers rapidly. Standardisation of the methods adopted had shown 0.05 anna to be exceedingly reasonable for the costs of a mill installation. The effect of evaporation had been allowed for, and although figures were not accessible, the allowance was enormous. The governing of the turbines by deflecting nozzles had proved successful so far. The installation was not sufficiently advanced to permit the allocation of the charge for energy between capital and running expenses. The twisted sleeve joint had proved very satisfactory, both mechanically and electrically. Even if the resistance were twice that of an equivalent length of conductor, the effect would be immaterial. Regarding the suggestion of a fixed charge per H.P. to provide for a slack season, the Indian financiers had certainly protected themselves from any failure from that source.

COAL SUPPLY CONFERENCE.

On Thursday afternoon, last week, a crowded meeting of representatives of the gas and electrical supply industries was held at the Institution of Electrical Engineers, in response to an invitation issued by Sir John Snell, to attend a national conference to discuss the shortage of coal supply and "for the purpose of considering the best course to adopt for bringing the far-reaching issues involved under the attention of the Government, with a view to some immediate measures of relief being obtained."

Sir Corbet Woodall, who occupied the chair, drew attention to the extreme importance of adequate coal supplies to both the gas and electrical supply industries; he emphasised the obligations of suppliers of these commodities which justified their demands, and answered those who hinted that they were wanting in patriotism in bringing them forward.

In Germany the use of coal for gas making was being encouraged in view of the valuable by-products obtained.

The present position was brought about in the early days of the war by the commandeering of a large proportion of the shipping, which resulted in freight charges being increased for the remainder, and railway congestion added to the trouble. Now, owing to enlistment of colliers, the supply of coal was apparently less than the demand, and the highest possible prices were being asked for the output.

He thought it should be possible to prevent the exportation of coal so long as it was needed at home.

Sir John Snell (President, I.E.E.) expressed the willingness of the Council of the Institution to help matters forward, provided Government action was not hindered in any way; he took it that they wanted to improve the output of coal and transport facilities.

Ald. Kay (Manchester) said one could not control a large undertaking such as theirs without experiencing great alarm at the situation. The Manchester gas undertaking was in a worse position to-day than during the coal strike, and in his opinion there was no need for it. He moved a resolution in view of the vital necessity of gas and electricity for lighting, cooking, and for manufacturing purposes generally:

(1) "That this meeting congratulates the Government on having appointed a committee to deal with the exportation of coal, and hopes that this may be effective in limiting exports, but views with the deepest concern the depleted stocks of coal and the difficulty, under present conditions, of renewing them for present and future requirements, and urges the Government to take further and immediate steps (*a*) to increase the output of coal from the pits, (*b*) to give greater facilities for the transport of coal by rail, and (*c*) to have regard, in requisitioning steam colliers, to the requirements of public utility undertakings which depend for their supplies on sea-borne coal."

Unless there was some improvement, they could not hope to meet the normal winter demand, and he was afraid the Government did not recognise the position. Time was of the greatest moment, and even more important than money.

Mr. Frank Bailey (London), in seconding the resolution, said a Parliamentary Committee had inquired into the question of house coal supply and found the position serious, but he denied the necessity for every man to hoard up his little stock of coal when there were public utilities ready to supply his light, heat, and power requirements more efficiently. He urged that the requirements of gas and electric concerns should come first. He paid a tribute to the work being done by the gas undertakings, who used the greater quantity of coal but had a valuable by-product in coke. He considered that those who sold coal in London had not taken undue advantage of the situation; in some cases he thought they had lost money.

Mr. John Bond (President, Inst. G.E.), in supporting the resolution, said his council had approached the Government on the question, and now the Board of Trade was taking action to prevent exportation.

Mr. R. A. Chattock (representing the I.M.E.A.) said their position was that some hundreds of electricity undertakings were supplying works engaged on Government contracts. Last year they burnt some two million tons of coal, but the stocks were now reduced to 25 per cent. of their amount before the war. He was glad to see that the Government was helping some undertakings, but the price was some 50 per cent. higher than before the war. Lighting supply represented only a tithe of their output, and the power was almost all used in Government work. He urged that they must have adequate coal supplies at a reasonable price.

Mr. Reginald Neville, M.P., suggested that the desired result might be obtained by impressing on the consuming public the necessity of curtailing the use of gas and electricity.

Prof. Sir Alex. Kennedy expressed sympathy with the resolution, agreeing that the London coal men were not making extra profit at the present time; other speakers suggested that this was really a consumers' question, and would be settled if the Government found the voters in opposition; that the definite idea in the resolution was the restriction of export of coal, and a strong point should be made of the dependence of the work of the country on electricity and gas; that the root of the question was the output of the coal workers, which could be increased if the Government, which had power to do it, suspended Clause 4 of the Coal Mine Regulations Act, 1908, which prescribed the working hours; also that in some districts the output of coal had actually increased as compared with last year.

In the end the resolution was adopted practically unanimously.

Ald. Phillips (Salford), while agreeing with the first resolution, thought it did not go far enough, as it left out the important question of price. He therefore moved:—

(2) "That the Government be asked to take such steps as may be necessary to reduce the price of coals to reasonable limits."

The Board of Trade Committee had admitted that prices had risen out of all proportion to the situation, and had hinted at the possible necessity of the Government taking over the supply of coal.

This resolution was seconded by Ald. Hall (Workington), who considered that there was strong reason to ask for Government inquiry into the methods of selling coal in view of the part taken by coal associations in fixing prices.

Mr. John Christie (Brighton) urged that the Chancellor of the Exchequer should surcharge ship-owners so as to limit their profits to 15 per cent.; in their case coal freights by sea were costing £15,000 a year for services worth about £5,000.

The resolution was also discussed by other speakers, one of whom pointed out that the resolution left the price quite in doubt, and to remedy that proposed an amendment, which was lost, the original resolution being carried by a large majority.

The Chairman then moved the third resolution, which was seconded by Sir John Snell, and was as follows:—

(3) "That a representative deputation of the gas and electricity industries be now appointed to present our case to the members of Parliament and to take such further action as may be found advisable.

That a conference with members of Parliament be held in London to seek their aid in urging upon the Government immediate action to give effect to the above recommendations.

That each authority represented pledges itself to take steps to secure the presence of their member or members of Parliament at the proposed conference."

The composition of the deputation, which was approved by the meeting, is as follows:—Sir Ryland Adkins, M.P., director, Herne Bay Gas & Electricity Co.; Mr. Edward Allen, engineer, Liverpool Gas Co.; Mr. F. Bailey, joint managing director, City of London E.L. Co.; Mr. J. Ferguson Bell, manager, Derby Gas L. & Coke Co.; Sir Joseph Bellamy, chairman, Plymouth and Stonehouse Gas L. & Coke Co.; Mr. John Bond, president, Inst. Gas Engineers; Mr. W. G. Bradshaw, chairman, Commercial Gas Co., Lond.; Dr. Charles Carpenter, chairman, South Met. Gas Co.; Mr. W. A. Chamen, engineer, South Wales E.P.D. Co.; Mr. R. A. Chattock, acting president, I.M.E.A.; Mr. F. E. Cooper, sec., Gas. Co.'s Protection Assoc.; Mr. A. C. Cramb, president-elect, I.M.E.A.; Mr. W. T. Dunn, sec., Inst. Gas Engineers; Mr. Hardman A. Earle, Yorks. Elec. Power Co.; Sir J. Fortescue Flannery, Bart., M.P., director, South Suburban Gas Co.; Sir D. Ford Goddard, M.P., chairman, Ipswich Gas L. Co.; Mr. J. S. Highfield, engineer, Met. Elec. Supply Co.; Captain R. S. Hilton, manager, Birmingham Corp. Gas Dept.; Bailie Irwin, chairman, Glasgow Corp. Gas Comm.; Mr. J. R. H. Jacobs, sec., Southampton Gas L. & Coke Co.; Mr. H. E. Jones, chairman, Wandsworth, Wimbledon and Epsom Dist. Gas Co.; Ald. Kay, chairman, Manchester Corp. Gas Comm.; Sir Alexander Kennedy, F.R.S., cons. engineer, Westminster Elec. Supply Corp., Ltd.; Mr. A. Masterton, engineer, Edinburgh and Leith Corp. Gas Dept.; Mr. C. H. Merz, Newcastle-upon-Tyne El. Supply Co.; Mr. Reginald Neville, M.P., chairman, Brentford Gas Co.; Mr. G. W. Partridge, chief engineer, London Elec. Supply Corp., Ltd.; Mr. S. L. Pearce, chief electrical engineer, Manchester; Ald. F. S. Phillips, chairman, Salford Corp. Gas Dept.; Mr. W. E. Price, engineer, Hampton Court Gas Co.; Mr. P. F. Rowell, sec., Inst. Elec. Engineers; Mr. A. H. Seabrook, manager, St. Marylebone Elec. Supply; Mr. James Smith, engineer, Belfast Corp. Gas Dept.; Bailie W. B. Smith, chairman, Glasgow Corp. Elec. Dept.; Sir John Snell, president, Inst. Elec. Engineers; Mr. C. P. Sparks, chief engineer, County of Lond. Elec. Supply Co.; Sir Albert Stanley, managing director, London Elec. Railway Co.; Mr. C. D. Taite, engineer, Lancs. Elec. Power Co.; Mr. Hanbury Thomas, managing director, Sheffield Untd. Gas L. Co.; Mr. F. J. Walker, Conf. Chief Officials of London Elec. Supply Cos.; Mr. D. Milne Watson, general manager, Gas L. & Coke Co.; and Sir Corbet Woodall, governor, Gas L. & Coke Co.

The Chairman said the names were numerous, but it was quite right that this should be so; the proceedings closed with votes of thanks to the Institution of Electrical Engineers and to the Chairman.

SOME PECULIAR VIEWS ON ELECTRIC LIGHT SWITCHING.

By W. PERREN MAYCOCK, M.I.E.E.

It may be mentioned to start with that by "Electric Light Switching" is here meant the control of glow-lamp circuits by means of small local switches mostly of the tumbler variety.

It is, perhaps, hardly necessary at this time of day to point out that quite a number of other electrical types of tumbler switch besides the single-way are available, and that their intelligent utilisation forms almost as important a branch of electric-light fitting as attention to the requirements of satisfactory illumination.

Without entering into details, it may be stated that there is as much difference between an installation fitted with due regard to modern switching conveniences, and one fitted in the ordinary manner, as there would be between the latter and an installation with all the switches in the lampholders.

It may interest some readers of this journal to know that your contemporary *Electricity* is publishing this month one of the periodical sets of examination papers in electric-light switching due to Messrs. A. P. Lundberg & Sons; and those who are not acquainted with these examinations might do worse than investigate this subject. That it calls for investigation by many who are concerned with electric light fitting is very obvious to those who know what peculiar ideas of it some people have.

It is proposed to confine this article to a few instances which were quoted in reply to the following question in the last examination:—

"Cite any instances that have come to your notice of the deplorable ignorance of the connections and conveniences of modern controls that exists in some quarters. As an example, there was a consulting engineer who objected to the use of 'Twinob' switches because of the danger of short-circuiting."

The writer (who was the examiner) has taken care to put the various cases without any exaggeration, though a little disguise has been necessary. The few examples that are given are obviously but a drop in the ocean to those that must occur daily.

(*a*) A two-way-intermediate circuit had been fitted up in a tunnel, where it proved of undoubted advantage. The chief afterwards remarked to the fitter—referring to the intermediate switch—"I suppose that's one of those 'Twinobs' down there." The point here is the confusion of the Intermediate with the "Twinob" switch, whose functions are quite different.

(*b*) An intermediate switch was suggested as a necessary addition to a two-way control in a railway station, at a point quite close to the existing strapping wires. The foreman was averse to the idea, as he thought it involved bringing the "feed" up to the switch. As a matter of fact, all that was necessary was to cut the strapping-wires, lengthen them slightly, and connect them into the intermediate switch.

(*c*) A two-way control was ordered for the yard of a works, and an intermediate switch was suggested for a mid-way point past which the two-way strapping wires had to run. The proposal was not appreciated because it meant "two or three extra wires to the switch." In reality no more wire was required.

(*d*) The second engineer to a very large provincial electric supply department considered two-way control a great novelty, and asked some of his wiremen if they had ever heard of it, and whether they could do it. Actually, the two-way control is something like a quarter of a century old!

(*e*) An electrician-in-charge started on the wiring of a new circuit, which included a two-way control. When the time came to wire-up to the switches, our friend was taken suddenly ill, and his illness was so protracted that a contractor was deputed to finish the work. As soon as this arrangement was entered into, the electrician recovered and resumed his duties in company with the contractor's wireman!

The conclusion that may be drawn is clear.

(*f*) For a certain very important purpose a two-way intermediate control was required on a ship. This requirement proved to be beyond the powers of several "specialists." After some months' waste of time on this intricate problem the writer (examinee) ventured to fit up the control himself, to the surprise and confusion of the "specialists," who had seen nothing like it. The switches have since been on continuous and satisfactory duty night and day for many months.

(*g*) There was a professional man who, although also an amateur electrician, proposed to revert to gas because his electricity bill was higher. Happily, a friend stepped in, introduced a few modern controls which effected economy in consumption, and so saved the situation.

(*h*) A series-parallel-and-off switch fitted on a steamer proved a puzzle to an electrical engineer, who had to be shown by a friend that there was a central or "off" position.

(*i*) A firm of London contractors of some repute once tried to obtain two-way-intermediate control with three two-way switches!

(*j*) An institute is being built in Scotland, and is to be lighted by electricity. The lighting committee consists of some half-dozen people whose knowledge of the subject is of the vaguest kind. Advice on modern controls was tendered by the one qualified electrician in the district, but was rejected, and the single-way switch is to hold undisputed sway.

It will be observed that most of the above examples relate to two-way or two-way-intermediate circuits. It may, therefore, be assumed that the somewhat more special controls—restrictive, master or pilot, for instance—still remain to be discovered by many people of technical repute.

Locating Projectiles by A.C. Electromagnet.—According to a note to the Académie des Sciences by M. J. Bergonié, alternating current electromagnets have been used successfully in Temporary Hospital No. 1 (Grand Lebrun) at Bordeaux, to locate shell splinters, German bullets or other magnetic projectiles in wounded soldiers. Best results have been obtained when using a core of insulated plates 0·2 mm thick, 75 cm. long and 7·7 cm in diameter wound with 252 turns of wire carrying 23·5 amps at 240 volts, 50 cycles per second. The alternating magnetic field thus produced sets in vibration any magnetic material embedded in living tissue, and either by visible vibration of the surface of the flesh or by a trembling drag on the hand holding the magnet, it permits the detection and approximate localisation of magnetic splinters and bullets. Holding the core just clear of the flesh, it is said to be possible to locate a 5 gm. splinter or bullet at a depth of 10 cm. and, without the aid of radiography, to ascertain quickly where the metal is nearest the surface, and hence the means by which it can best be removed. In the original communication (April 6th, 1915), several examples are given of the application of this new method.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

6,178. "Protecting electrical conductors." A. Marr & J. Lister. April 26th.

6,196. "Combination electric switch and fuse." A. H. Short. April 26th. (Addition to 8,456/14.) (Complete.)

6,197. "Controlling mechanism for automobiles." British Thomson-Houston Co., Ltd. April 26th. (General Electric Co., United States.)

6,217 "Wireless telegraphy." C. M. Agner. April 26th. (Convention date June 8th, 1914, United States.) (Complete.)

6,222. "Combined electric switches and plug couplings." G. Markt. (Complete.) April 26th.

6,244. "Telephone transmitters." M. S. Conner & A. R. Kahl. April 27th.

6,253. "Method of obtaining a sparkless-break of an inductive electrical circuit." T. F. Wall. April 27th.

6,259. "Electro-magnetic projectile-transmitting apparatus." E. Bachelet. April 27th.

6,273. "Means for applying electric treatment." G. Vernon-Ward. April 27th.

6,296. "Arc lamps adapted to be used also for the production of electrical oscillations for wireless telegraphy, wireless telephony, and for other purposes." I. Mauclaire & A. Breton. April 27th.

6,297. "Fluid-pressure controlling-systems." H. T. Kerr. April 27th. (Convention date, May 19th, 1914, United States.) (Complete.)

6,302. "Electrically-actuated tools." W. J. Mellersh-Jackson. April 27th. (Commonwealth Electric Tool Co., United States.) (Divided application on 21,143/14, October 17th.) (Complete.)

6,314. "Renewable terminal for electric ignition and the like accumulators and other purposes." B. Barber. April 28th.

6,343. "Portable dry batteries, as adaptable and employed for ringing electrical bells and the like." J. W. Lea. April 28th.

6,349. "Ball-and-socket joints." British Thomson-Houston Co., Ltd. April 28th. (General Electric Co., United States.)

6,362. "Automatic signalling arrangement for tramway lines or electric railways." D. Samaia. (Addition to 10,434/12.) April 28th. (Complete.)

6,364. "Electrically-actuated tools." W. J. Mellersh-Jackson. April 28th. (Commonwealth Electric Tool Co., United States.) (Divided application on 21,143 14, October 17th.) (Complete.)

6,373. "Incandescent electric lighting." J. S. Hecht. April 29th.

6,374. "Electric conductors or cables." W. E. Hitch. April 29th.

6,407. "Regulation of dynamo-electric machines." British Thomson-Houston Co., Ltd. April 29th. (General Electric Co., United States.)

6,408. "Electric motors." British Thomson-Houston Co., Ltd. April 29th. (General Electric Co., United States.)

6,412. "Electric-arc soldering." E. H. Jones. April 29th.

6,457. "Electrical fire-alarm systems." Siemens & Halske Akt. Ges. April 30th. (Convention date, May 1st, 1914, Germany.) (Complete.)

6,466. "Combined electric-light fitting and clock." B. Ries. April 30th.

6,469. "Controlling mechanism for dynamo-electric machines." British Thomson-Houston Co., Ltd. April 30th. (General Electric Co., United States.)

6,476. "Cathodes of vacuous tubes suitable for use in wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd., & H. J. Round. April 30th. (Divided application on 13,247/14, May 29th.)

6,480. "Telephone systems." H. S. Turner. April 30th. (Convention date, June 20th, 1914, United States.) (Complete.)

6,486. "Wireless telegraph and telephone systems." L. de Forest. April 30th.

6,495. "Rotary field magnets." Svenska Turbinfabriks Atkiebolaget Ljungstrom. April 30th. (Convention date, June 22nd, 1914, Sweden.) (Complete.)

6,542. "Electric signalling system for railways." W. J. Mackenzie. May 1st.

6,551. "Arrangements for transmitting and receiving signals by electro-magnetic waves." O. Imray. May 1st. (Samuel M. Kintner & Halsey M. Barrett, United States.) (Complete.)

6,558. "Leakage protection device for electric cables." W. J. Howard. May 1st.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

17,889. Electric Lamp Casings. H. H. Hirsch. August 5th.

27,533. Telephone Systems. Automatic Telephone Manufacturing Co. and F. Newforth. November 29th.

1914.

1,969. Telephone Systems. Automatic Telephone Manufacturing Co. and F. Newforth. January 24th

3,702. Incandescent Lamp Sockets. H. Marks & S. Helsel. February 12th.

4,908. Electrical Hair Brushes, Massage Brushes, and the like. Tokalon, Ltd. & M. F. Pratt. February 25th.

6,209. Electrical Impulse Transmitters and the like. Betulander Automatic Telephone Co. & W. Aitken. March 11th.

6,214. Means for the Electrical Transmission and Distant Control of Movements specially applicable to Systems for Signalling Orders and the like. E. H. Graham & W. J. Rickets. March 11th.

8,931. Magnetos and other Electric Generators. A. Keller-Dorian. April 6th (April 14th, 1913.)

9,035. Electric Switches. J. H. Tucker & J. A. Crabtree. April 9th. (Cognate application, 18,942/14.)

9,056. Methods of and Apparatus for Shaping Filaments. British Thomson-Houston Co. April 9th. (General Electric Co.)

9,305. Electric Couplings of the Plug and Socket Type. J. W. Annand. April 15th.

9,578. Dynamo-electric Machines of the Alternating-current Commutator Type British Thomson-Houston Co. & N. Shuttleworth. April 17th.

9,648. Telephone Systems. Automatic Telephone Manufacturing Co., A. B. Sperry, & A. J. Ray. April 18th.

9,659. Electric Light Shade Carrier or Holder. R. J. Eskrigge. April 18th.

9,726. Control of Electric Fan Motors. S. G. Jones, F. E. Wilson, and W. A. Shepherd. April 20th.

12,233. Telephone Call Recorders. D. J. McGauran. May 18th. (July 22nd, 1913.)

15,031. Spark Gaps for Radio-telegraphy. E. Girardeau & J. Bethenod. June 23rd. (February 25th, 1914. Addition. to 14,884/14.)

15,155. Controlling Arrangements for Direct-current Electric Motors. Soc. Anon. Dite. S.T.A.R. (Systeme de Traction Auto-Regulateur.) June 24th. (July 21st, 1913.)

17,986. Electric Time Switches. J. E. H. Beraud. July 29th. (Addition to 945 14.)

18,277. Means for Connecting Electric Conduits to their Fittings. A. Myers & L. Myers. August 7th.

20,131. Rheostats Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). September 24th.

21,090. Electro-magnetic Perforators. E. Thompson. October 16th.

21,906. Reversible Pin and Socket Coupling for Electrical Apparatus. W. A. S. Benson & Co. and E. Ellwood. November 3rd.

21,952. Order Telegraphs. E. A. Graham. November 3rd.

1915.

1,377 Electric Cooking Ovens. J. T Negus & Negus. January 28th (Divided application on 9,213/14, April 14th.)

Nickel-Plating Aluminium.—The difficulty of electroplating aluminium with nickel lies not in devising a suitable electrochemical process but in securing a coherent deposit. An intermediate coating has generally been considered indispensable between aluminium and nickel, and copper, zinc and iron have been proposed and tried in various ways. In the first place, however, a chemically clean surface must be secured on the aluminium, and to the well-known difficulty of obtaining this must be attributed failure to secure a deposit which will stand mechanical working. A new process described by MM. Canac and Tassilly before the Société d'Encouragement pour l'Industrie Nationale, is claimed to overcome this defect. The aluminium piece to be plated is passed first through a boiling potash bath, then brushed with milk of lime, dipped in a 0·2 per cent. potassium cyanide bath for several minutes, and finally subjected to attack by an iron chloride solution (500 gm. hydrochloric acid, 500 gm. water, 2 gm. iron), till the appearance of the aluminium resembles crystallised tinplate. After each stage in this treatment the work is thoroughly washed in water. The following is found to be a satisfactory nickelling solution:—Water, 1,000 cc.; nickel chloride, 50 gm.; boric acid, 20 gm., worked at 2 5 volts and 1 ampere per sq. dcm. The deposit obtained is matt-grey on leaving the bath, but easily takes a good polish under the scratch brush. Above all, it is claimed that the coating will stand bending and hammering without peeling or cracking. The reason for the adherence of the deposit appears to lie in the strong reducing action of the nascent hydrogen evolved when the aluminium is plunged in the ferric chloride pickle. Metallic iron is deposited on the aluminium, and, though its amount is so small (0·25 to 0·5 gm. per sq. metre), that it cannot form a continous intermediate deposit, the iron forms with the aluminium a number of tiny couples favouring attack by the acid pickle. The surface of the aluminium is thus very minutely but very completely pitted so that, besides being deposited on the nearest practicable approach to a chemically pure surface, the nickel coating is actually locked or "rooted" into every part of the aluminium surface, and it is on this mechanical action that the tenacity of the deposit depends. Aluminium thus protected is said to be unaffected by moist air, dilute and boiling soda, acetic acid, sea salt, wines, and foodstuffs, and does not permit leakage of petrol. It is recommended as useful for electrical conductors and is claimed to extend greatly the possible applications of aluminium.

Wireless Control of Public Clocks.—A letter from Mr. A. E. Ball, in the April number of the *Horological Journal*, replies to the remarks of Mr. Hope Jones on this subject, mentioned in our issue of April 30th. Mr. Ball points out that to check each clock locally by the Eiffel Tower signals destroys the essence of his scheme—central control—and involves checking the local observers. The cost of the wireless control, he says, is small, and the latter, with a wave length of 50 m., in no way interferes, even with amateurs who use 200 m. Moreover, at the times chosen for checking the clocks, 10 a.m. and 3 p.m., hardly any amateurs would be at work.

Reporting back by wire involves a cost for wayleaves, &c., out of all proportion to the advantages gained.

Oil-Electric Barges.—A novel type of barge propelled by electric motors, the power being obtained from dynamos driven by oil engines, is to be put in service by the Mississippi Electric Navigation Co., of St. Louis.

The arrangements adopted are extraordinary. There are two 240-H.P. Diesel engines, driving dynamos in the engine room, where are also located the auxiliary lighting and pumping sets. For the propulsion there are four screws, each driven by an electric motor, which is external to the boat and enclosed in a watertight casing. All the motor-propeller units are hinged together, and serve as a rudder. The boats are designed to carry 1,000 tons on a draught of 5 ft. 6 in., and are to be fitted with three loading cranes. The total cost of construction is said to be about £14,000.—*Motor Ship and Motor Boat.*

THE
ELECTRICAL REVIEW.

VOL. LXXVII. MAY 21, 1915. No. 1,956.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: May 21, 1915. [No. 1,956.

Page
A Government Policy Announced 713
Standardisation Rules 714
Copper 715
The Telephone Disservice 715
Some Notes on Shunt Regulating Resistances, by Thomas Carter (*illus.*) 716
Three-Phase Electric Cranes at the Port of Bordeaux ... 717
New Electrical Devices, Fittings and Plant (*illus.*) 718
Legal 719
War Items 720
Correspondence—
  Wireless Control of Public Clocks 721
  Photo-Printing Charges: Preferential Terms 721
  Automatic Lift Accidents 722
  Trade After the War 722
  Cab Signalling 722
  The Engineering Industry and the War 722
Business Notes 723
Notes 727
Electricity Supply at Karachi, India (*illus.*) 729
The Wood Green Electricity Undertaking (*illus.*) 731
City Notes 735
Stocks and Shares 739
Share List of Electrical Companies 740
Exports and Imports of Electrical Goods during April, 1915 741
Standardisation Rules for Electrical Machinery (Excluding Railway and Tramway Motors) (*illus.*) 742
Technical Education in India 744
The Power Supply of the Central Mining-Rand Mines Group, by J. H. Rider (*illus.*) 745
Institution of Electrical Engineers 747
New Patents Applied for, 1915 748
Abstracts of Published Specifications 748
Contractors' Column ... ... Advertisement page xx

THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 938; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).
1915 EDITION
NOW READY.
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C

A GOVERNMENT POLICY ANNOUNCED.

LAST week, when most minds were preoccupied with the serious question of the unnaturalised alien within our borders, Mr. Asquith's announcement respecting the new policy of the Government in this matter received so much attention in the Press that we were in danger of overlooking the importance of a speech from the lips of the Right Hon. J. A. Pease, which followed at a later stage of the same sitting of the House.

Mr. Pease was making the annual statement regarding the work of the Board of Education and its various establishments, and after having paid a fitting tribute to the Universities, London and Provincial, for the large number of their students who have joined the Colours, he entered upon a matter of supreme importance to the industrial future of this country, and announced a policy which proves that the appeals that have been made to the Government to consider some of the possible after-effects of the war upon our manufacturing industries have not fallen upon deaf ears.

The Government, it appears, has decided to proceed immediately with the appointment of an Advisory Council on Industrial Research, and Mr. Pease is in search of a Committee of experts who will consult with other expert Committees working in different directions. These expert Committee-men will, in turn, associate with leaders of industry, and in the whole matter "the Department"—we are not sure whether this means Mr. Pease's own department or the Advisory Council itself—will work in close cooperation with the Board of Trade. Mr. Pease proceeded further to state that he was then considering names, and hoped that the Advisory Council would be at work within a few weeks.

Readers who have closely followed our articles relating to the war since August last will remember that we have on several occasions dealt in some detail with the necessity for such a course being adopted by the Government, in view of the many and peculiar new problems that have presented themselves in connection with certain manufacturing industries consequent upon the state of war. We need not recapitulate our own suggestions now—they will be found in detail in our issue of October 23rd, 1914—but we congratulate the Government upon having found time in these very trying Parliamentary days to take steps which, at any rate, form an excellent beginning.

The apprehensions that many trade and industrial authorities have, that after the war is over Teutonic competition will be fiercer and still less scrupulous in its methods than it has been in recent years, are also the apprehensions of Mr. Pease, and he recognises that strong and appropriate measures must be adopted. The Government have had the matter under consideration, and have agreed that something must be done at once. It is not at all inappropriate that the announcement should emanate from the lips of the representative of the Board of Education, for in all discussion of this subject it has been most obvious that our educational system has much to answer for in respect of our shortcomings, though, of course, there are many other and important factors as well. But after so much discussion concerning the necessities of the situation, it is gratifying that at last the serious nature of some of our industrial problems has been actually brought home to the mind of the Government, and that action is being taken. From the *Times* report of Mr. Pease's speech we gather that the Government agree that we must make more use of the workers who exist in this country; that we must prepare for an increased supply of them; that we must bring our Universities and technical schools into closer association with industries, and our leaders of industry into closer association with skilled workers. It is for these and other purposes that this Advisory Council on Industrial Research is being set up, and we are sure that the proposal, which met with a cordial reception from subsequent speakers in the House, will also be received with a general chorus of approval from both scientific and industrial authorities. As a beginning, Mr. Pease hopes to place on the Supplementary Estimates a vote of between £25,000 and £30,000 for the objects named, and in adding that the scheme must be dependent upon State help for years to come, he said that this State help must steadily progress. Two further remarks in his speech convey the idea that he has a fairly correct appreciation of the criticisms of educational authorities in recent years. For the future of the country our youth must be kept longer at school when it shows itself able to benefit by further education; and the nation must create careers for men who are capable in the scientific world to benefit therefrom.

From the foregoing it will be clear that this Advisory Council on Industrial Research will not be too closely restricted in regard to the scope of its operations. Its problems are large, its duties are of extreme importance, and the time may be short. We hope that no time will be lost in securing the best men available for the Council, and ensuring that they shall be brought into effective association with the leaders of our own and other industries, and that the promised close co-operation with the Board of Trade may enable us nationally to adopt, without any further delay, that course which shall ensure the more efficient co-operation of science and industry which is so essential if we are to render ourselves better able to hold our own against nations which have eternally disgraced themselves by their barbarities and inhumanities, and have made themselves unfit to trade with until they have rendered for ever harmless all who have been responsible for the horrible carnage of these terrible days.

In one of our early editorials on the war, we suggested the holding of a conference of electrical industrial and commercial authorities, in the hope that some organised form of pressure could by that means be brought to bear upon the Government in respect of the above and cognate matters. We gather from the annual report of the Council of the Institution of Electrical Engineers that a German Trade Committee was appointed and held a number of meetings in conjunction with representatives of the B.E.A.M.A. The following quotation from the report will explain what was the ultimate decision:—

> GERMAN TRADE.
>
> Soon after the outbreak of the war a Committee was appointed by the Council to keep in touch with the British Electrical and Allied Manufacturers' Association in regard to the question of securing for British manufacturers the trade hitherto done by Germany and Austria-Hungary. A number of meetings of this Committee were held, at which representatives of the Manufacturers' Association were present, and the position was very fully discussed.
>
> Eventually, after several suggestions had been considered, the Committee came to the conclusion, with the concurrence of the Manufacturers' representatives, that the continuance and expansion of British trade after the war will mainly depend on economic principles and on the commercial industry and initiative of British manufacturers, and that no useful action on the part of the Institution appeared to be possible.
>
> At first the Committee were in favour of holding a meeting for the purpose of discussing a paper on certain aspects of the competition of foreign countries, but after consideration the Manufacturers' Association were of the opinion that the result likely to to be obtained would not justify such a meeting being held, and, at their request, the idea was abandoned.
>
> The Committee referred to above still remains in being for the purpose of advising the Council in regard to any question which may arise in the future.

We are glad to read the closing paragraph, for it is comforting to know that the Committee still *remains in being*. May we be pardoned if we await with certain anxiety the next bulletin? It will be quite excusable, seeing the absorbing interest that most electrical men are taking in the future possibilities of the industry, if the average member of the Institution wishes to inquire which is the correct authority to decide what are and what are not fit subjects for discussion in public meeting.

Inquisitiveness may even lead some to wonder whether in appointing its Council on Industrial Research the mind of the Government was influenced in any degree by any of our representative electrical organisations. If so, we think it should be known; if not—well, the credit belongs to somebody else; either the Government authorities, or some of the scientific societies which, as we mentioned in our last issue, have busied themselves with the subject of science and industry, and recently sent a deputation to the Presidents of the Board of Trade and the Board of Education.

Standardisation Rules.

WHEN we commented on the rules for the standardisation of electrical machinery formulated and provisionally adopted by the British Electrical and Allied Manufacturers' Association just two years ago, we remarked that it would be unfortunate if every Association were to issue a set of rules on its own account, but that in view of the pressure of competition it was desirable that a uniform basis of rating electrical machinery should be established without undue delay. At that time the International Electrotechnical Commission was engaged upon this very question, and the Report of the Engineering Standards Committee on Standards for Electrical Machinery was out of date.

In the interval the I.E.C. has given great attention to the matter, and has endeavoured to harmonise the views of the British, American and German Committees, with especial reference to the temperature limits to be prescribed; as regards the German Committee, circumstances have intervened which need not be particularised, but so recently as last month an American deputation was in this country conferring with our representatives on the subject of electrical standards, and we believe substantial agreement was arrived at. The importance of international uniformity in this respect is obvious. No definite rules, however, have yet been issued in this country other than those above referred to, and therefore it is apparent that the Association was well advised in providing a set of standards for use in the interim.

A new edition, or rather a reprint, of these rules has now been issued by the B.E.A.M.A., and in the preface we are informed that owing to the impending publication of the first section of the new British standard rules by the Engineering Standards Committee, it was thought best not to introduce the changes in the Association's rules which would otherwise have been made. This decision is commendable, as it limits the confusion and disturbance due to modifications in the rules to a single set of changes. Seeing that the Standards Committee has had the matter in hand so long, it is interesting to learn that we may look for the fruit of its labours at an early date.

The B.E.A.M.A., however, has appended very considerable additions to the original code, in the form of a supplement, which we reproduce in full in this issue. It will be seen that the new sections cover a wide range, and doubtless represent a great deal of hard work on the part of the Committee charged with the duty of formulating the rules. Some interesting questions are raised by the new clauses; the introduction of "tolerances," for instance, into guarantees, and the method of determining the "average-load guarantee," are novel features. Whether in some cases the range of tolerance permitted will be acceptable to the purchaser, when the latter is himself an engineer and capable of appreciating exactly the value and meaning of the limits specified, is open to question.

It will be borne in mind, of course, that these rules are primarily designed for the use of the manufacturer, and while we do not suggest that they are prejudicial to the interests of the purchaser, it is not to be expected that they shall err in his favour.

Some of the rules savour rather of the text-book, such as those relating to cyclic irregularity and to the use of reactances for the protection of alternators; Section X, in fact, can hardly be said to embody anything in the nature of standardisation.

An excellent feature of the code is the provision of distinctive and uniform markings for the terminals of machines and transformers, and of conventional symbols and letters for switchgear and instruments; it is to be hoped that these will meet with general acceptance. Other countries have long had in operation codes of symbols for wiring diagrams, &c., and it is very desirable that uniformity should be attained in this respect, as in the use of symbols in formulæ, which has already been dealt with by the I.E.C.

While representing the views of only one section, though a very important and influential section, of the industry, and to be regarded rather as a temporary system pending the issue of a code of rules by the Engineering Standards Committee that will be acceptable to all parties, the Rules of the B.E.A.M.A. are to be welcomed as a praiseworthy and practical effort to amend a very marked deficiency in our industrial organisation. We take it that they are not put forward as rigid and immutable standards, but as a working basis for friendly agreement between the parties to a commercial transaction, and we have no doubt that in this sense they will be favourably received by the industry.

Copper. The tone of the copper market has been hardly so good, but this has arisen apparently not because of any rift in the situation, but as a reflex of the dastardly outrage of the German Admiralty, acting, no doubt, under the direct instructions of the Arch-Hun, upon the *Lusitania*, and of the political conditions arising therefrom. Of course, no man living can say whether the American President is again bluffing hard, or whether he really does resent the murder of American citizens on the high seas, with which policy Germany has familiarised the world during the past six months, but if he is not engaged in a game of poker, we should be approaching the time when Germany will have to introduce some surface gloss of civilisation into her methods, which may in turn create an altered situation. With the civilised world determined to wipe out the Hun and his practices, the consumption of copper must go on regardless of temporary fluctuations, produced by what, after all, are mainly sentimental considerations. All that the murder of women and children, and the crucifying of wounded really involves, is the further and further wiping out of existence of the perpetrators of nameless outrages, and all this means that copper must be used in ever increasing quantities.

There has been less activity in demands lately, but the restriction of buying on the part of consumers is always inevitable whenever the standard market wears an appearance of reaction. The actual consumption going on increases steadily, and buying will be impelled from time to time, as orders for ammunition and other work are being increased. The position in the United States has improved considerably as regards consumption, largely owing, of course, to the heavy orders which have been booked by American cartridge makers in connection with the requirements of the belligerents, and the brass trade across the Atlantic is now experiencing a degree of activity and prosperity to which it has been a stranger for years. Meanwhile, production continues to progress steadily, and, indeed, every effort seems to be strained to increase output owing to the exceedingly profitable nature of the business. There can be no diminution in consumption for war purposes, and although there may be a lull in new buying when the war ends, this can be only a temporary measure, for the replacement of damage and the ordinary extensions which have been held back during the war period, will then have to be dealt with, and these should account, for a time at least, for every ton of copper which the world can produce.

For the moment there is a very wide disparity between the prices of standard copper and refined material. There has been liquidation of the former, owing to the political situation in the United States, but, on the other hand, producers have shown not the least sign of wavering, and an adjustment will probably be made, by renewed confidence on the part of speculators causing a buying movement in standard copper, which will practically restore the normal relations between the two grades of material.

The Telephone Disservice. When the proposal that the State should purchase and work the telephone system was coming to a head, we pointed out that the result of this proceeding would inevitably be lower efficiency, higher rates, and incompetent management. We endeavoured to disabuse the minds of the well-meaning but uninformed public of the idea that the State could conduct so intricate an undertaking more ably than a private concern, and by way of example we cited the disastrous records of the telegraphs, than which it would be difficult to find a more convincing illustration of State mismanagement. Our warnings, and those of others who shared our views, were disregarded, and the mischief was done; the property of the National Telephone Co. was acquired under compulsion, on terms which verged upon confiscation, and the trouble began.

To deny that the position of the telephone subscriber had changed for the worse would be shutting one's eyes to the obvious facts; the storm of protest, the agonised appeals for rescue from the tyranny and ineptitude of a State service that swept over London in 1912-13 will not soon be forgotten by the telephone department, which itself was sorely tried by the necessity of coping with the difficulties of a gigantic and complex problem with an inadequate staff, under the control of laymen. Those who hoped for an all-round reduction of rates were sadly disillusioned, as we warned them they would be; there is good reason to anticipate an increase rather than a decrease. The efficiency of the service fell so low that leading City men denounced it as a nuisance rather than an aid to business. Moreover, with the change of ownership came the accompanying change from the reasonable and co-operative methods of a commercial undertaking to the autocratic and arbitrary ways of a bureaucracy; the telephone service was no longer a convenience provided in return for a monetary consideration, but a privilege vouchsafed to those who succeeded in obtaining connections, subject to withdrawal on slight provocation and involving the user in unknown liabilities in the shape of payments for calls of unknown origin, the sole record of which was made by the Post Office staff.

Our warnings and criticisms were issued in the interest of the general public, and not on our own behalf; but we are not to escape unscathed. We have just received a notice to the effect that our telephone number, which has become as familiar to our friends as the colour of our cover, is to be changed (in August, or before) from Holborn 933 to City 997, "owing to the acquisition by the State of the late National Telephone Co.'s system," which has necessitated the rearrangement of certain of the exchange boundaries. There are no half-measures about it; arrangements are in progress for the transfer, and if we don't like it we can, of course, do the other thing. We hardly need point out to business men that the possession of a recognised telephone number, in spite of the deficiencies of the service, is something of an asset, like a known business address, and the arbitrary substitution of a new number is in effect an act of confiscation, without hope of redress.

"The Postmaster-General trusts that you will excuse any temporary inconvenience which may arise from this change"—this is the velvet glove, cynically affecting to conceal the iron hand in whose grip we are, in common with other victims of this Department of State. The Postmaster-General is adept in the use of smooth words and sugared phrases, but these afford no consolation for the injury inflicted upon us.

SOME NOTES ON SHUNT REGULATING RESISTANCES.

By THOMAS CARTER.

A RECENT article in the ELECTRICAL REVIEW (March 26th, 1915), on "Potentiometer Rheostats and Rheostats with Protective Resistances," suggested to the present writer that some notes on the same subject, dealing with it from a rather more general point of view, might be interesting and useful to those who have to get out resistances of this special character frequently. Three separate sections will be treated, namely :—

I.—Potentiometer Regulators.

II.—Regulators with Protective Resistances.

III.—A Special Grading for Ordinary Regulators.

The treatment is, perhaps, more detailed and comprehensive than is required for most practical purposes, but, just because it is full, it will cover any case likely to arise ; and for ordinary purposes the user of the method abstracts as much as deals with average cases, and probably simplifies many of the formulæ for rapid use. As in all other processes employing formulæ, care should be taken not to use them blindly, but only after making sure that they deal with the case considered. The use of a formula without care and intelligence is certain to lead sooner or later to disaster : a formula is a good angel if a servant, but if it becomes master, it is more subtle in temptation than Satanus himself.

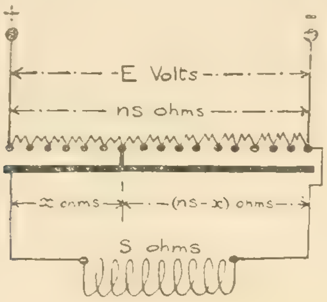


FIG. 1.

1. *Potentiometer Regulators.*—The standard connections of a potentiometer regulator are shown in fig. 1.

The exciting voltage, E, has across it a resistance, $n s$, and the field winding, whose resistance is s, is put in parallel with more or less of $n s$, according as its current is to be increased or diminished.

The amount of resistance in $n s$ is arbitrarily chosen, but it is useful, as will be seen from what follows, to choose some round value for the multiplier n, and to make $n s$ thus bear a simple ratio to s, for greater convenience in plotting sets of curves. The present writer was greatly interested to see the set of curves in the earlier article already referred to, as they are absolutely identical in form with those developed by him on more general lines many years ago, and used by him with great convenience ever since. The usual value of n is from 2 to 4, and the circumstances of each case generally show fairly clearly which value is most suitable.

Whatever n be, the following treatment is perfectly general, and expresses all currents in all parts of the circuit in terms of E/s—*i.e.*, of the maximum value of the field current which it is possible to obtain. Let the sliding contact of the regulator be moved to a position which gives x ohms in series with a loop consisting of $(n s - x)$ ohms in parallel with s ohms. Let x be q times $n s$ (q having any value from zero to unity). Then the total resistance between terminals is—

$$x + \frac{(n s - x) s}{n s - x + s} = q n s + \frac{(n s - q n s) s}{n s - q n s + s},$$

which simplifies to $s \cdot \dfrac{(q - q^2) n^2 + n}{(1 - q) n + 1}$.

The total current in the circuit is therefore—

$$\frac{E}{s} \cdot \frac{(1 - q) n + 1}{(q - q^2) n^2 + n},$$

and this is clearly the value of the current in x. The current in $(n s - x)$ is $s/(n s - q n s + s) = 1/((1 - q) n + 1)$ of the total, and the current in s is $(n s - q n s)/(n s - q n s + s) = (1 - q) n/((1 - q) n + 1)$ of the total, so that—

$\dfrac{E}{s} \cdot \dfrac{1}{(q - q^2) n^2 + n}$ is the current in $(n s - x)$,

and $\dfrac{E}{s} \cdot \dfrac{(1 - q) n}{(q - q^2) n^2 + n}$ is the current in the field winding.

The curves in fig. 2 are plotted from the above expressions, the ordinates representing currents in terms of E/s, and the abscissæ values of x from zero up to $n s$—*i.e.*, from $q = 0$ to $q = 1{\cdot}0$. The value of n chosen for these particular curves is 3·5.

The following table gives the values (with n indeterminate) of the current in the three parts of the circuit for various values of x.

$x = q n s$.	Current in $(n s - x)$.	Current in x = total current.	Current in s = field current.
0	$E/s \,.\, 1/n$	$E/s \,.\, (n+1)/n$	$E/s \,.\, n/n = E/s$
·1 ns	$E/s \,.\, 1/({\cdot}09n^2+n)$	$E/s \,.\, ({\cdot}9n+1)/({\cdot}09n^2+n)$	$E/s \,.\, {\cdot}9n/({\cdot}09n^2+n)$
·2 ns	$E/s \,.\, 1/({\cdot}16n^2+n)$	$E/s \,.\, ({\cdot}8n+1)/({\cdot}16n^2+n)$	$E/s \,.\, {\cdot}8n/({\cdot}16n^2+n)$
·3 ns	$E/s \,.\, 1/({\cdot}21n^2+n)$	$E/s \,.\, ({\cdot}7n+1)/({\cdot}21n^2+n)$	$E/s \,.\, {\cdot}7n/({\cdot}21n^2+n)$
·4 ns	$E/s \,.\, 1/({\cdot}24n^2+n)$	$E/s \,.\, ({\cdot}6n+1)/({\cdot}24n^2+n)$	$E/s \,.\, {\cdot}6n/({\cdot}24n^2+n)$
·5 ns	$E/s \,.\, 1/({\cdot}25n^2+n)$	$E/s \,.\, ({\cdot}5n+1)/({\cdot}25n^2+n)$	$E/s \,.\, {\cdot}5n/({\cdot}25n^2+n)$
·6 ns	$E/s \,.\, 1/({\cdot}24n^2+n)$	$E/s \,.\, ({\cdot}4n+1)/({\cdot}24n^2+n)$	$E/s \,.\, {\cdot}4n/({\cdot}24n^2+n)$
·7 ns	$E/s \,.\, 1/({\cdot}21n^2+n)$	$E/s \,.\, ({\cdot}3n+1)/({\cdot}21n^2+n)$	$E/s \,.\, {\cdot}3n/({\cdot}21n^2+n)$
·8 ns	$E/s \,.\, 1/({\cdot}16n^2+n)$	$E/s \,.\, ({\cdot}2n+1)/({\cdot}16n^2+n)$	$E/s \,.\, {\cdot}2n/({\cdot}16n^2+n)$
·9 ns	$E/s \,.\, 1/({\cdot}09n^2+n)$	$E/s \,.\, ({\cdot}1n+1)/({\cdot}09n^2+n)$	$E/s \,.\, {\cdot}1n/({\cdot}09n^2+n$
1·0 ns	$E/s \,.\, 1/n$	$E/s \,.\, 1/n$	$E/s \,.\, 0/n = 0$

If curves be plotted, similar to those in fig. 2, but for other values of n, say 2, 2·5, 3 and 4, this set of curves will cover practically all possible cases that can arise. These curves are clearly of a more generally applicable nature than those shown in the earlier article, as the latter apply to certain definite currents in amperes and definite resistances in ohms, while those here described, being based on fractional values of a perfectly general total, are of perfectly universal applicability. The only constants required for any case are E and s, which are given, and n, which is suitably chosen. The value of the field current required at each step of the regulation is first determined to suit the specified conditions of speed or voltage variation. These successive values of field current are tabulated as fractions of E/s, and from the curves the corresponding values of x, as a fraction of $n s$, and current in x, as a fraction of E/s, are obtained. By multiplying these two sets of figures by $n s$ and E/s respectively, the required resistance in ohms and capacity in amperes of the steps of the regulator are obtained. A numerical example is scarcely necessary, as the simplicity of the method is obvious.

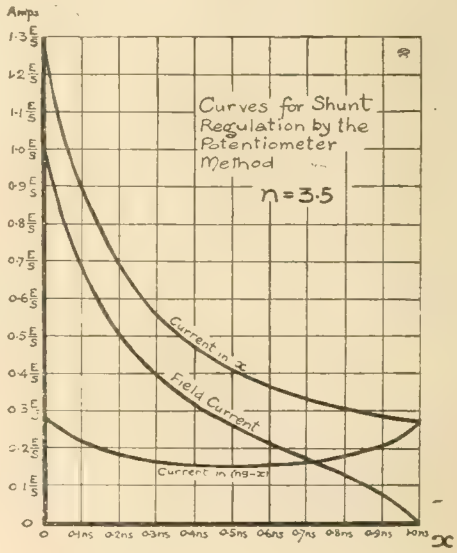


FIG. 2.

For a case like a booster, it is, of course, permissible to reduce the field current to zero ; but in the case of a motor, there will usually be a limiting value below which the current should not be reduced. This means that not all of $n s$ should be variable, but that a certain part should be arranged as a last step, not capable of being cut out, of such a value as will give the required field for the maximum speed specified. If this be not done, there is the danger that the field may be made to disappear altogether, with disastrous results for the motor.

The use of a potentiometer regulator clearly diminishes the efficiency of the machine it is used with. Hence n should be kept as great as possible, so as to reduce the additional loss in the regulator as much as possible. But, on the other hand, if $n s$ be abnormally large, it may lead to a very bulky resistance, as the regulator has always to carry a current greater than the field current. The choice of n is therefore, as in so many cases, a compromise between two opposing ideals, and experience is the best guide in making the selection. The most usual range of values has, however, already been indicated.

(*To be continued.*)

THREE-PHASE ELECTRIC CRANES AT THE PORT OF BORDEAUX.

Traffic to the port of Bordeaux has increased very rapidly during recent years, some indication of its growth being given by the fact that 116 goods-handling machines of various types worked nearly 140,000 hours in 1912, as compared with 51 machines working 36,000 hours in 1902; and during the first six months of 1913 the weight of merchandise handled was 2,230,000 tons, or 28 per cent. increase on the corresponding figure for 1912. On the extended Queyries wharves, the No. 2 wet dock, and in the elaborate silo and transporter equipment erected to serve warehouses and the coal yards of the Paris-Orleans Railway, electrical equipment has been adopted very extensively, and has resulted in marked acceleration and cheapening of operation. According to *La Revue Electrique*, six large electric cranes are now installed on the Queyries wharves, each capable of raising 3,300 lb. at 235 ft. per min.; 6,600 lb. at 160 or 235 ft. per min.; or 11,000 lb. at 160 ft. per min. The range is 34 to 46 ft., according to the inclination of the jib; the speed of crane rotation, 2 R.P.M.; speed of translation, 40 ft. per min.; total travel of hook, 100 ft.; centre of jib pulley above rails at maximum radius, 60 ft.; gauge of rails, 9 ft. 3 in. In each case a double drum windlass is provided, permitting the use of three-cable grab-buckets (two cables for lifting, one for opening), and so arranged that the lifting drum can be used alone for loads up to 11,000 lb., or the auxiliary drum alone for loads up to 6,600 lb. The grab bucket can be raised or lowered when open or shut; and can be opened or shut at any point in its travel whether full or empty. Of the 14 electric cranes at the No. 2 dock—five have 46-ft. radius and lift up to 6,600 lb. by single cables; five otherwise similar cranes have three-cable grab-bucket gear; and four of 46-ft. radius, lift up to 11,000 lb. in three-cable grab-buckets.

Three of the Queyries cranes use compressed air at 90 lb. per sq. in. to operate brakes and couplings, but three later cranes include, among other improvements, all electric operation of auxiliary parts. The mechanical features of the latest hoisting gear are particularly simple. A heavy foundation plate carries both drum shafts on ball bearings, the latter being used to reduce maintenance, increase efficiency, and permit light loads to descend easily without current. The front shaft carries the main drum; the rear shaft carries the auxiliary drum, driving gear and cone clutch. Between the drum shafts is a countershaft, driven electrically through a band brake coupling which is closed only during hoisting. On this shaft are two loose pinions, provided with claws which may be engaged with corresponding countershaft claws, the latter being operated simultaneously or independently by the driver. As a result, the drums may be driven simultaneously or independently, and any desired combination of movements can be easily secured.

The main drum is driven through a geared rim, the auxiliary drum through a large leather-faced cone. The latter has a "counter-cone" so that, when working with grab buckets, the release-cable is tightened during closing, and no time is wasted when the bucket is to be opened. A motor-brake engages the cone of the auxiliary drum, liberates it (leaving the drum free), or engages with the counter-cone while closing the grab. The winding drums are 700 mm. in diameter, grooved, and each is provided with a long-arc, band-brake drum. The front drum has two 20-mm. cables and the other drum a single 22-mm. cable, which is used to open and close the grab or to lift loads up to 6,600 lb. On the end of the intermediate shaft opposite to the coupling, is an automatic brake preventing running back of the load during hoisting, due to current failure or other cause. All brakes and couplings are actuated by small 100-volt, single-phase, series commutator motors, the energy consumption of which is kept down to a minimum by suitable brush displacement. Compressed air is supplied to the brakes and clutches of the three older Queyries cranes by an electrically-driven compressor.

The mechanical features of the older cranes are less simple, an intermediate change-speed gearing being employed to suit various loads. In the later cranes, three-phase series commutator motors are used (instead of ordinary induction motors) in order to secure automatic speed variation in inverse proportion to the load.

Three-phase current at 440 volts, 50 cycles, is taken from distribution boxes connected in underground cables, by a cable coiled on an automatic paying-out drum, which takes up all slack and permits 66 ft. travel of the crane on either side of the distributing box. From slip-rings on the cable drum, current is taken through rings on the pivot and brushes on the turning part of the crane to the cabin switchboard.

The jib is elevated through double worm gearing by a 4·5-KW., 1,000-R.P.M., 440-volt motor, and its position at any moment is shown automatically by an indicator in the driver's cabin. Slewing is effected by a 7·5-KW., 1,000-R.P.M. motor driving a worm gear and pinion, meshing with a circular rack on a track 12 ft. in diameter. Another 7·5-KW. motor propels the crane as a whole through worm, parallel and bevel gears. These three motors are asynchronous machines; the slewing motor is open, the others are enclosed and further protected by sheet metal hoods. The winch motor is an open-type 52-KW., 200-R.P.M. machine, with ball-bearings; its commutator gives no trouble in service. The 100-volt, single-phase auxiliary motors are supplied through a transformer in the cabin.

Ordinary rheostatic control being inapplicable to three-phase motors, two systems were tried in the first three Queyries cranes. In each case a single lever controller is arranged so that pushing the lever forward starts and couples the hoisting motor, while completely releasing the brakes; and pulling the lever backwards releases the brakes progressively for lowering loads without current. In two cranes fitted with asynchronous hoisting motors, the control lever actuates an ordinary grid resistance controller, but in the third crane, using a series commutator winch motor, the controller is connected to the tappings of a variable voltage transformer. In both cases the control lever operates the air brake and clutch valves simultaneously with the electrical connections.

In the newer cranes, all driven by three-phase series commutator motors, the control lever operates a quick-acting reversing switch, and also through a toothed sector, the rotating winding of a variable ratio static transformer, which is mechanically balanced in all positions of the control lever. A simple means is thus provided for varying power and speed, according to requirements; resistance losses are reduced to an absolute minimum.

The acceptance test on these cranes demanded that full load be raised 6½ ft., rotated 10° and lowered to earth; then raised to 33 ft., swung through 170° and lowered; after which the empty hook was to be raised 33 ft., swung though 170°, lowered to 6½ ft., swung through 10° and lowered to earth. The guaranteed mean consumption for this performance was 400 watt-hours, with 11,000 lb. load, and 274 watt-hours, with 6,600 lb. The actual consumption averaged less on 10 tests.

Of the nine three-cable cranes alongside the No. 2 dock four are of 11,000 lb. maximum capacity, and identical with the newer Queyrie cranes. The other five are 6,600 lb cranes, similar to the above but reduced in dimensions in the ratio 7 : 6, and fitted with 37-KW., 280 R.P.M., hoisting motors instead of 52-KW., 200-R.P.M. machines. There are besides five 6,600-lb. single-cable cranes with 600-mm. drums. An automatic brake prevents running back during hoisting, and is released by hand when lowering loads. The main band brake is motor controlled, directly during hoisting, progressively during lowering. The band coupling is also motor-operated and acts only during hoisting. All shafts run on ball bearings and the motor is completely uncoupled during lowering so that, with only 120 lb. weight on the hook, a "light" lowering speed of 400 ft. per min. is quickly attained.

The hoisting motor develops 37 KW. at 280 R.P.M., and is a 440-volt three-phase series commutator machine. Variable voltage control is again adopted in preference to brush shifting (which offers mechanical difficulties) to secure speed variation from 60 to 200 ft. per min. hoisting full load; and up to 265 ft. per min., hoisting half load. The brake and coupling motors are single-phase, 100-volt series commutator motors regulated by brush displacement. Motors for jib elevation and slewing and crane propulsion are of the three-phase slip-ring, induction type.

The two latest 330-ft. berths on the Queyries wharves are equipped with seven electric grab-bucket, travelling transporter bridges, a line of reinforced concrete storage hoppers and two aerial transporter systems, one running to the Paris Orleans Railway coal yards, 1¼ miles away, and the other serving warehouses and yards along the quay. This equipment has been erected at a cost of about £80 000 specially to expedite the discharge of heavy cargoes, and to reduce handling to a minimum. The wharf transporter bridges permit at least 300 tons per hour of coal to be discharged through four hatches and dumped directly in the silo bins. The total hopper capacity (in 24 bins) is about 2,200 tons for each berth.

Coal is discharged from the bottom of the silos into railway trucks beneath, or into the buckets of one of the aerial electric transporters, each of which conveys 200 tons an hour at an average speed of 2·75 M.P.H. The total coal tonnage handled for the Paris-Orleans Railway is about 400,000 tons per annum, the charges for wharf, crane, silo and transporter service averaging 4d. to 4·13d. per ton. The new berths with their electrical equipment practically double the effective capacity of the wharves. At least 500,000 tons per annum can be discharged through each new berth, as compared with 186,000 tons per annum for each of the seven older berths equipped with travelling cranes discharging directly into railway wagons.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The Lock-Out Contactor.

The British Westinghouse Co., Ltd., of Trafford Park, Manchester, have recently put on the market a control system known as the "Series Lock Out Contactor system," which possesses the advantages of the series relay, but eliminates its weak point, *i.e.*, the relay contact. The feature of this contactor is that it "locks out," and will not close, when the current is *above* the value at which it has been set, resistance being cut out only when the current has fallen to a predetermined value.

Motor current passes through the operating coil winding directly; with the contactor in the open position (shown in full lines, fig. 3) at the instant of applying current, assuming this current to be above the value at which the contactor should close, a flux will pass through the main air gap, through the armature, and along the steel piece A fixed to the armature and carrying the adjusting plug, through the small air gap, and on to the base. This flux tends to hold the contactor open, due to the pull between the plug and the frame being greater than the pull at the main air gap. For a fraction of a second current is prevented from passing through the part marked "saturated section," due to the very heavy damping coil which is wound round this.

As the current falls, due to the motor speeding up, the flux through A decreases, but the flux through the saturated section remains the same; in consequence, the pull between the plug and the base decreases, until the pull through the main air gap overcomes it, and the contactor closes.

Without the damping coil the contactor would close as the current was rising, upon it reaching the value at which it was set to operate. But owing to the damping coil the flux is prevented from passing through the saturated section, and consequently it all passes through the adjusting plug, and the contactor cannot close. In a fraction of a second after the current reaches the full value, the flux divides between the two circuits, and the contactor is held out by the normal operation of the Lock-Out device. It is free to close when the current falls to the value for which the contactor has been adjusted.

An ordinary non-reversing automatic starter embodying this type of contactor would contain, firstly, a shunt-wound contactor; secondly, a number of contactors of the type described above, to short-circuit the resistance in the armature circuit. These contactors are so connected that without the use of any interlocking contacts each contactor is put into circuit, and consequently closes in the order desired. Also the different contactors have their coils short-circuited, and consequently fall out as the next step of resistance to them is short circuited, so that in the "full on" position only the shunt-wound line contactor and the last series-wound contactor are in circuit.

In order to keep the shunt coil as nearly as possible in line with the series coils as regards reliability, it is wound for a low voltage, and a resistance is connected permanently in series with it.

In comparison with other forms of automatic control gear, the Series Lock-Out system offers the following advantages:—

1. The number of shunt coils is reduced to a minimum. These shunt coils are never subjected to the full voltage of the circuit, as in the case, at least momentarily, with most other types of control gear.
2. No dash-pot retarders are used, the acceleration, as explained above, being fixed by the load on the motors.
3. Small interlock contacts and switches for cutting in an economy resistance are not necessary.

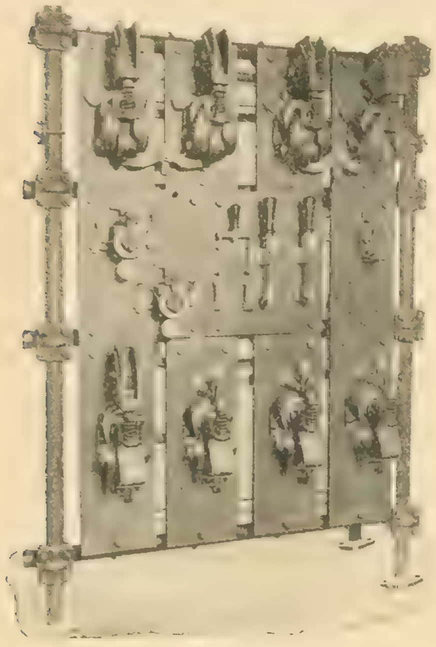


Fig. 1.—Complete Control Panel.

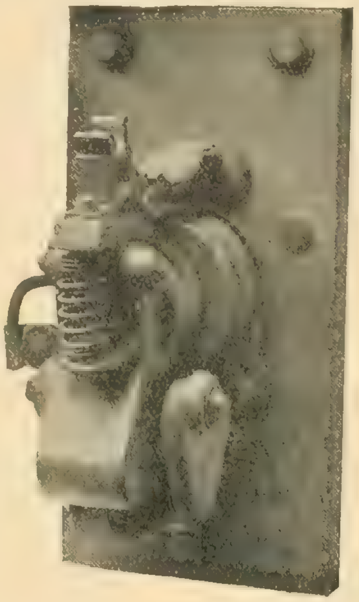


Fig. 2.—Lock-Out Contactor.

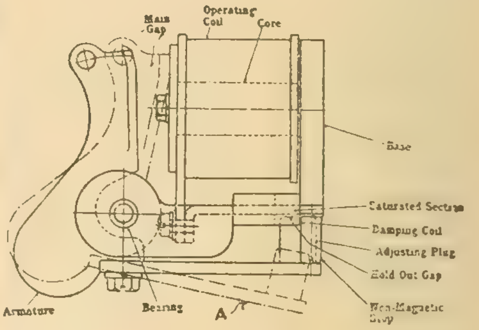


Fig. 3.

British Westinghouse Series Lock-Out Contactor System.

Terminal for Portable Accumulator.

Mr. B. Barber, engineer to the Oulton Broad Electricity Co., Ltd., finding that many ignition cells and other portable accumulators that were placed in his hands for charging had lost their terminals, or had terminals badly corroded with acid, and being dissatisfied with the makeshift of soldering a terminal on the lug, has devised a neat repair terminal, for which he has obtained provisional protection. Incidentally, he points out that the terminals usually fitted, with a metal stud embedded in the lead lug, are crude and easily twisted off. The component parts of the device are illustrated in fig. 4; they consist of a screw A with a tapered and slotted base, a ferrule B fitting over the latter, and a milled nut C. The end of the lug is cleaned and filed up to fit the inside of the base, which is bored parallel; the base is then put on the lug, and the ferrule B is slipped over the tapered exterior of the base and forced home with the nut, thus squeezing the slotted base tightly on the lug and gripping the latter firmly. The terminal is shown on the lug at D; it can easily be attached by the user of the battery, and forms a sound and permanent repair. We understand that Mr. Barber wishes to dispose of the right to manufacture the device.

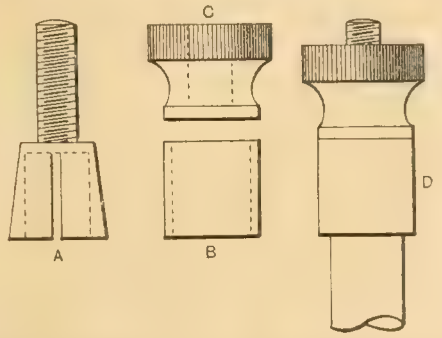


Fig. 4.—Terminal for Portable Accumulator.

LEGAL.

Chester Corporation v. Chester Water Works Co.

In the Chancery Division on Tuesday, Mr. Justice Eve heard an application for an injunction by the plaintiff Corporation to restrain defendants from pulling up streets in the city to lay electric cables to the river side.

Mr. McMorran, K.C., for the Corporation, said as Mr. Dighton Pollock, for the defendants, would give an undertaking not to proceed with the work for a fortnight, he would consent to a postponement of the trial for that time.

British Vacuum Cleaner Co.'s Appeal Dismissed.

Judgment was given in the House of Lords on Monday (May 17th) in the appeal by the British Vacuum Cleaner Co., Ltd., against an order of the Court of Appeal in favour of the respondents, Messrs. James Robertshaw & Sons, Ltd., in which judgment was reserved on April 26th, as already reported by us, page 613 *ante*.

The Lord Chancellor, in giving judgment, said the action was brought by the British Vacuum Cleaner Co., as plaintiffs, to restrain infringement of a patent, granted to Hubert Cecil Booth, for improvements relating to the extraction of dust from carpets and other materials. The defence was twofold: first, non-infringement; and, secondly, prior publication and user. The patent had been on several occasions before the Courts in other cases, and this House had decided that it contained a sufficient subject-matter, and was to be construed in a particular sense. It was, however, open to the defendants to prove anticipation as well as non-infringement, and the Court of Appeal, by a majority, reversing the judgment of Mr. Justice Sargant, sitting as Judge in the Chancery Division, decided in favour of the defendants on the question of non-infringement.

The appellants' invention consisted of the combination of an extracting implement and a power-driven suction pump, by means of which a considerable vacuum was obtained and dust laden air drawn into the machine. Prior to the appellants' invention there had been on the market an apparatus for removing dust by suction, but in that apparatus the suction was obtained by bellows as distinguished from a cylinder pump, and its object was to remove dust from the surface only, a process which required but moderate suction.

The conclusion his Lordship came to was that the decision of the majority of the Court of Appeal was right. The appellants had limited their claim to an apparatus capable of maintaining a pressure of at least 5 lb. at the nozzle and the respondents' machines did not come within the patent so interpreted. Accordingly, he moved that this appeal should be dismissed, with costs.

Lords Strathclyde, Parker and Parmoor read judgments to the same effect, and Lord Sumner expressed his entire concurrence in the result arrived at.

Accordingly, the appeal was dismissed, with costs.

Electrical Apparatus Co., Ltd., v. Canadian British Engineering Co. Ltd.

In the City of London Court on Tuesday, before his Honour Judge Atherley-Jones, K.C., an action was brought by the Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, against the Canadian British Engineering Co., Ltd., 4, Queen Victoria Street, to recover £70 18s. 6d., which consisted of £43 15s. 1d. for electrical goods supplied and £27 3s. 5d. for goods bargained and sold, and damages for refusing to accept delivery under the Sale of Goods Act.

It seemed that the defendants ordered the plaintiffs to dispatch one 10-ampere single-phase meter, 110 volts, to Ontario, and a similar one to the defendant company's office in Winnipeg. Plaintiffs had the goods specially manufactured for the defendants, and then asked for special instructions about delivering them.

Mr. Taylor, the plaintiffs' secretary, said they telephoned to the defendants that the goods were ready for shipment. They had never been able to receive the necessary instructions, with the result that the goods were on their hands. There was no available market for them as they were made specially for the defendants.

The Secretary of the defendant company said they could not pay at present. Ninety per cent. of the company's creditors in Canada and the greater part of the creditors in England had agreed to a scheme whereby they were to have six months' extension of time. If judgment was given for the plaintiffs in that case, the defendant company would have to go into liquidation, and the plaintiffs were the only creditors who were pressing them.

Judge Atherley-Jones said he did not want to break up the defendant company, and no doubt the plaintiffs would meet them in a reasonable way.

Mr. Taylor replied that a meeting had been held of the defendants' creditors in Canada without any reference to the plaintiffs, and there had been no formal meeting in England at which they could attend to discuss the defendants' financial position. They did not consider they were deserving of any consideration, having shown none to the plaintiffs. They did not wish to act vindictively.

Judge Atherley-Jones, K.C., said he did not think they did. He must give judgment for the plaintiffs for £67 3s. 6d. The Canadians had deserved well of this country, and therefore the defendants should receive every consideration.

Electric Furnaces in Italy.—Recently published statistics relating to the number of electric furnaces in Italy up to 1913, show that they are in use by four establishments engaged in iron smelting and ten in other industries. Of the former, the Dalmiene works at Bergamo have doubled their plant, and their output of iron piping is now 30 tons yearly. The plant comprises two Héroult furnaces. The Tranchi-Griffin works at Brescia is considering the introduction of a Stassano electric furnace for the production of cast-steel. The Darfodelle Ferriere works at Volta has continued the production of foundry iron with a 3,000-kw. Héroult furnace; it also produces fine iron, ferro-manganese, ferro-silicon, and carbide of calcium with three Keller furnaces of 1,500-kw. capacity, four of 750, and two of 75, adapted to each purpose. In the Milan works of the Acciaierie Milanesi, two Stassano furnaces are in steady operation. At Turin the Fonderie Riunite is obtaining good results from the Bassanese furnace, which is of the arc type like the Stassano.

Of electric furnace installations employed in other industries, there is the installation at the works of Prof. Rossi, of Legnano, whose capacity was doubled in 1913. It consists of 18 furnaces of 500 kw. at 4,000 volts, used for the fixation of atmospheric nitrogen, and a small furnace of 120 kw., employed in making an alloy called "Elianite," invented by Prof. Rossi, which is fusible like iron, but absolutely unattackable by acid. In the manufacture of aluminium the Bussi Works treated in 1913 over 6,000 metric tons of bauxite, yielding 874 metric tons of metal. Of carbide, the Darfo Works, with their Keller furnaces, turned out about the same quantity as the preceding. In the neighbourhood of the Italian capital a much greater production was effected—some 34,000 metric tons (against 26,000) in the several works at Foligno, Anversa, Narni, Papigno, and Collestatte. The Foligno Works have now given up this branch of production, and devote their energies to ferro-silicon, but a new carbide factory, employing three furnaces of a total capacity of 2,250 kw., has been started at S. Giovanni Lapatoto. Calcium cyanamide is also produced at Collestatte, to the extent of 12,600 metric tons. Lastly, electric carbons are manufactured at Narni, the output in 1913 totalling 18,000 metric tons.

WAR ITEMS.

Electric Motor Lorry at Erith.—Messrs. Vickers, Ltd., have just put into service a 3½-ton Baker electric motor lorry in connection with their works at Erith, Kent. It is to be used for the transport of war material to Woolwich Arsenal and Dartford and for the collection of goods from the railway station.

Board of Trade Publications.—The C.I. Branch of the Board of Trade has issued No. 20 of its lists of inquiries for the sources of supply of goods for the week ended May 8th.

An Australian Charge.—Reuter's correspondent at Adelaide says that, on May 14th, Mr. Justice Gordon decided that there was no case to go before a jury in connection with the charge brought against Mr. Francis Hugh Snow, a well-known merchant, of attempting to supply copper ores to a firm in Germany. The accused will probably be prosecuted on another charge.

Carbon-making in Australia.—An Austrailan paper states that a company, to be known as the Australian Arc Carbons Co. Pty., Ltd., has been formed, with an authorised capital of £4,000, in 400 shares of £10 paid up, for the local manufacture of carbons of the kind extensively used for cinema shows, naval searchlights, railway arc lamps, municipal lighting, and various electrical influence machines. "In the past these have been largely imported from Germany and Austria. The secretary is Sir Alexander Peacock, 339, Collins Street, and the sole distributing agents are Messrs. Newby & King, National Mutual Buildings, Collins Street, Melbourne."

Russian Demand for Electric Fittings.—A Petrograd paper says that with the opening of the building season the question of the scarcity of electrical materials becomes a very acute one. The previously existing supplies of sundry accessories for installing electricity, as the demand throughout the winter was not reduced, have considerably declined, and the question now is one of making up the supplies. Local factories that engage in producing such goods are so overwhelmed with large and urgent orders that the production for stock, or for the market, is reduced to a minimum, and the Moscow factories are unable to satisfy the demand. The large increase in Customs duties is having its effect upon the prices which, for the most part, are up from 30 to 40 per cent. For want of raw material the production of batteries too has been very much curtailed. There is no carbon for arc lamps. Very satisfactory offers of installation material have been received from America, but the conditions of sale are not suitable to the Russian market. The proposals submitted at the council of electro-technicians held in January this year, to manufacture in Russia some of the more generally used types of fittings in place of those previously imported from Germany, have not yet materialised, because, as stated above, the Russian factories are overwhelmed with important orders. The demand at the moment is not important, but it is expected to become so in a few weeks' time.

Government Cable Contracts.—Among the Parliamentary questions, asked on May 13th, was one put to the First Commissioner of Works by Mr. Booth, who asked if Julius Hirschmann was still a director of the Union Cable Co., which received a Government contract; if he was a nominee of the Deutsche Kabelwerke A. G., Berlin; and where he was now residing. Mr. Walter Rea, in reply, stated:—"So far as the information in the possession of the Office of Works shows, Julius Hirschmann is not a director of this company. His place of residence is not known."

The following letter has come to hand just as we go to press:—"I do not know your correspondent, Mr. A. R. Munday, and have no wish to reply to his letter, but since so much publicity has been given to the matter, perhaps it is well our friends should know that five-sixths of the work we have in hand at the present moment is on direct Government contracts for various departments. So long as the Government offer us work, we shall carry on, in the belief that we are patriotic, and allow the Board of Trade and its Supervisor to look after any profits there may be. I trust you will be good enough to publish this letter.—J. A. Blackwood (on behalf of the employés of the Union Cable Co., Ltd.), Dagenham Dock. May 19th, 1915."

The Lighting of London Streets.—At the Lambeth County Court, before Judge Parry, on Friday, George Brown, a taxi-cab proprietor, brought an action against the Lambeth Borough Council to recover damages for injuries to a cab. It was stated that, after emerging from the glare of a shaded gas-lamp at Brixton, plaintiff was plunged into total darkness, and ran, a short distance away, into a refuge, on which was an electric arc lamp. At the time of the accident this electric lamp was out, the result being that the driver smashed the lamp column and damaged the car. Evidence was called to prove that the electric lamp on the refuge was out at the time of the accident, and that it was practically impossible for a driver to see the refuge after he had come from the glare on the road caused by the shaded gas lamp. A police-sergeant stated that it was so dark that he had to go into the cab and turn up the light in order to make a note of the accident. Mr. Bruce Penny, Town Clerk of Lambeth, for the defence, maintained that there was no negligence on the part of the Council, inasmuch as the lighting arrangements were carried out by the gas company and the South London Electric Supply Corporation. He also pleaded that the Council was not responsible for the accident, as it was acting under the instructions of the Chief Commissioner of Police, who was responsible for the lighting of the streets under the Defence of the Realms Act. Mr. H. C. J. Edwards, the borough engineer for Lambeth, stated that the lamps had been shaded at the instigation of the police, who approved of the measures taken by him and his staff. It was desired that the lights from the lamps should be thrown on the ground, but that did not cause a glaring light. It was common knowledge that the whole of the lighting of London had been taken out of the hands of the local authorities, and that the police were responsible for it. Evidence was given that the electric arc lamp should have been in working order at the time of the accident, and that it should have been alight, as it was found to be burning at eleven o'clock on the morning after the accident. Mr. Lever pointed out that under a recent decision in the High Courts, when a similar action was taken against the Poplar Borough Council, the Council was responsible for an accident of this nature. Judge Parry said, in view of the importance of the case, he should reserve his decision.

Limiting Municipal Expenditure in War-time.—The Finance Committee of the L.C.C. has reported to the Council at some length on the subject of the restriction of capital expenditure. The object of the Treasury is to conserve and direct into channels useful to the nation for the furtherance of the war both the capital and the labour of the nation, and it is desired by their lordships to stop or reduce capital expenditure by local authorities rather than merely to restrict fresh borrowing. The Committee has considered the matter in order to report what action should be taken to comply with the spirit of the Government's suggestions, and it concludes that the general principle to be observed is that all capital expenditure not necessary for the furtherance of the war should be postponed; in other words, that municipal or local interests must be subordinated to national interests. The Committee says:—"One exception only is specifically allowed, viz., urgent works connected with the public health; but the Treasury will apparently give a somewhat broad interpretation to the expression 'furtherance of the war' which will allow of expenditure on any municipal service which, if not carried on, would hamper those engaged in industries directly concerned with military requirements. It is possible that the approval of the Treasury might be secured to expenditure on isolated purchases of property in cases in which specially favourable opportunities occur, as such expenditure makes no demand on labour, but the actual payment of the purchase money should be postponed, if possible. Further, expenditure on works in progress under existing contracts will only be allowed if, after due inquiry and consideration, it appears that such expenditure cannot be postponed or delayed." A letter from the Treasury, dated 28th April, indicates another ground—extreme urgency, which may influence them in granting sanctions, for it says:—"With regard to the proposed expenditure of £88,000 on providing two additional turbo-generators at the Greenwich generating station, My Lords recognise that this is a service of urgent importance which cannot be deferred indefinitely, but they would ask that the London County Council should further consider whether it is not possible to postpone the expenditure consistently with safety for (say) six months or a year. They will not refuse sanction for the borrowing of the money if and when the London County Council determine that it is absolutely impossible further to postpone the expenditure." The Committee continues:—It is necessary that definite action should be taken by the Council without delay, and instructions given to committees to review the position and reconsider their annual capital estimates for 1915-16, and we submit the recommendations accordingly. We desire to refer to the action taken by the Emergency Committee on August 14th, 1914, and subsequently continued by us, subject to certain modifications, as reported to the Council on 27th April, 1915, with a view to making more frequent payments to contractors than those to which they are entitled under their contracts. The object of this action was to prevent the delay of works at a time when, as the Local Government Board, in its circular of 11th March, 1915, has pointed out, "there was reason to fear that unemployment might be widespread." The same circular urges that the position is now reversed, and that "it will be necessary to economise labour to the greatest extent possible." We have accordingly given instructions for the special arrangements referred to to be discontinued, and that no further action shall be taken under the resolution of 23rd March, 1915, which was as follows:—

> That, until the conclusion of the war or during such shorter period as may be determined by the Finance Committee, in all future contracts for the execution of works of construction or manufacture with regard to which the heads of the departments concerned consider it desirable that more frequent payments than those provided for by the standing orders of the Council should be made, a provision be inserted to the effect that heads of departments shall issue certificates for weekly advances on all such contracts of less than £2,000, and for fortnightly advances on all other works contracts.

As regards sanctions to borrowings by metropolitan borough councils and loans to local authorities in London, the Committee proposes to deal with all such cases in accordance with the policy indicated in the letter from the Treasury, except those in which, as stated in the circular letter, dated 25th March, 1915, from the Local Government Board, that authority, and not the Treasury, is to decide whether the purpose for which the loan is required is one with which it is desirable to proceed at the present time. The Committee's recommendations include the following:—(a) That, in order to comply with the requirements of His Majesty's Treasury as regards the restriction of capital expenditure during the continuance of the war, the Council do take all possible steps to limit its capital expenditure. (b) That it be an instruction to all committees of the Council to take steps forthwith (i) to postpone or delay expenditure as far as possible under existing contracts and estimates already approved by the Council; and (ii) to refrain from submitting estimates for new proposals or works unless the same are for the furtherance of the war, or are of such urgent necessity that they must be undertaken immediately. (c) That it be instruction to all committees of the Council to reconsider their annual capital estimates for 1915-16, in accordance with the decisions arrived at under the foregoing resolutions (a) and (b), and to forward them, as amended, to the Finance Committee at the earliest possible date.

War Service Badges and Recruiting.—Some time ago, when Messrs. E. Bennis & Co., Ltd., of Little Hulton, were officially notified by the War Office that they had been placed upon the list of firms exempted from recruiting in consequence of being engaged on war contracts, a personal letter, as under, was addressed to each of the firm's employés impressing upon them the importance of the work on which they were engaged. Those employés who were of recruitable age were requested to give a guarantee to enlist if called upon before exemption badges could be supplied. We learn that as a result of the firm's appeal over 95 per cent. of their recruitable employés applied for badges and signed the necessary guarantee:—

GOVERNMENT CONTRACTS.

We have received official intimation from the War Office that this firm has been placed on the list of those exempted from recruiting during the period that we have armament contracts on hand.

We are in a position now to obtain war badges for those of our employés who are of recruitable age (between 18 and 38), and these we can obtain from the War Office upon each man or youth signing an application form, which can be obtained in the time office during the dinner hour or at 5.30 p.m.

We take this opportunity of pointing out to our employés that we have large contracts in hand for mechanical stokers, coal elevators, conveyors, ash handling plants, etc., for several ammunition and powder factories that are being put up with all possible speed by the Government, quite 80 per cent. of our work now being of this character.

The present orders cover several months' work, and as we are under stringent guarantees as regards deliveries, the speed at which we turn out these orders and the quality of the work will control the placing of further War Office orders which we have at present under negotiation.

We, therefore, trust each man will realise his responsibility and assist the Government in their urgent need for war munitions by attending to his duties regularly and conscientiously, avoiding broken time, and getting through his work as speedily as possible, thus enabling us to execute the work we have undertaken within the times guaranteed.

It is our opinion that the men at home engaged in output of war munitions have as responsible and important duties to perform as have their brothers in the trenches, as it is only by their unselfish co-operation that our soldiers can be kept well supplied with ammunition, now so urgently necessary to bring this unfortunate war to a speedy and satisfactory end.

We appeal to your loyalty and patriotism, and we do not think we shall appeal in vain.

For EDWARD BENNIS & CO., LTD.,
EDWARD BENNIS, *Managing Director.*

May 5th, 1915.

Personal.—Mr. S. C. Hurry, of the Sheffield Corporation electricity staff, has been granted a commission as a second-lieutenant in the Royal Engineers' Signal Section. He has been at the front as a motor cyclist dispatch rider attached to the Cavalry Division.

Mr. Tom Sumner, electrician, of Hulton, Bolton, owes his escape from the "Lusitania" to his capabilities as a swimmer. After two years in Canada and the States as an electrician, he decided to return home recently, and booked his passage on the "Lusitania." He was on deck smoking when the first torpedo struck the ship. From the explosion, splinters flew over him. He rushed down for a lifebelt, slid down a line into the sea, and struck away just as he saw the foam of the second torpedo. He remained in the water three hours before he was picked up.

Lieut. C. L. Faunthorpe has accepted a commission in the 9th West Kent Regiment. For years he has been secretary of Blackburn Civilian Rifle Club. Lieut. Faunthorpe holds a position on the staff of Blackburn Electricity Works.

Mr. Percy Taylor, assistant electrical engineer to Darwen Corporation, has enlisted in the motor transport service. He left for Coventry on May 13th.

Mr. Jones, an electrician on the "Lusitania," was among the saved.

The "London Gazette" contains the following notice:—
"Admiralty, May 12th. Royal Marines, Submarine Miners Captain George Arthur Bruce, Tyne Electrical Engineers, Royal Engineers, Territorial Force, is granted a temporary commission as a Captain, and to remain seconded in his unit. Dated April 1st."

Roll of Honour.—Sub-Lieutenant E. B. Trimmer, of Paisley, is reported to have been wounded at the Dardanelles. Previous to the war he had charge of the electricity generating station at the Anchor Thread Mills.

Private John Francis Hobson, of Stalybridge, formerly employed at the generating station in Tame Valley, has died from wounds received in action.

It is with deep regret that we read in the "Times" that Second-Lieut. Stanley Bastian, 4th Seaforth Highlanders, the only son of Mr. C. Orme Bastian, was killed in France on May 9th. The deceased, who was 23 years of age, was, until the outbreak of war, engaged in the service of Messrs. Dick, Kerr & Co., Ltd., preparing for a commercial career. He enlisted last September, and went to the front early in November. Mr. C. O. Bastian's numerous friends in the electrical world will, we are sure, desire to join us in an expression of deep sympathy with him and Mrs. Bastian in their loss.

Private Arthur Baker, of the 8th Warwicks, who was employed at the Moseley Road depôt of the Birmingham Tramways Department up to the outbreak of war, has been wounded, and is at the Military Hospital, Kent.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Wireless Control of Public Clocks.

I have observed a paragraph under the above heading on page 624 of your issue of the 30th ult., which I recognise as an extract from a criticism by Mr. Hope-Jones, which was published in the March issue of the *Horological Journal*.

In fairness to myself, I should like to state that a complete answer to Mr. Hope-Jones's criticism appeared in the April issue of the journal in question. I would also point out that the date of issue of the *Horological Journal* in which my answer appeared was April 9th, and that my article did not appear in the ELECTRICAL REVIEW until April 16th.

It is a pity, I think, that your correspondent did not see the April issue of the *Horological Journal* before sending you the extract from the March issue, because he would have seen that Mr. Hope-Jones's condemnation was founded chiefly on an erroneous idea of the subject.

Further, the proposal to install a receiving apparatus does away with the principle of obtaining "collective" control, which is the very marrow of a well-appointed time service. A receiving apparatus could certainly be added to the scheme, but wireless control from a central point would still be required to enable a responsible individual to know that the clocks were really to time.

The last paragraph of the extract is not a literal reproduction of the statement which appeared in the original. The paragraph as it appears is misleading, and gives the impression that no licence has been necessary for receiving wireless signals. I would respectfully point out that the Postmaster-General's licence has always been necessary for receiving wireless signals, as well as for transmitting them.

Alfred E. Ball.

Leicester, *May 17th*, 1915.

[An extract from Mr. Ball's reply to Mr. Hope-Jones was published on p. [illegible] of our last issue; evidently our correspondent has overlooked this.—EDS. ELEC. REV.]

Photo-Printing Charges: Preferential Terms.

In your issue dated the 2nd inst. you published in your columns a letter of mine wherein I reported that the [illegible] Corporation had instructed Mr. S. F. [illegible], the Town Clerk, to state a case for the opinion of counsel (Mr. W. C. Tyldesley Jones), as to whether it is legal to supply energy for photo-printing purposes at the same rates as charged for power.

Your readers will remember that in my letter I also pointed out that in reply to questions of mine, the Local Government Board wrote: "The Board are not aware of any [illegible] the general law upon the subject [illegible] I [illegible] that in connection with this [illegible] question I resigned my position as Chairman of the [illegible] Committee.

The position now is that counsel's [illegible] since the beginning of April, but it has not yet been made public. The Town Clerk read the [illegible] the Electricity Committee [illegible] to take a copy [illegible] given to keep the matter strictly private, which the writer declined to do.

Surely it is not necessary in the public interest that such secrecy should be [illegible]

This is not a purely local question, but a matter affecting hundreds of [illegible] than photographers— throughout the country.

E.

Again, counsel's opinion has been taken at the expense of the ratepayers [illegible] in contemplation. Is it not necessary that the ratepayers should be allowed to know the reasons [illegible] especially as the charges for energy to the photographers of Ilkeston have recently been advanced from [illegible] rates to [illegible] rates on the plea that it is [illegible] photographic purposes at power rates?

[illegible] of your readers will express their views on the [illegible] the necessity of keeping strictly private and confidential the opinion of counsel in this particular case I shall [illegible]

(Coun.) William Smith.

Ilkeston, *May 14th*, 1915.

[We have already pointed out that the Corporation has the right to fix any scale of charges for energy used for photo-printing that it pleases; if the scale happens to coincide with the charges for power, that does not imply that there is any connection between the two. We see no reason why the opinion of counsel should be kept secret, but that is a matter which, of course, is within the discretion of the Committee.—Eds. Elec. Rev.]

Automatic-Lift Accidents.

In reference to Mr. Broadbent's article on lift-door locks appearing in your issue of May 14th, all lift engineers will appreciate the difficulties he refers to. Undoubtedly collapsible gates are very convenient, but with the necessarily open spaces between the pickets it becomes difficult to prevent the kind of tampering with the locks referred to. We consider it is preferable to lock such gates at the centre, but we have standardised an attachment to our lock whereby the releasing mechanism is, as he suggests, placed near the top of the gate frame, to put it as far out of reach as possible. We entirely agree with Mr. Broadbent's contention that the addition of complicated apparatus which is not essential is likely in the end to be more trouble than it is worth, but we have quite a number of installations in which the doors or gates are actually locked before the lift moves away from a landing, and the doors remain locked while it is passing; this applies equally to automatic control as to what is known as car switch control. In such cases, if a fault developed in the lock attention would be called to it by the refusal of the lift to start.

Of course, in these days of severe competition there is bound to be a difference in the quality of the various mechanisms which go to make up a lift, but we consider that too much care cannot be given to devices such as are used for the locking of the gates, seeing how much is dependent upon their proper working. The use of a second catch for the locking lever, which we always fit, should have prevented the even remote possibility of opening the gate to which Mr. Broadbent refers, provided, of course, that the locks and other apparatus are kept in proper order.

For **Waygood-Otis, Ltd.**

H. Harmsworth, *Director and Sales Manager*.

London, S.E., *May 17th*, 1915.

Trade After the War.

In view of the great [illegible] on the space, I would like to say that I think Mr. Edward Bergtheil's letter in your current issue very apt, with the exception that most business houses, as he suggests, do not know exactly how to begin on the overseas campaign. Provided a person or business man has seen a bit of the world outside his own native island, the problem of getting a good hold in respect of the overseas ex-Austro-German trade is fairly easy. The people, however, who might move seem mentally lethargic—in fact, one cannot kick them into animation, and I have been at it since the second week in August!

I may add, by way of explanation, that three trade associations have had my services in the past (two British and one American), and, in addition, on behalf of British and foreign firms I have either travelled or been in France, Belgium, Germany, Austria, Russia, Turkey, part of Persia, U.S.A., etc., so do not speak without my book. With this and much other experience behind me, it is clear to me that any British firm which has already an overseas connection should develop it from the overseas pitch either by suitable and more energetic salesmanship, by local publicity work (a most important item), or by a thorough investigation of the requirements in goods and terms of the overseas place or places. If a firm has no overseas depôts, well, let it get suitable agents, but first see that they are suitable, and get them to disclose their successful activities in the past, and then go by their advice as to goods, literature and service required, so that if there is to be a fault, it may be theirs, and not that of the home manufacturer.

As [illegible] than business wanderer (though, unfortunately, nothing of a linguist), I will be most happy to write a lengthy and more detailed general letter on the above subject if your readers show any interest.

A. M.T.

Wimbledon, S.W., *May 17th*, 1915.

Cab Signalling.

As one who has carefully studied railway signalling methods in four countries for more than ten years, I wish to commend as strongly as possible Mr. Ogden's thoroughly sound and accurate criticisms in your current edition. From the public safety point of view, it would have been all the better for Mr. Ogden to have extended his critique to include the other grave mistakes Mr. Acfield makes concerning electrical signalling. On every point in dispute between the two writers Mr. Ogden is right and Mr. Acfield is wrong.

Track circuiting certainly was not "introduced into railway signalling in the past few years." I travelled under track-circuit protection more than fourteen years ago, and such circuits had then been in regular service for more than fourteen years. No valid reason can be given for the fact that, as to track circuiting, British steam railways are so many years behind those American railroads which operate under the same conditions. British steam railways would be signalled more economically and far more safely if antiquated mechanical devices were superseded by modern electrical apparatus.

Mr. Acfield would have been less misleading if he had paid appropriate attention to the serious objections peculiar to A.C. track circuits. It is questionable whether the undoubted advantages of this class of circuits, when considered in connection with their marked disadvantages, are sufficient to warrant the optimistic opinion he expresses. The three-wire track circuit certainly seems to offer very decided advantages over the A.C.

In asserting that the Railophone "is undoubtedly designed on right lines," Mr. Acfield is utterly wrong, as I have several times proved in the technical Press and in lectures to technical meetings in London, Birmingham, Sheffield, and elsewhere. According to published descriptions, the test (?) of this toy on the Midland Railway is a very frivolous waste of time. For instance, at least two illustrated articles (neither of them by me) in the Press show the Midland "tests" as proceeding under the conditions that two distant signals on tracks of opposite traffic are about twice the requisite viewing distance apart, that there is not a home arm on the same pole with either distant, and that there is no intervening home or distant signal for either track. Mr. Acfield knows quite well that this combination of conditions does not occur one time in a hundred. It would certainly be interesting for Mr. Acfield to inform your readers, by the aid of circuit diagrams, as to how he would extend the Midland Railophone installation so as to take care of the case of a double-track junction with a four-track route.

Every wireless cab system, whether Faradic or Hertzian, that has ever been publicly proposed is designed on lines that are decidedly wrong. The very fact that the action is "wireless"—*i.e.*, radiative—connotes a dangerous tendency inherent in such systems, but entirely absent from electrical ramp systems. The wireless impulse tries as hard to go to the wrong locomotive as it does to go to the right one; but the same is not true of the conducted—and non-radiative—impulse in the ramp systems.

Wm. H. Dammond.

Nottingham, *May 15th*, 1915.

The Engineering Industry and the War.

The statements contained in my letter of May 7th are entirely correct. I did not give weight of the human heart, but capacity and industrial performance.

J. Sutherland Warner, A.M.I.Mech.E.

London, W., *May 17th*, 1915.

Electrical Standards.—Mr. H. M. Hobart and Mr. C. E. Skinner, who were sent to London as delegates from the American Institute of Electrical Engineers to confer with the Standards Committee of the Institution of Electrical Engineers of Great Britain in February, completed their work on March 25th, and were to make their formal report to the Standards Committee of the A.I.E.E. on May 7th. It is understood that their mission was successful, and that substantial agreement between the standards of the two countries has been reached. Sir John Snell, president of the Institution of Electrical Engineers, formally welcomed the delegates, and Dr. R. T. Glazebrook, director of the National Physical Laboratory, acted as chairman of the conferences, which were held at the home of the Institution of Civil Engineers in London. Every possible courtesy was shown to the American delegates, and there was ample evidence of the earnest desire of the British Standards Committee to arrive at a complete agreement. It is expected that through their study of both sets of rules with the British Committee the delegates will be able to make important suggestions for the clarification of the American rules. It is also thought that they will make certain recommendations for changes in the American rules in order to arrive at closer agreement than would otherwise have been possible. While there probably will still be minor differences to be settled, and while the wording of the two sets of rules will be different in many respects, it is expected that in all essential points the machinery built in accordance with either set of standards will fulfil the same specifications.—*Electrical World.*

BUSINESS NOTES.

Consular Notes.—CHINA.—The American Consul at Peking reports that at a recent meeting of the American Association of North China a resolution was passed asking American manufacturers of machinery to follow the practice of British manufacturers in sending machinery to Chinese technical schools and universities for their use as a means of advertising American machinery and bringing it into favour with the Chinese students, who, on account of their familiarity with the machinery during their school days, will be inclined to favour its use in fields to which they may be called later in life. A committee was appointed to draw up a list of the kinds of machinery in demand, and of the institutions to which they could advantageously be presented.

HONG-KONG.—The American Consul at Hong-Kong reports : "The opportunity for the introduction of cheaper grades of electrical supplies in the Hong-Kong field growing out of the closing of the trade to German manufacturers as a result of the war, is being taken advantage of by Japanese manufacturers, and many lines of electrical goods are coming into this market from that country. There are three well-equipped factories for such goods in Japan, according to Hong-Kong importers concerned in this trade, and all of them have carried on an active campaign in behalf of their goods, which include practically all lines of ordinary electrical supplies, aside from electrical machinery and the finer grades of electrical apparatus. Prices are much lower than those for American goods answering the same purpose, though the American goods are much superior in quality. The nature of the trade is indicated by the fact that one company imports filaments for incandescent lamps from the United States and manufactures the lamps in Japan, the lamps selling here for about 15 cents gold wholesale. These lamps lack the life and the efficiency of the American or European lamp competing with them, but they attract a considerable trade and supplant, for the time being at least, the better grade lamps manufactured in Europe or the United States. The situation is similar as regards the trade in insulated wire, fuses, porcelain insulators, globes, and similar accessories. The Japanese may almost be said to control the market in some of these lines at present. A curious phase of the trade is that the Chinese importers usually prefer to buy such Japanese goods through foreign houses in Hong-Kong, thus adding a profit to the cost, but avoiding transactions with Japan direct. Prices in some of these goods from Japan run almost 50 per cent. cheaper than goods from the United States or Europe. The hope of future trade, however, lies in the poor grade of the goods and the consequent expense and trouble of early renewal. In a general way only high-grade goods will stand the climate in Hong-Kong, and the purchase of inferior grades will undoubtedly be expensive in the long run. The trade in electrical goods generally in Hong-Kong, which received special development about two years ago, continues to increase in a conservative way, in spite of the depression caused by the war. The close of hostilities and the resumption of normal trading will doubtless result in a great increase in the use of all sorts of electrical goods in this field."

Book Notices.—*How to Cook by Electricity.*—By Amy Cross and Alys Waterman. London : Lake, Sison & Brown, Ltd. Price 9d.—This little book consists of 13 pages about electric cooking, and 53 pages of tested recipes, the latter numbering 100, and covering a wide range of dishes. The talented authoresses lead off with eight good reasons for the growing popularity of cooking by electricity, and proceed to show that good oven cooking is essentially a scientific operation ; to reproduce the best results with certainty, the use of the thermometer is indispensable. A thermometer, however, is useless when applied to an oven through which there is a current of air, such as a gas oven of the usual type, as the temperature cannot be correctly ascertained. With an electric oven, fitted with a thermometer, it is now possible for domestic cookery to be done on scientific lines and with the certainty of successful results. There is only one obstacle to the production of recipe books with definite directions for the times and temperatures to be employed—namely, the absence of standardisation, to which we have repeatedly drawn attention. Hence, while the writers give in their recipes the temperatures which they have proved satisfactory with most of the best ovens on the market, they suggest that the reader shall make a note of the temperatures she finds best with her own oven, and a space is left for this purpose after each recipe. Once this is done, success is certain. All the recipes given are for oven work, because the recipes found in any cookery book may be used for boiled, grilled and fried dishes. A variety of information is included regarding the use of switches, hot plates, saucepans, grills, &c., and about baking, cleaning, and using the oven without a thermometer. It is pointed out that the very best results in cooking meat are obtained by using moderate temperatures for a longer time than is customary, and that great economics can be effected by cooking with the reserve heat of the oven after shutting off the current. We feel sure that this book, tersely written in plain language and with convincing commonsense, will be heartily welcomed by electric cooks and by supply station authorities.

"*Journal* of the Institution of Electrical Engineers." Vol. LIII, No. 248. May 15th. London : E. & F. N. Spon, Ltd. Price 3s. 6d. —This issue contains a paper on "The Bombay Hydro-Electric Scheme," by Alfred Dickinson, as well as the Report of the Council for 1914 15, the annual and Benevolent Fund accounts, and the papers set in the examination for Associate Membership.

Electric Mining Regulations and Data is the title of a useful little handbook just issued, after revision, by Messrs. W. T. Glover and Co., Ltd., of Trafford Park, Manchester. It brings together in convenient form the Home Office Regulations and Memorandum, as revised in March, 1914, and a selection of data and formulæ, with a section illustrating the firm's cables and accessories designed to comply with the regulations. It is a neat and well got-up booklet, and should be welcomed by colliery engineers.

"Electric Handbook." By A. S. Richey and W. C. Greenough. London : The Hill Publishing Co. Price 17s. net.

"Single-Phase Electric Railways." By Edwin Austin. London : Constable & Co. Price 21s. net.

"The Hardening of Metals." Reprint from the *Transactions* of the Faraday Society. London : The Society. Price 7s. 6d.

War Service. — Messrs. Berry, Skinner & Co. ask us to request contractors in the electrical trade requiring their switchgear to anticipate their requirements as much as possible. They say :—"It is of paramount importance, when delivery cannot be reasonably anticipated, to mention with the order if, and when, required for war service, with sufficient details so that preference may be obtained, not only with the railway companies, but, when necessary, with the suppliers of raw material and component parts. War service orders take precedence of everything, and are delivered in strict rotation as received, except by special order of the Government."

Liquidations and Dissolutions. The Combination Gas-Steam Engine Syndicate, Ltd.—A meeting is called for June 15th, at 2 and 3, West Street, Finsbury Circus, E.C., to hear an account of the winding up from the liquidator, Mr. W. F. Conner.

Vivian Younger & Bond, metal brokers and merchants, 7, Gracechurch Street, E.C.—Messrs. C. L. Budd, W. C. Bond and J. A. Amschel have dissolved partnership so far as Mr. J. A. Amschel is concerned.

Patent Exploitation Trust, Ltd., Finsbury House, Blomfield Street, E.C.—First meetings of creditors and contributories June 1st at Carey Street, W.C.

Large Electric Furnaces.—Referring to the article on large electric furnaces for foundry work which appeared in our last issue, Mr. G. J. Stock, of The Villas, Middleton St. George, Co. Durham, informs us that he represents the makers of the furnace in question (the Snyder Electric Furnace Co.) in this country, and has sent us some brochures describing the apparatus.

Private Arrangements.—Frank Thornton & Co., electrical engineers and contractors, Bridge Street, Burnley.—The creditors interested herein were called together last week when a statement of affairs was presented which showed liabilities of £921. The assets were estimated to realise £1,085, from which had to be deducted £53 for preferential claims, leaving net assets of £1,032, or a surplus of assets over liabilities of £110. The book debts (£370) were said to be practically all good, while for the purposes of the statement the stock (£649) had been taken at cost or under. Owing to the rising prices the stock was really worth 25 per cent. more. A sum of £200 had been spent in fitting up the premises, which were well adapted for the purposes of the business. It was anticipated, however, that if a realisation took place, not more than £60 would be realised for the fittings and fixtures. The present position had been brought about by shortness of working capital and by the fact that the Corporation had issued notices to the effect that no further mains or services were to be laid down. As a result, the business of the firm had been restricted. After discussing the position, it was decided that a deed of inspectorship should be executed and a committee of three of the principal creditors was also elected. The following are creditors :—

Electrical Co., Ltd.	£33	Hodgson, S. A. & Co.	41
Falk, Stadelmann & Co.	28	Premier Electric Heaters, Ltd.	11
Edison & Swan	16	Scatterwood & John	41
General Electric Co.	11	Gratton, Smith, & Bros.	[illegible]
Stern Electrical Co.	12	Jessop, H. A., & Co.	14
Electrical Conduits, Ltd.	14	Ward & Goldstone	[illegible]
Veritys, Ltd.	12	[illegible] Lamp Co.	12

Trade Announcements.—Messrs. Invetrol Lighting, Ltd., of Invetrol Works, Bracebridge Street, Birmingham, have recently added to their business a new department for the manufacture of electric pocket batteries. It is in charge of an expert, who, we are informed, has had many years' experience in this line with leading battery manufacturers in this country. A leaflet has been issued briefly referring to the "Invetrol" "H.P." (high power) dry battery.

Messrs. A. Seage & Co. announce that their works at Hammersmith will be entirely closed from 22nd to 31st inst., as they are removing to larger premises owing to increased business and lack of facilities for extensions. The new works, which have three times the floor space of the old, are at Railway Approach, Prebend Gardens, Hammersmith, W. New telephone number : "Hammersmith 613."

The Herbert Frood Co., Ltd., have appointed Messrs. Hitchen-Blaikie, Ltd., of 28, Cathedral Street, Manchester sole agents for Lancashire, Yorkshire, Cheshire and North Wales, and they will carry stocks of Ferodo clutch and brake linings.

The Norman Electrical Agencies, of 70 Great Portland Street, London, W., have been appointed sole selling agents by Messrs. Pitter's Ventilating and Engineering Co. for the sale of their multiblade desk fans.

Bankruptcy Proceedings.—J. W. Jarvis, electrician, [illegible], Devon Place, Edinburgh.—The estates of J. W. Jarvis were sequestrated by the Sheriff on May 11th. A meeting is called for to-day at 18, George Street, Edinburgh, to elect the trustee and commissioners. A composition may be offered at this meeting. The *Scotsman* states that the application for warrant to sequestrate the estate was made by Mr. James Scott, S.S.C., at Edinburgh Bankruptcy Court, on 11th inst., in order to obtain payment of a debt of £29. Granting of the warrant was opposed by the respondent on the grounds that he was unable to pay, that he was liable to be called up for active service at any moment, and that he expected to be able to pay his debts at the conclusion of the war. The debts represented legal fees in proceedings in which the respondent had obtained divorce from his previous wife. Within five weeks he married again, but had not paid his lawyer's bill. Sheriff-Substitute Orphoot granted the application.

G. J. T. J. Parfitt, consulting electrical engineer, 11, Priory Road, Keynsham, near Bristol, Somerset.—The adjourned public examination of this debtor was held at the Guildhall, Bristol, last week, before Mr. Registrar Wright, who declared the case closed.

T. Moore, electrical engineer, Headingley, Leeds.—Trustee (Mr. H. C. Bowling, Official Receiver, 24, Bond Street, Leeds) released March 15th, 1915.

G. E. Hepkins, electrical engineer, Dudley.—Last day for proofs for dividend, June 1st. Trustee, Mr. A. M. Fairbairn; Official Receiver, 1, Priory Street, Dudley.

Catalogues and Lists.—Mr. H. C. Jeffcoat, 18, Ranelagh Gardens, Hammersmith, London, W.—Price leaflet of "Lamlock" lampholders.

Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—Three new illustrated priced leaflets for the trade. No. 266 gives particulars of the "Change-Ad" electric sign service; No. 267 deals with a new range of "Sunlite" porcelain enamelled reflectors for half-watt lamps; and No. 268 describes portable electric drills, an electric grinder for machine shops, and an electric buffer for motor garages.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—New conduit catalogue of between 170 and 180 pages, containing those sections of the firm's catalogue dealing with conduits, conduit fittings, distribution boards, fuses, switchgear, watertight fittings, and cables. The list has been rearranged to a more convenient size; many new fittings and devices have been introduced; engineers and contractors can have copies of the publication on application.

The Steel Barrel Co., Ltd., Phœnix Wharf, Uxbridge.—Souvenir illustrated pamphlet of 32 pages, containing some information concerning the company and its works, and the steel barrels, casks, pipes, tanks, &c., which it manufactures.

General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—New price-list of Osram drawn-wire lamps, "Atmos type," 100 to 1,500 watts, and for various voltages from 50 to 255.

For Sale.—Four thousand pairs Conradty carbons for open type lamps and 2 cwt. short ends, also 150 round glass globes for street lighting. Particulars are given in our advertisement pages.

An Australian Contract.—It is reported in the newspapers that Messrs. Norton, Griffiths & Co. have entered into a £10,000,000 contract with the New South Wales Government for railways, water conservation, harbour and irrigation works, the expenditure to be spread over five years from July, 1915.

LIGHTING and POWER NOTES.

Accrington.—Year's Working.—A loss of £3,073 is recorded on the year's working of the electricity undertaking. The gross revenue amounted to £28,802, a decrease of £1,124, and the gross expenditure to £21,613, an increase of £3,634. Some 6,340,000 units were sold, as compared with 5,850,000 units in the previous year, the power supply, excluding tramways, accounting for 4,113,000 units.

Arbroath.—Street Lighting.—The T.C.'s agreement for street lighting with the Arbroath Electric Light and Power Co. expires in August next, and the company is to be asked on what terms it will renew the agreement.

Ashton-under-Lyne. — Subject to permission being obtained from Hurst U.D.C., the T.C. has acceded to an application from Messrs. Jas. Howe, Ltd., for a supply of current to Mount Mill, Hurst.

Australia.—According to the *Sydney Daily Telegraph* a large up-to-date electrical plant is being installed at Mount Pleasant Colliery, on the South Coast, at an estimated cost of £35,000. The installation will consist of three alternators coupled to steam engines, each capable of developing 440 kw. at 6,600 volts. The power will be applied to various purposes connected with the working of the colliery, about three miles distant. The main heading will be illuminated with electricity, and a new haulage house at the pit mouth will contain one of the largest endless rope haulage sets in the Southern hemisphere, capable of hauling 1,2[illegible] tons of coal per day.

Aylesbury.—Public Lighting, &c.—The U.D.C. has agreed to have the Market Square lit by electricity, at a cost of £170; to give a day supply of 50 h.p. to the Dominion Dairy Co., at 1¼d. per unit, and to purchase a 20-ton barge of fuel oil, at £3 13s. 6d. per ton.

Barnes.—Year's Working.—The result of the past year's working of the electricity undertaking shows a net profit of £1,765, as against £3,214 in the previous year. This decrease is attributed solely to the war. In view of the restricted lighting order the Electricity Committee has reduced the street lighting account by £57 in respect of the past quarter.

Barnsley.—Proposed Extensions.—The Electricity Committee recommends that the Council approve of the scheme for extensions to the electricity works, at a cost of £21,850, and that application be made to the L.G.B. for borrowing powers. The Committee also recommends that the Corporation scale of grants be not applicable to men joining the Army Service Corps.

Blackpool.—Price Increase.—From the commencement of the September quarter all electricity tariffs are to be advanced 10 per cent.

Boston.—Prov. Order.—The B. of T. has granted to Mr. Robert Arthur Smith, of Westminster, a prov. order for E.L. within the borough, and at Skirbeck, Skirbeck Quarter, Fishtoft, Freeston, Wyberton, Frampton, and Kirton, in the area of the R.D.C. The T.C. is to have the option of purchasing the undertaking at the end of stated periods, but the order is not to come into force until the end of the war.

The L.G.B. has agreed to sanction a loan for a refuse destructor, but it is not to be taken up during the duration of the war.

Bradford.—The profit of the electricity department for the past year has been £12,000, and £7,500 is proposed as a contribution to the relief of the rates.

Carshalton.—Refuse Destructor.—The U.D.C. has referred to the Sanitary Committee the question of approaching the Beddington and Wallington U.D.C.'s, with a view to the provision of a refuse destructor for use for the three parishes.

Croydon.—The borough electrical engineer reports that in considering necessary extensions for next winter's supply he would, in the ordinary course, have recommended works involving an outlay of £3,500, but, owing to shortage of labour and L.G.B. restrictions, he advises only works of imperative necessity—viz., extensions of cables, at a cost of £498. The recommendations have been adopted by the Council.

Dover. — Correction. — We regret to find that the second paragraph appearing under "Dover" heading last week found its way there in error. The information related to another borough, not to Dover.

East Sussex.—Asylum Lighting.—The C.C. has, in consequence of enhanced prices of materials and difficulty of delivery, decided not to have the electrical storage battery at the Asylum renewed, but to install a smaller complete engine and dynamo set. The new scheme, it is anticipated, will cost less than the £900 allowed for the renewal of the battery, and will reduce the running and maintenance cost.

Gravesend.—The T.C. has sanctioned three extensions of mains, one to supply current to the factory of the Associated Portland Cement Manufacturers, and another to Wombwell Hall.

Heywood.—A loss of £927 was sustained on the working of the electricity undertaking for the year ended March 31st, 1915.

Owing to the high prices of fuel the charges for electricity are to be increased 10 per cent. from May 1st, 1915.

Hove.—The T.C. has decided to extend the mains to Portland Road Schools, now used as a military hospital, at a cost of about £387, provided the War Office bears the cost of the extension.

India.—The new electric power scheme for Darjeeling, which was formulated by the late engineer to the municipality, by which current was to be supplied to the two cantonments of Lebong and Jellapahar and outlying places, is being held in abeyance pending a report from Mr. Stoneybridge, whose services have been engaged by the municipality for the consideration of a larger scheme. The present intention is to establish three or more power stations on the Mahanady River at Phulbazar, and on the Tista, near Geljhora, four miles from the Tista Bridge. It is believed that with such a scheme in operation the needs of the tea gardens throughout the district right down to Dim Dimma, and those on the Nepal border as far down as Nuxalbarie, including the town of Siliguri, would be amply met.—*Indiaman.*

Keighley.—Prov. Order.—The B. of T. has granted a prov. order, for inclusion in a confirmation Bill, authorising the Corporation to supply electricity to places in Oakworth, Oxenhope, and Keighley rural district, except East and West Morton.

Leigh.—Loan Sanction.—In reference to the paragraph in our last issue concerning the delay to Government contracts suffered by the Anchor Cable Co., and the steps taken to deal with the matter, it is now announced that the L.G.B. has sanctioned, without inquiry, the borrowing of the money necessary for the extensions at the electricity works.

London.—The Shoreditch B.C. is recommended to make application to the L.C.C. for sanction to a loan of £1,500 for house services, mains, &c.

Bermondsey.—The Electricity Committee has further considered the question of altering the stokers of the three Howden boilers at the generating station, and has received an additional scheme submitted by Babcock & Wilcox, Ltd., for providing a chain-grate stoker to each boiler, the cost of which would be £400 per boiler, plus £130 for the driving gear and motor for all three, making a total of £1,330, or a saving of £428 as compared with the previous scheme. The Committee reports that it has adopted this scheme in preference to the more expensive one.

L.C.C.—The conference, mentioned in our last issue as being convened by the L.C.C. to discuss the question of London's electricity supply, was held on Wednesday, practically every borough council and supply company being represented.

Manchester.—Barton Scheme Inquiry.—The electricity department of the Corporation is hopeful that it will be able to convince the Treasury of the pressing need for an extension of its generating plant by the commencement forthwith of the erection of the new generating station at Barton, at a cost, approximately, of £768,000. As a result of representations made by the Electricity Committee, the L.G.B. has decided to hold a public inquiry to-day.

Mansfield Woodhouse.—The U.D.C. has consented to Mansfield T.C. erecting overhead lines in the district for the transmission of current to Clipstone Military Camp.

Market Weighton.—E.L. Scheme.—The Pocklington R.D.C. has given consent for the E.L. scheme submitted by Mr. C. H. Best, of Bradford, to be commenced. Mr. Best informed the Council that the scheme will be proceeded with if certain financial support is secured to assist local efforts.

Swansea.—Street Lighting, &c.—The Lighting Committee of the T.C. is considering a proposal for lighting a portion of Neath Road with 300-c.p. incandescent lamps attached to each alternate tramway pole and fed by an overhead wire, at a cost of £1,500. The electrical engineer has reported as to the running of a new feeder from the electricity works to Morriston. The consideration of the matter has been deferred. The Committee has approved the suggestion of a local firm (which intends to sell electric cars), that the department should supply current for charging electric cars at low rates, and has decided to charge all batteries on the restricted hour rate of 1⅛d. per unit, with a minimum sum of £2 per service per annum.

Slaithwaite.—The Electricity Committee has deferred consideration of the specifications of the proposed electric lighting plant.

TRAMWAY and RAILWAY NOTES.

Barnes. — Electrically-Propelled Dust Vans.—An offer of Edison Accumulators, Ltd., owing to the fact that L.G.B. sanction to the loan could not be obtained, to accept payment in four annual amounts of £1,060 each for the vans, proposed to be purchased by the Council, has been declined.

Bolton.—Various improvements in the track have now been completed in parts of the Corporation's tramway system. The suggestion of extending the system from Deane to Westhoughton appears to have been shelved indefinitely.

Bradford.—Employes at the Front.—The number of Corporation employés who have enlisted for war service is 701, equal to about 10 per cent., and of these the largest number has been contributed by the tramway department, which has sent 215 men, 7 of whom had been killed and 23 wounded, so far as is known at present. The total number of Corporation employés known to have been killed is 14, wounded 44, and prisoners in Germany about half a dozen.

The approximate profit for the year in the Corporation tramway department was £27,500, as compared with £29,500 in the previous year, and it is proposed to put £25,000 to relief of rates.

Clifton (Lancs.).—An agitation has again been set on foot for securing the linking up of the South Lancashire Tramway Co.'s system at Clifton with the Salford Corporation's lines at Pendlebury. The Kearsley District Council has appointed a deputation to represent its interests in the matter.

Continental.—Belgium.—According to Dutch reports, an Allied airman recently dropped a bomb on an electric car at Ostend, killing 24 soldiers.

Croydon.—The B.C. has adopted the following resolutions passed at a conference of managers of the tramway undertakings within the metropolitan area held on May 7th :—(1) That tramways revenue cannot be improved by increasing fares generally; (2) That joint action should be taken by the tramway authorities in the metropolitan area, to obtain more equitable treatment for tramways in respect of rates and the upkeep of roads; (3) That powers should be obtained to jointly run omnibus services. There are 119 Croydon tramway employés now with the Colours, or 30 per cent. The London strike was reported to have caused a material reduction of tramway receipts in Croydon.

East Ham.—The Tramways Committee proposes to negotiate with the Barking District Council for the purchase of two of the latter's tramcars.

Heywood.—Year's Working.—For the year ended March 31st last, there was a loss of £1,042 on the tramways undertaking. This is attributed to decreased earnings owing to the war, and to heavy expenditure on repairs to track.

Ipswich.—Female Labour.—The T.C. has arranged to release a number of tramway conductors to be employed in the manufacture of munitions of war, and to employ in their stead females over the age of 21 years, who will be paid 22s. per week of 60 hours, and be provided with overalls and hats.

London.—L.C.C. Strike.—On Friday last a general strike of L.C.C. tramway employés commenced, and has, at the time of writing, spread to the Metropolitan Electric Tramways in North London and adjoining areas. The men apparently want an immediate increase of 15 per cent. in wages; a re-arrangement of the working hours; and claim that their requests to enlist for the war, and be reinstated afterwards, have been refused. The Highways Committee points out that, under the Conciliation Board's scheme, the men agreed not to reopen the question of wages until June 26th next; that 79·81 per cent. of the men receive the maximum rate of 6s. 6d. a day, and only 12·28 per cent. receive as little as 5s. or 5s. 3d. a day, these men having been engaged to replace enlisted men, and receiving in addition a bonus. It is admitted that at four periods of the year the duties are spread over 14 or 15 hours a day, but the minimum spread-over is under 9 hours, and the average daily hours of work are 8 hours 24 minutes. About 2,000 employés have enlisted, and the Committee states that as many as 500 have withdrawn applications to enlist which had already been conceded.

London Electric Railway Companies' Facilities Bill. The Parliamentary Committee of the L.C.C. recommends that, in the opinion of the Council, the proposals contained in the London Electric Railway Companies' Facilities Bill, 1915, should not become law unless accompanied by adequate safeguards for the interests of the Council and of the travelling public of London, and that a petition be presented against the Bill.

Newcastle.—Bonus Arbitration.—The award in connection with the war bonus dispute on the Newcastle tramway system was made known last week. The Corporation had agreed to a bonus of 2s. 6d. per week to those earning less than 30s. a week; 1s. 6d. to those earning 30s. or more; and 1s. to youths up to 18 years old. The Tramways Committee as an alternative more agreeable to the men suggested 2s. 6d. a week to householders; 1s. 6d. to single men without dependents; and 1s. to youths. The latter proposal, which was rejected by the Council, has been adopted in its entirety by the Arbitration Committee.

Paisley.—Female Conductors.—Arrangements have been made by the Paisley and District Tramways Co., for the employment of women car conductors, fully 100 of the male workers having left the service for the Army. Lady checkers have meantime been appointed.

Salford.—The Tramways Committee has agreed to refer the bonus question to arbitration. The first body of women conductors were expected to begin their training this week. The Committee has decided to reduce the facilities for half fares for children to those not above 12 years, instead of 14 years as formerly, and this is expected to give increased revenue to the extent of £4.000 per annum, given normal traffic.

Southampton.—Year's Working. — Traffic receipts on the Corporation Tramways for the year ended March 31st last show an increase of £369, as compared with the previous 12 months. The number of passengers carried shows an increase of 103,491; 159,691 more miles were run than in 1914 and the receipts per car-mile show a decrease of ·930d. There has been an increase of 35,871 units in the current consumed, costing an additional £224.

South Staffordshire.—A meeting of drivers and conductors employed by the B.E.T. Co. in this area was held last week, when it was decided to ask for an increase of ½d. per hour in wages to cover the increased cost of living. Failing this being granted, it was also decided to cease work on Saturday. A resolution was likewise passed protesting against the employment of women in connection with the services.

Venezuela. — Railway Electrification. — At the meeting in London last week of the La Guaira Harbour Corporation, Ltd., it was stated that the conversion to electric traction of the Macuto and Coast Line Railway has been completed and had proved a great success.

TELEGRAPH and TELEPHONE NOTES.

Illicit Wireless.—A resident of Malvern, Victoria, named W. A. Bleeck, has been charged with being in the unlawful possession of wireless apparatus; he was an employé of the Commonwealth postal department. A technical breach of the War Precautions Act was proved, and a small fine imposed.

New Atlantic Cable.—A statement has appeared in the German Press to the effect that a new cable is about to be laid between the Scandinavian States and the United States, which will not as heretofore pass *via* England. The preliminary work has been carried out, and the estimated cost will amount to 40,000,000 marks. Thanks to this new cable, says the journal, Germany will be able to telegraph to the United States without the necessity of making use of wireless, and, consequently, will be able to send secret messages.

Norway.—The number of telegrams transmitted during the year 1913-14 amounted to 3,870,000, or 73,000 more than during the period 1912-13. Telephone messages over long distances numbered 6,270,000, an increase of 688,000 as compared with the previous period. There are now nearly three messages per capita, which probably represents a record. The total revenue from the telegraph and telephone lines amounted to £738,200, as compared with £404,300, and the working expenses amounted to £319.000, as compared with £294.900 during 1912-13. The surplus was £12,000, as against £11,000 for the previous period. The total capital spent on telegraph and telephone lines amounted to nearly 2 million pounds sterling, and the sum added during the last period was about £207,000.

Pacific Cable.—Last week armed raiders made an attack upon the Pacific cable station at Bamfield Bay, on the west coast of Vancouver Island. Several men landed in a boat and made an attempt to cut the cable which connects Canada with Australia. The sentry on duty fired at them and turned the guard out; the guard rushed to the beach, but the men by that time had jumped into their launch, and were making off. Shots were fired after them. No damage was done to the cable.

South Africa.—The British forces under General Botha last week occupied Windhuk, the capital of German South-West Africa. The wireless station, a very powerful one, able to communicate with the stations in Togoland, and at Tabora, in German East Africa, was found practically intact.

Week-End Letter Telegrams.—The arrangement introduced on January 1st for sending week-end letter telegrams at approximately one-fourth of the charges for ordinary telegrams between soldiers, sailors and nurses serving with His Majesty's Forces in the United Kingdom, France and Belgium and members of the general public in British possessions, has now been extended to the Forces serving in German South-West Africa. The special telegrams can be accepted for Lüderitzbucht at 9d. per word, and for Swakopmund at 10d. per work. The transmission thence to members of the Forces who may have advanced inland will be undertaken by the military authorities.

Wireless on Board Ship.—The Board of Trade has decided to take the necessary steps to postpone the coming into operation of the Merchant Shipping (Convention) Act, 1914, until January 1st, 1916. By this Act all British ships carrying 50 or more persons, and also foreign ships entering British ports, are required to be provided with a wireless telegraph installation.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—MELBOURNE.—June 15th. City Council. Four mechanically-fired boilers, one turbine-driven boiler-feed pump, two fuel economisers, circulating water pumps. City Electrical Engineer. Specifications from Messrs. McIlwraith, McEacharn & Co., Ltd., London, E.C.

June 30th. Victorian Railway Commissioners. One 13-in. centre lathe for turning or grinding commutators for traction armatures; one 9-KW. motor-generator and battery-charging accessories; four electric motors.*

SYDNEY.—July 12th. Metropolitan Board of Water Supply and Sewerage. Two steam turbines and condensers at Ryde pumping station, for the Chatswood pumping plant. Secretary, 341, Pitt Street, Sydney.

July 19th. Council. Maximum-demand indicators. Specification (10s. 6d.) from Electric Light Department.

July 19th. Municipal Council. One or two 12,000-KW. turbo-alternators (Contract No. 363).* A copy of the specification can be obtained from the City Electrical Engineer, Sydney.

July 19th. Steel towers for 33,000-volt transmission line. Specification (10s. 6d.) at E.L. Department, Town Hall.

July 21st. N.S.W. Government Railways and Tramways Department. One 250-K.V.A. turbo-generator.*

ADELAIDE.—June 30th.*—Deputy P.M.G. 120 miles of outside distributing wire; 123 miles of insulated copper wire.

July 7th.*—27,000 jointing sleeves and 55,000 copper binders.

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Bury St. Edmunds.—May 27th. Corporation. Twelve months' supply of coal for the Electricity Department. Forms of tender from Mr. S. E. Day, Borough Electrical Engineer.

Chesterfield.—May [illegible]. Coal (about 8,000 tons of slack) for a year from September 1st, for the Corporation electricity works. Mr. R. L. Acland, Borough Electrical Engineer, Chatsworth Road.

Dublin.—May 25th. Corporation. Underfed stoker. See "Official Notices" May 14th.

Dundee.—June 4th. Corporation Electricity Department. Reinforced-concrete floors and jointless flooring, required for the extension to Carolina Port generating station.

Edinburgh.—June 21st. Two 5,000-KW. turbo-alternators and condensing plant, for Portobello supply station. See "Official Notices" to-day.

Finchley.—May 31st. U.D.C. Wiring, for light, 100 workmen's dwellings. See "Official Notices" May 7th.

Grangemouth.—The burgh invites tenders for supply of stores, including electric lamps. Mr. David A. Donald, Burgh Engineer.

Leeds.—May 26th. Corporation. Steam, feed and water pipes. See "Official Notices" May 7th.

London.—L.C.C.—The Highways Committee recommends that tenders be invited from selected firms for the provision of switchgear in connection with the temporary supply of power for the working of the Council's tramways, and that the chairman and the vice-chairman of the Committee be severally authorised during the Whitsuntide recess to accept the most favourable.

June 4th. Installation, 260 wiring points, 345 lights, also electric bells, at the County Secondary School, South Hackney. See "Official Notices" to-day.

Manchester.—June 2nd. Corporation. Coal-unloading crane, conveying plants, &c. See "Official Notices" May 7th.

Middlesbrough.—5,000 tons of rough small steam coal, for the Cleveland and Durham Electric Power Co., Ltd. Particulars from the Secretary, Hinton's Buildings.

Portsmouth.—June 1st. Corporation. 100 tons of steel girder tram rails, five tons of steel fishplates, one ton of fishplates, three tons of 5-ft. wrought-iron tie-bars. See "Official Notices" May 14th.

May 26th. Electric lighting, &c., at Girls' Hostel, for the Education Committee. See "Official Notices" May 14th.

Rangoon.—August 11th. Installation of a system of fire-alarms for the municipality. Specification (10s.) from Messrs. Ogilvy, Gillanders & Co., 67, Cornhill, E.C.

Sheffield.—May 28th. Two natural draught cooling towers complete. For the Electric Supply Department. See "Official Notices" May 7th.

Tasmania.—LAUNCESTON.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Wigan.—May 29th. Corporation. H.T., three-core, paper and lead-covered, armoured feeder cable, transformer and switchgear. See "Official Notices" May 14th.

CLOSED.

Australia.—The Melbourne, Brunswick and Coburg Tramways Trust has accepted the tender of Messrs. Duncan and Fraser, of Adelaide, for 12 cars at £486 per car. Tenders let for the overhead equipment and material, sub-stations, trucks, wheels, axles and car equipment amount to over £53,000. The system is expected to be running early in 1916.

East Ham.—The tender of Messrs. Dick, Kerr & Co., Ltd., to re-equip one of the tramcars with a 40-H.P. motor, new controllers, &c, for £275, has been recommended to the T.C. for acceptance.

Edinburgh.—The Corporation E.L. Committee recommends the acceptance of the tender of the Stirling Boiler Co., Renfrew, at £32,000 in connection with the extension works at Portobello.

Hendon.—The following tenders have been received by the Guardians for installing electric light at the institution:—

Hendon Electric Supply Co.	(including lamps and shades) (accepted)	£350
Strand Electric Co.	(do. do. do.)	421
C. C. Pudney & Co.	(not including lamps)	310
Napier-Kimber, Ltd.	(not including lamps and shades)	212
H. J. Galliers	(do. do. do.)	334
A. F. Goodwin & Co.	(including lamps and shades)	469
Electra, Ltd.	(do. do. do.)	370
C. H. Cathcart & Co.	(not including lamps and shades)	475

The tender of the Hendon Electric Supply Co., provided for a 10-H.P. motor, which was larger than required for the institution. The firm were, however, prepared to supply a 7½-H.P. motor and allow £4, and a further £6 discount on lamps, &c., which would reduce their tender to £340. The company's amended tender has been accepted.

Ilford.—The District Council has accepted the tender of Edison Accumulators, Ltd., at £1,240, for the supply of an electrical coal wagon of 4 tons' capacity, fitted with battery and automatic tipping gear. According to the report of the electrical engineer, the tenders received included three makes of battery, viz., lead, lead (ironclad) and Edison. The lowest cost of carrying 12,000 tons of coal annually was quoted by the Cedes Electric Traction, Ltd., whose vehicle is fitted with a lead battery. The next lowest was that of the Edison Accumulators, which was only £6 above that of the Cedes Co. The engineer was of opinion that the best proposition was that of Edison Accumulators, Ltd., because, although the first cost was rather higher than some of the other quotations, the running cost was less, and at the end of 10 years, when the capital had been wiped out, the vehicle should still be fit for several years' further service.

Ipswich.—The T.C. has accepted the tender of Messrs. Heenan & Froude for extensions to the refuse destructor plant. The total cost will be £5,200.

London.—The Metropolitan Asylums Board has accepted the tender of the London and Rugby Engineering Co., at £32, for an electric motor for driving workshop tools at the North-Western Hospital: also the tender of Messrs. Lund Bros., & Co., at £28, for accumulator-charging plant at the South-Eastern Station.

Bermondsey.—The Electricity Committee recommends the acceptance of the tender of Messrs. Babcock & Wilcox, Ltd., at £1,330, for three chain grate stokers.

L.C.C.—The Education Committee recommends that the chairman, vice-chairman and deputy-chairman of the Council, the chairman and vice-chairman of the Education Committee, or the chairman and vice-chairman of the Education (Buildings Sub-) Committee may open during the Whitsuntide recess tenders for installing electric light in the County Secondary School, South Hackney.

Maidstone.—For the E.L. installation at the Agricultural Hall the following tenders were received:—

W. Cogger	(accepted)	£27
Drake & Fletcher		39
W. T. Burrows		40
Haynes Bros.		46
Oswald Jones & Co.		49

Malvern.—The U.D.C. has accepted the tender of the Electrical Apparatus Co., Ltd., for a year's supply of meters.

The Gas and Electricity Committee has accepted the following tenders for coal:—South Wales and C. C. Coal Co., Ltd., 2,500 tons; Mr. W. Edwards, 1,500 tons; Wilson, Carter & Pearson, 2,000 tons.

Meter Contracts.—Messrs. Chamberlain & Hookham, Ltd., have received the following contracts for the supply of meters for the coming year:—Battersea, Dundee and Swansea; also from Southwark, for prepayment meters.

Messrs. Ferranti, Ltd., have recently obtained contracts for C.C. meters for one year from the following electric supply authorities:—Hornsey, Battersea, Pontypridd, Edinburgh, and Stockton-on-Tees. Also from York Corporation for prepayment meters for a year.

The Southwark Borough Council has placed a contract for D.C. meters up to and including 25 amperes, and the Worthing Corporation has placed a renewal contract for the sole supply of 3-ampere meters during 12 months, with the Electrical Apparatus Co., Ltd.

The County Borough of East Ham has placed a contract with the British Thomson-Houston Co., Ltd., of Coventry, for twelve months' supply of their direct-current meters.

Pontypridd.—The U.D.C. has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for "Wotan" and tantalum lamps for twelve months.

Southend-on-Sea.—The following tenders have been recommended to the T.C. for acceptance:—

John Browne.—Five dozen steel tram tires, £20 per ton.
F. Carrick & Sons.—Overhead travelling crane, £301.

Tottenham.—The District Council has been recommended to accept the tender of Messrs. Keene & Co., at £90 10s., for the supply of an electric motor.

FORTHCOMING EVENTS.

Association of Supervising Electricians. Tuesday, May 25th. At St. Bride's Institute, Bride Lane, E.C. Annual General Meeting.

Institution of Electrical Engineers.—Thursday, May 27th. At 8 p.m. At Victoria Embankment, W.C. Annual General Meeting.

Physical Society of London. Friday, May 28th. At 8 p.m. At King's College, Strand. Papers on "Numerical Relations Between Electronic and Atomic Constants," by Dr. H. S. Allen; "A Method of Calculating the Absorption Coefficients of Homogeneous X-Radiation," by Mr. H. Moore; "Two Experiments Illustrating Novel Properties of the Electron Currents from Hot Metals," by Prof. O. W. Richardson, F.R.S.; "High Permeability in Iron," by Prof. E. Wilson.

Royal Institution of Great Britain.—Friday, May 28th. At 9 a.m. At Albemarle Street, W. Paper on "Engineering Problems of Mesopotamia and Euphrates Valley," by Sir J. Jackson.

NOTES.

Trans-Oceanic Telegraphy.—Some time ago it was announced in Germany, on good authority, that the German cable companies would by no means pass over the payment of dividends for the past year, notwithstanding the protracted interruption of traffic through British action. Apart from the fact that business had been in course of further development in the first seven months in 1914, the German cable companies are in enjoyment of Imperial subsidies which were fixed in such a manner as not only to afford security for the loans issued by them, but also to ensure a certain return to the ordinary shareholders. At the same time it has to be borne in mind that the working expenses, particularly in regard to the cost of acquiring new business, have been reduced by the compulsory interruption of traffic. This statement has now been confirmed in one case, seeing that the German Atlantic Telegraph Co. proposes to pay a dividend of 6 per cent. as compared with 7½ per cent. in 1913.

A further matter of current interest relates to wireless telegraphy across the Atlantic. It will be recollected that in September of 1912 the High-Frequency Machine Co., of Berlin, concluded an agreement with an international undertaking—the Compagnie Universelle de Télégraphie et Téléphonie, of Paris—whereby the latter was to take over the stations built or then in course of construction by the former, at Eilvese, in Germany, and Tuckerton, New Jersey. The explanation of the proposed transfer lies in the fact that the Germans assumed at the time that their aims would be more likely to obtain recognition, especially in the United States, through an international than through a purely German enterprise. At any rate, the German company was to receive, partly in cash and partly in shares, the sum of £100,000 from the Paris company for the use of the Goldschmidt high-frequency machine patents outside of Germany, and £80,000 for the station at Tuckerton, but it is uncertain how much was to be paid for the Eilvese station, if it was really intended that this should be transferred to the control of the international company—a control which would probably have been merely a nominal one from the Teutonic point of view. But the occurrence of war naturally brought about a change in relationship. When hostilities first took place the transmission of wireless messages between the Tuckerton station—which had been established prior to the Germans securing a licence or concession from the Government of the United States—and the Eilvese station had passed beyond the experimental stage, and an application was then submitted to the American authorities asking for a concession.

The agreement between the two companies had not been completed on the outbreak of the war, but the Paris company is now seeking to secure its fulfilment in the United States, through proceedings which have been instituted in the courts at New Jersey, although the Tuckerton station, which has been placed under the control of the United States Government for the duration of the war, would be of no use unless a corresponding station were erected in France. The German company contests the competency of the New Jersey courts, contending that the plaintiff company must proceed before the German courts. It is also submitted, according to a New York correspondent of a German newspaper, that actions for differences in regard to property between subjects of nations now engaged in war cannot hold good, and that if the American courts settled them they would represent a breach of neutrality. If, however, the Paris company were placed in possession of the Tuckerton station, the Eilvese station would not remain in communication with it, and thus the service to Germany, which is now maintained only through the American control, would be, it is held, seriously injured. It is specially by means of this station, apart from the station of lesser power at Sayville, that communication is maintained with Germany, which would otherwise be entirely cut off from the United States. On the other hand, it is urged that the surrender of the Tuckerton station to the Paris company would also have the result of rendering matters inconvenient for the American Government. The correspondent concludes, therefore, that even if the New Jersey courts should decide in favour of the plaintiff company it is probably out of the question that the latter would gain possession of the station, and that there are so many legal measures available against such a judgment that the war would have to last a very long time before these resources were exhausted.

Denmark.—A firm of engineers in Odense desires to secure the representation of United Kingdom manufacturers of electrical goods, including transformers, insulators (especially H.T.), insulating materials (fibre, &c.), watertight fittings, tumbler and ironclad switches, ammeters and voltmeters. Apply to the Commercial Intelligence Branch of the Board of Trade, London, E.C., for the name and address.

Patents and Alien Enemies.—Application has been made to the Board of Trade by Messrs. Gilbert Gilkes & Co., Ltd., to avoid or suspend Patent No. 22,565/12, granted to Honold, for runners for Francis turbines. The Board has granted a licence to Messrs. W. T. Henley's Telegraph Works Co., Ltd., in respect of Patent No. 5,198/08, granted to Miele.

The King at Parsons's Turbine Works.—In the course of his visit on Wednesday to Tyneside engineering and shipbuilding works, his Majesty the King was conducted through Messrs. Parsons's turbine works by Sir Chas. Parsons.

Market Quotations.—The British Aluminium Co. quote the following prices for aluminium:—Ingots, £[illegible] per ton; wire, £[illegible] per ton; sheet, £[illegible] per ton.

The British Association.—At the annual meeting, which, as already announced, takes place at Manchester, from Tuesday, September 7th, to Saturday, September 11th, Prof. A. Schuster will deliver the presidential address in the Free Trade Hall, and the evening discourses will also be delivered there. A conversazione will be held on Wednesday evening, September 8th, in the Manchester Institute of Technology. It is hoped that visits may be paid to some of the principal works, mills and warehouses of Manchester and Salford. The reception room will be in the Whitworth Hall of the University. The sectional meetings will take place in the buildings of the University or its immediate neighbourhood.

Section A.—Mathematical and Physical Science.—Chairman, Sir F. W. Dyson, F.R.S.

Section B.—Chemistry.—Chairman, Prof. H. B. Baker, F.R.S.

Section G.—Engineering.—Chairman, Dr. H. S. Hele-Shaw, F.R.S.

Sheffield Electrical Social Union.—On Monday evening, the 17th inst., the members of this Union held a successful gathering at Stevenson's Restaurant, Castle Street, Sheffield. Tea was served at 6.30, and was followed by a thoroughly enjoyable Smoking Concert. Well encored songs were given by Messrs. Farrant, Giles, Burdett, Robinson, Chatfield, Royce and Hemmington, whilst Mr. Clarke gave banjo solos. Mr. Lumb was in the chair.

Canada.—A Vancouver firm desires to be placed in communication with United Kingdom manufacturers of dry batteries and bulbs for flashlights, torches, &c., torch cases, flashlight cases, and nitrogen-filled half-watt lamps. An agent in Montreal, who has had considerable experience in the purchasing of hardware and electrical fixtures and general tramway supplies, desires to secure the agencies of United Kingdom manufacturers of these goods. Applications should first be addressed to the C.I. Branch of the Board of Trade in London.

Fires Due to Air Raids.—The British Fire Prevention Committee, which is always on the alert for an opportunity to carry on its beneficent work, has issued a circular (memorandum No. 18) pointing out that the fire brigades will necessarily devote their attention first to protecting Government offices and military stores and works, so that the owners of private property should organise measures for their own protection. Suggestions are therefore given as to the proper steps to be taken in anticipation of raids by air-craft, and technical advice in special cases is offered free of charge. Inquiries should be addressed to the Gen. Hon. Secretary, Mr. Ellis Marsland, 8, Waterloo Place, Pall Mall, S.W.

British Industries Fair.—According to all reports the British Industries Fair, held at Islington, has been an unqualified success. A dinner was to be held on Wednesday night at the Hotel Cecil, Lord Southwark, President of the London Chamber of Commerce, presiding, and with Mr. Runciman, President of the Board of Trade, as principal guest, for the purpose of marking exhibitors' appreciation of the services of the Board of Trade. The *Times*, in referring to the large amount of business that has been done as the result of new industrial enterprises embarked upon since the outbreak of war, says:—"In the glass and pottery sections orders amounting to some £40,000 have been placed for glass bulbs for electric lamps, in which Germany has hitherto held a lead." There seems to be a strong desire for the Government to organise the Fair annually, and there can be little doubt that, as we suggested last week, if such a course be adopted, quite a big event of very far-reaching importance, requiring much larger premises, may be expected.

L.C.C. Employés.—It was reported at Tuesday's meeting of the L.C.C. that a petition had been received from some of the light and power attendants employed in the rolling-stock section of the tramway department asking that their rate of pay (8d. an hour) be increased by 1½d. an hour; that light and power attendants who had done wiremen's work in the past, and were now engaged on electrical work, might be regarded as traction wiremen for depôt work only; and that an opportunity might be given for such traction wiremen to be promoted to the grade of general wiremen as vacancies occurred. As the Highways Committee was not prepared to recommend the Council to accede to these requests, the men asked that their application be referred to the appropriate conciliation board, and it is proposed that this course be agreed to.

Thefts of Electric Lamps.—At the Central Criminal Court, before the Recorder, Alfred Sears, 43, traveller, was convicted of stealing electric lamps from the office of Mr. Farloe, 50, Gresham Street. It was stated that the prisoner had made a practice of visiting various offices and, representing that he had authority to inspect electric lamps, had availed himself of the opportunity of substituting old lamps for new ones, which he took away and sold. He was detected by the housekeeper at 50, Gresham Street and given into custody. He said, on arrest, "Do forgive me, I have a wife and family." Detective Dyer, City police, proved that accused had been twice previously convicted of stealing electric lamps, and there were numerous complaints of losses from City offices. Prisoner was sentenced to 12 months' hard labour.

Inquiry.—Makers of Reflex carbons for kinematograph purposes are asked for.

Institution and Lecture Notes.—Electrical Association of Australia.—In his address as president of the Victorian Section, on March 31st, Mr. W. H. Alabaster detailed the progress that had been made in the use of electricity in Melbourne during the past 10 years, and indicated the possibilities for future advances. In 1914 the Melbourne undertakings had an output of 36 million units; he anticipated that in five years this would be increased to 100 millions, in addition to 129 millions for the suburban railways, making a total of 229 million units for Melbourne and the suburbs, Mr. Alabaster also discussed the use of electricity for cooking. which he had practised for a long period in his home; he considered that some system of hire-purchase was necessary to induce consumers to install the apparatus.

Junior Institution of Engineers.—Mr. C. H. Woodfield, speaking recently on the subject of cranes, said that in the comparison of steam or hydraulic cranes with electric cranes, there was not a single feature in favour of the former two as regarded cost of installation, durability, economy in working and upkeep, or facility of control. An important feature in favour of the electric crane was the ever-ready reserve power up to 100 per cent. momentarily and 50 per cent. for a longer period than was required for crane work. As regarded upkeep, the wear and tear of electric motors was not half as much as for the steam crane.

Society of Engineers (Incorporated).—On the 11th inst. Mr. A. H. Barker, Wh.Sc., read a paper on "Heating and Ventilation." He said that the legitimate function of the engineer was to produce and control specified movements of air and other effects, while it should be the duty of the physiologist and hygienist to specify what were healthy and comfortable conditions. In connection with heating, the expression "temperature of a room" was generally understood to mean the reading of a thermometer suspended in the room, but this reading did not necessarily indicate the temperature of the surrounding air, or form a reliable guide to the feelings of the occupants of the room. The air temperature, the radiant temperature, the quantity of convected heat and the quantity of radiant heat must all be determined, but first the relation between the thermometer reading, the air temperature and the radiant temperature must be determined. The freshness of air in a building depended on keeping the air temperature relatively low and the radiant temperature high. The chemical composition of the air had, within wide limits, no effect on the human organism, whereas the temperature and humidity were very important. The paper described experiments made at University College and the apparatus used in connection with them, and discussed briefly some problems which it was sought to solve experimentally.

Electric Lift Fatality.—At an inquest at Manchester recently, touching the death of Harold Vincent Burgess (27), who received fatal injuries through being pinned in the well of a lift for 40 minutes, it was stated that he pushed a truck into the cage of the lift and in endeavouring to reach over to press the lever he slipped. The lift was set in motion and, his legs hanging beyond the floor of the cage, he was trapped between the wall and the cage on the second floor. A verdict of "Accidental death" was returned, and the Coroner, commenting on the fact that he had conducted a similar inquiry a day or two before, said it seemed to him that there should be some protection for the starting handles of lifts.

Educational.—University of Bristol.—In order to provide additional residential accommodation for students, the University has recently rented houses which will form a temporary college for men students, and will be ready for use in a few weeks.

German Business Methods.—At the Sales Managers' Association in London last night, Mr. J. H. Vickery, LL.B., a Canadian, who for fourteen years practised International Law in Berlin, delivered an address on "German Business Methods as seen by a Canadian Resident in Berlin."

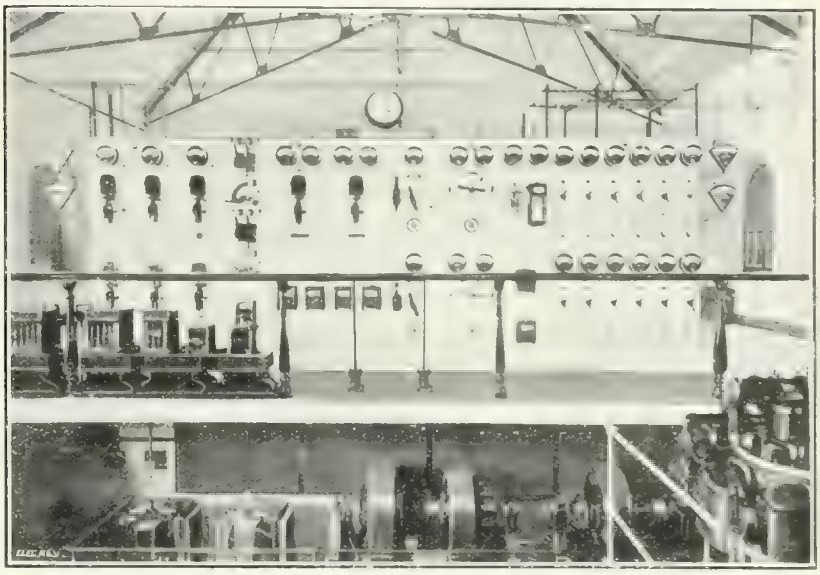
Appointments Vacant.—Junior assistant electrical engineers, over 19 (15s.), for Newcastle-on-Tyne Electric Supply Co.; junior engineer (temporarily), for Walsall Mains and Sales Departments (£2); charge engineer (38s.), for duration of war, for Wakefield Corporation. Particulars are given in our advertisement pages.

Copper.—The gradual increase in price of standard copper does not, so far, appear to have stimulated production in any marked degree. Messrs. H. R. Merton & Co.'s tabulated statistics for May 15th show an increase in European visible supplies of 1,065 tons for the fortnight, and an increase in English supplies of 2,915 tons. In detailed supplies. European arrivals from North America are low as compared with the pre-war average. Supplies from Spain and Portugal to England and France are well up, and considerably above the pre-war average, and those from unclassified "other countries" are also high. Chile shipments show the unusually low figure of 842 tons for the fortnight, which may be due to the large quantity received last month from this source. Australian shipments are maintained at the same figure as for the last three months, which is still about a quarter less than the pre-war average, though better than the earlier months of the war. Total deliveries are low compared with those for March, but promise to considerably exceed April deliveries. In view of unusual consumption it is remarkable that the price does not more rapidly increase, and that visible supplies increase at all.

(*Continued on page 733.*)

ELECTRICITY SUPPLY AT KARACHI, INDIA.

Karachi, the most westerly of the four great ports of commerce in the Indian Empire, has, during recent years, been growing in importance at a phenomenal rate, and it is not impossible that it will loom largely in the map of the world that is now being remade, as the Government have intimated that it will be the Indian terminus of the proposed great Trans-Persian Trunk Railway connecting Europe with India through Moscow and Baku, and surveys of the first part of the route from Karachi have already been made.



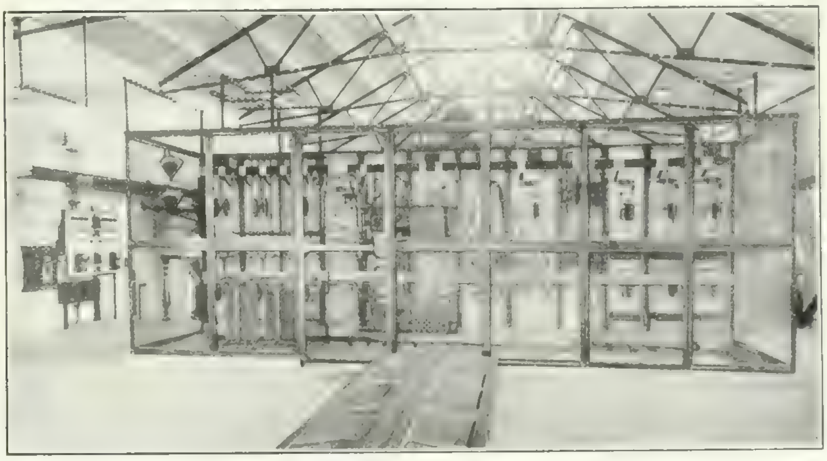
Main Switchboard, Karachi Electricity Station.

It is the chief outlet for the products of the Punjaub (wheat, oilseed, cotton, &c.), and has considerable commerce with Afghanistan and Baluchistan.

The total trade of the port has increased by leaps and bounds, and in 1912 it reached the phenomenal figure of £40,725,000, while in 1914, despite the war, it was still £34,000,000.

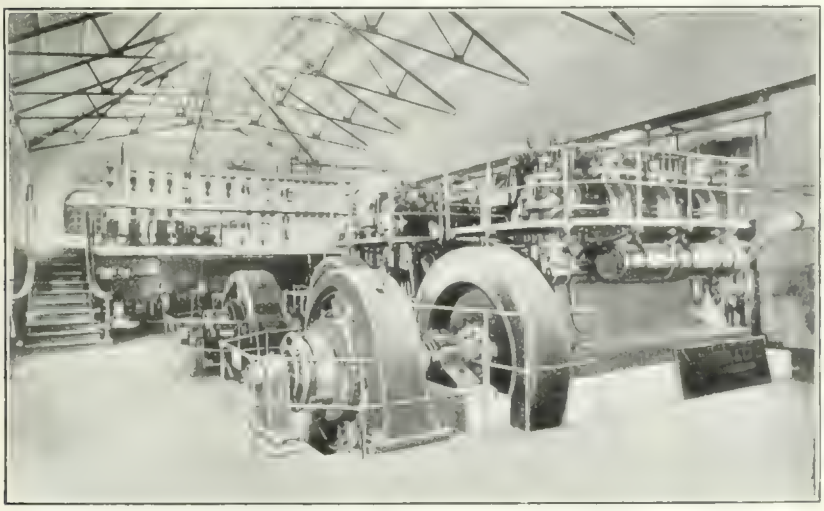
The population between the census of 1901 and that of 1911 jumped from 115,402 to 159,270—an increase of 38 per cent.

The commerce of the port overshadows everything else, but there naturally follow in its wake industries established there that pertain to commerce, among which are extensive local flour mills, ironworks, printing presses, soda water factories, &c., with land and facilities all ready for the considerable increase in their number that is sure to result from the general trend of events and the importance of the district.



View behind Switchboard, showing Cover of Battery Regulating Switches.

Some years ago the Port Authority installed their own electrical undertaking, but up to a month or two ago there was no public supply of electrical energy or of gas. A few years ago, however, the Hon. Mr. M. de P. Webb, C.I.E., of the well-known firm of Messrs. Forbes, Forbes, Campbell and Co., Ltd., took the preliminary steps to introduce a scheme for the supply of electrical energy, and this has now been achieved.



Interior of Engine Room, showing Diesel-Electric Plant.

It will be observed that Karachi is one of various prosperous communities in the East which have preferred to rely on electricity rather than on gas for their development and well-being.

Messrs. Crompton and Co., Ltd., the well-known electrical contractors, came on the scene at an early stage, and with their assistance, the Hon. Mr. M. de P. Webb investigated the prospects of a public electric supply undertaking, as a result of which Messrs. Forbes, Forbes, Campbell & Co., Ltd., decided to apply, under the Indian Electricity Act of 1910, for a Government Licence to supply electrical energy in Karachi.

This was granted in due course, and in 1912 the licensees retained Messrs. Handcock & Dykes, of Westminster, as their consulting engineers.

After some negotiations a very suitable site was selected in the Elander Road, with ample space for extensions, and with access to the railway.

As a result of full consideration it was decided to install a direct-current Diesel-driven plant, with a three-wire system of distribution throughout the district, and early in 1913 the Karachi Electric Supply Corporation, Ltd., was brought into existence, for the purpose of taking over the rights conveyed by the licence and of putting them into effect. A contract for the complete equipment of the power house and distributors was entered into with Messrs. Crompton, and shortly after that a start was made on the foundations.

These in themselves were a matter of considerable magnitude in proportion to the works, as, owing to the nature of the soil, it was necessary to excavate to some considerable depth, the work being also impeded by tidal waters and land floods. All difficulties of this nature were gradually overcome, and a substantial armoured-concrete bed put in position to receive the machinery.

PUTTING IN FOUNDATIONS OF STATION BUILDINGS, KARACHI.

The outbreak of the war caused considerable delay in the works, as the licensees, from patriotic motives, decided to transfer part of the staff to the wiring of troopships, while at a somewhat later stage the consulting engineers' representative, and also some of the contractors' representatives on the spot, joined His Majesty's Forces. The work originally was to have been completed by the end of 1914, and, despite delays and other difficulties due to current events, on February 1st, 1915, the completed station was formally opened by the Commissioner in Sind, R. P. Barrow, Esq., I.C.S., in the presence of a large gathering of the principal inhabitants.

WHERE EAST MEETS WEST : NATIVE GROUP OUTSIDE THE GENERATING STATION.

In an important city like Karachi it was necessary to give very careful consideration to the relative merits of overhead and underground distribution, and the engineers ultimately decided in favour of the former. The area of supply is roughly triangular, with the station situated centrally in a three-mile base line.

The first section of the generating plant, as at present installed, consists of two 240 B.H.P. and one 100-B.H.P. Diesel engines, supplied by Messrs. Mirrlees, Bickerton and Day, and direct-coupled to Crompton 440-580-volt dynamos.

The cooling of the circulating water was a problem calling for careful consideration, and the engineers finally decided on using Messrs. Heenan & Froude's coolers, two of which have been provided, either being capable of dealing with the circulating water required at full load. The coolers are fixed in a cooler house opening out of the engine room, a 10,000-gallon water storage tank (fed from the town mains) being fixed above to provide the necessary storage of water.

The main switchboard, consisting of 14 white marble panels, including three generator, two battery, two booster, two balancer, one summation, one earth and three feeder panels, complete with moving-coil measuring instruments and switchgear, is mounted above the battery room, being thus raised some 7 ft. above the engine room floor.

The battery consists of 276 Tudor cells, having a capacity of 653 ampere-hours at the 10 hours' discharge rate.

The pressure of supply is 220 volts on either side of a three-wire system (440 volts across the outers), but at full load the station voltage will rise to about 512 volts, to compensate for the drop in the feeders.

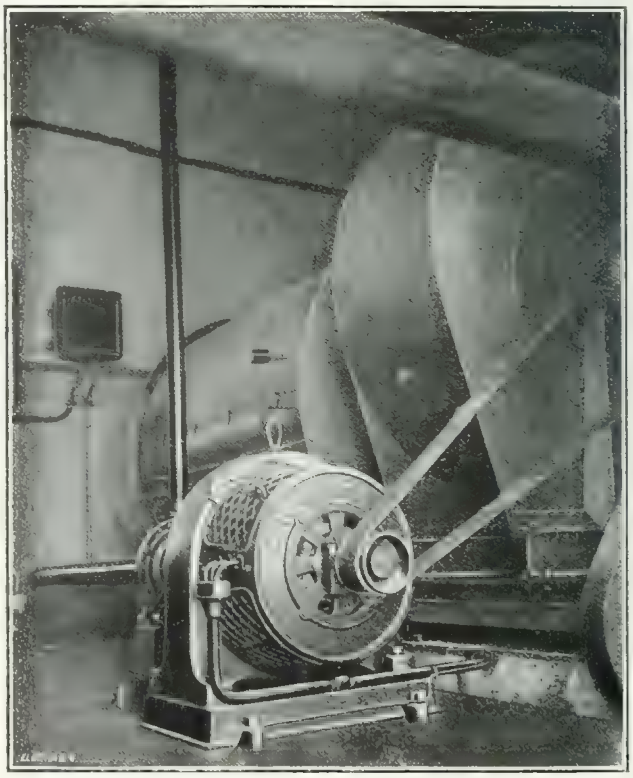
This necessitates battery regulating switches having a large number of contacts; these switches are of the horizontal pattern, and are fixed in the floor above the battery room, behind the main switchboard, being operated by levers similar to railway signal levers, fixed in front of the board.

There are two automatic balancers, each capable of dealing with an out-of-balance current of 75 amperes, and three motor-driven boosters, each capable of a continuous output of 150 amperes at 0—115 volts.

It was thought wise to start, in the first place, with direct current, as tending in the earlier stages to bring the undertaking more quickly to a remunerative stage; but it is not impossible that as the area and the scope of the operations are extended, a mixed system will be adopted to meet the probably large demand for energy for power purposes that is sure to grow up.

The whole of the overhead work has been carried out in strict accordance with the regulations of the Indian Government, and is most substantial throughout, with a considerable margin in the strength of the poles for additions as the undertaking develops.

The weight of copper installed with the first section is 35 tons.



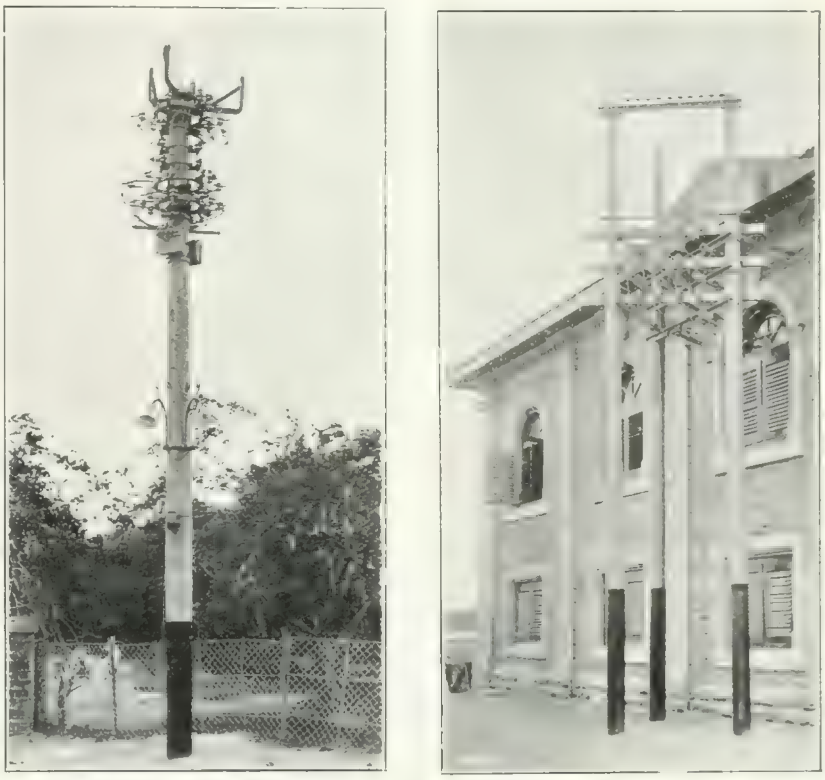
HEENAN COOLER AT GENERATING STATION.

A considerable number of consumers have already been connected, and the licensees have made arrangements by which all consumers who so wish, may have their wiring work carried out at a most reasonable price and in a first-class manner, under their supervision.

Messrs. Crompton & Co.'s contract has been carried out under the supervision of their representative, Mr. T. F. Raven ; the consulting engineers' representative during the earlier stages was Mr. F. N. Menzies, until he joined His Majesty's Forces, and Mr. H. Frazer Nash, his successor, has now become the resident engineer.

Considerable extensions of the works are already in hand, due to a very important contract entered into with the Municipality for public lighting, which, in the first instance, will embrace some 500 lamps.

Not the least interesting circumstance in connection with the undertaking is the fact that of the nine directors, seven are Indian gentlemen, who have given influential support to the project.



Feeder Pole : 36 wires. Station Terminal Pole.

Overhead Distribution, Karachi (see page 729).

THE WOOD GREEN ELECTRICITY UNDERTAKING.

The supply of electrical energy in Wood Green, which commenced last Christmas, is being given by the Tottenham District Light, Heat & Power Co.—formerly known as the Tottenham and Edmonton Gas Light and Coke Co.—to whom the statutory powers were transferred in 1913.

The area of supply under the order embraces the whole of the urban district, comprising 1,625 acres with a population of 50,000 inhabitants.

Link Pole. Pole Line, showing Lighting Bracket.

Overhead Distribution, Karachi (see page 729)

The generating station is situated in Ringslade Road at the rear of the company's local offices and in close proximity to the depôt of the Metropolitan Tramways.

Town gas supplied from the Tottenham works of the company is delivered through a 12-in. main into a holder on the site, which has a diameter of 40 ft., and performs the dual rôle of providing gas storage and maintaining it at the required pressure at the engine valves. A special meter of 20,000 cb. ft. per hour capacity has been provided to measure the gas used.

The generating station is a steel and brick structure with three bays, the centre one forming the engine house ; the ground floor of one of the side bays provides accommodation for the switchboard and electrical control gear, and for a fitters' workshop, above which the battery room has been constructed. Water-cooling plant and silencers occupy the other bay, the water-softening plant, storage tank, offices and stores being situated on the upper floor.

Two sets of generating plant have already been erected, one of 100 kw. and the other of 200 kw. capacity, and space is available for two additional sets of still larger capacity, as the demand develops. There is also a battery of 200-kw. capacity on a one hour discharge.

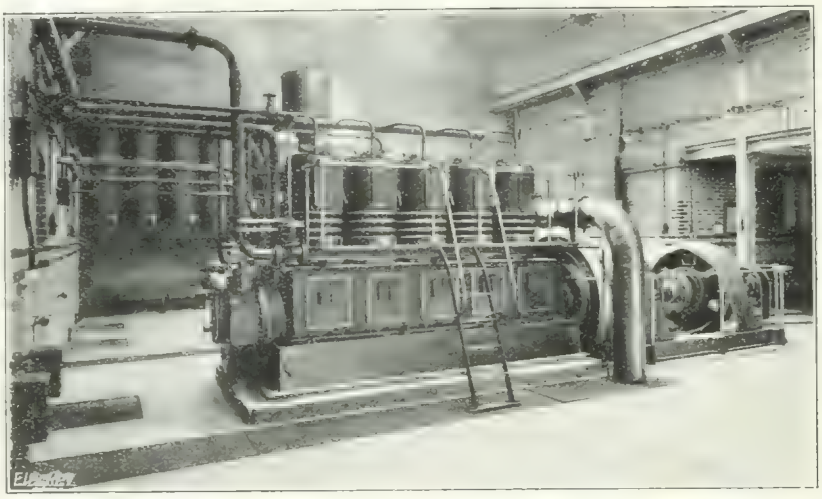
The gas engines are the modern high-speed vertical type, built by Messrs. Hindley and Sons, one of 170 and the other of 340 b.h.p., running at 150 r.p.m. and 350 r.p.m. respectively. Both have five cylinders, and are equipped with forced automatic lubricating arrangements and double magneto ignition.

By means of the multiple cylinders and high speed of rotation, the working parts of the engine are kept comparatively small. As the principal working parts are enclosed and lubricated under pressure, the wear and tear are reduced to a minimum. The engines can be started up and put on full load in less than a minute. There is no noticeable vibration—specially designed foundations having been provided to ensure this—and the silencing of the exhaust has been made almost ideally perfect, the multiple cylinders and high speed being a distinct aid to this attainment.

Compressed air is used for starting the engines, and is taken from a battery of four receivers, which are charged by a motor-driven air compressor.

The circulating water for the engine cooling is supplied by gravity from a tank of 1,600 gallons capacity, situated on the first floor over the cooling plant. By means of interlocking gear between the compressed-air valves and the water valves, the starting up of the engines without first turning on the water is rendered impossible. The water flows into two Heenan rotary water coolers, capable of dealing with 4,000 and 2,000 gallons of water per hour respectively, and is returned to the storage tanks by means of electrically driven centrifugal pumps. All the water used is first treated by a Boby water-softening plant of 300 gallons capacity.

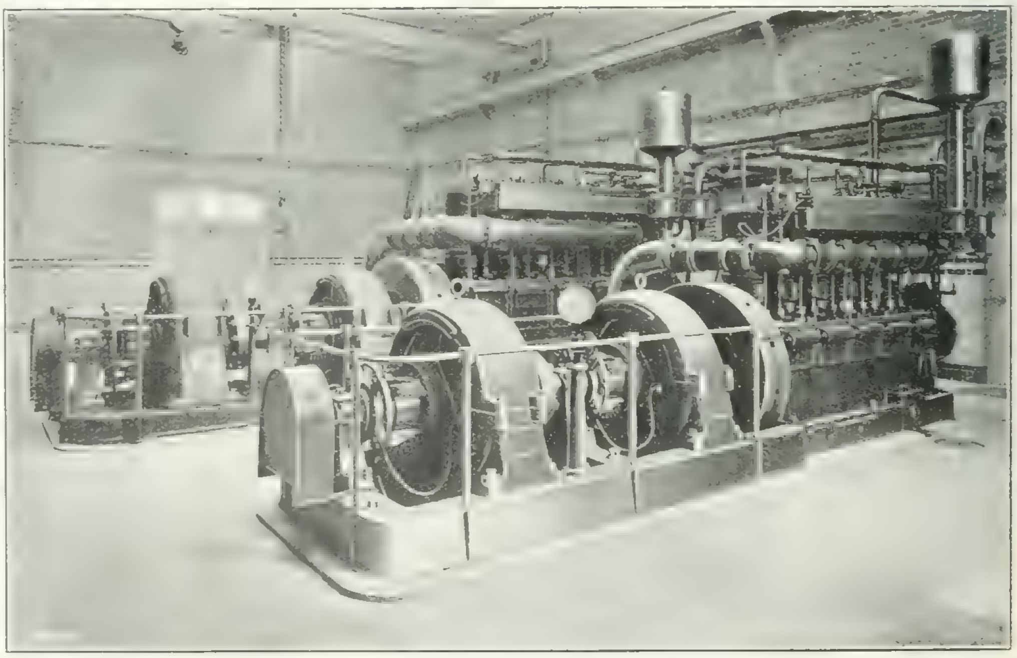
Heenan Coolers at Wood Green Generating Station.



Hindley High Speed Gas Engines Operating on Town Gas.

The engines are directly coupled to tandem direct-current dynamos of the Electric Construction Co.'s make, these being multipolar shunt-wound machines fitted with interpoles. The armatures of each set have been made strictly interchangeable, even to the provision of a coupling outside the outboard bearing. The machines are designed to generate current at any voltage from 250 to 280.

The battery, which was supplied by the Chloride Electrical Storage Co., consists of 270 Plantide cells. The whole of the regulating cells range along one side of the room, and the copper rod connections are carried on insulators on the wall to the centre, where they are carried down through insulating tubes in the floor to the regulating switches which are immediately below.



Wood Green Generating Station: Hindley-E.C.C. Gas-Electric Sets.

For charging the battery there is a double-ended E.C.C. booster in the engine room; the two boosting dynamos each have a capacity of 10 kw., and are driven by a 58-b.h.p. 500-volt motor, running at a speed of 1,200 r.p.m., the starting panel being fixed close at hand.

The switchboard, which also came from the Electric Construction Co., consists of two generator, one battery and booster, one integrating watt-hour meter, and three feeder panels, all of black enamelled slate.

The panels are divided horizontally at the centre by an enamelled slate shield, the top half being devoted entirely to the positive side of the system and the lower half to the negative. All the circuits are protected by automatic cut-outs, and, where suitable, time lag attachments are provided. The whole of the instruments are of the Cirscale type manufactured by the Record Electrical Co. The regulating gear has been kept entirely separate from the board; the resistances are placed in a cellar into which all the cable connections from the generators and boosters come and also the feeder cables. Immediately above the resistances, the control pillars, eight in number, including two for the battery regulating switches, are mounted on the engine room floor. An earth panel with an Everett-Edgcumbe disk recording ammeter, short-circuiting relay and overload breaker, is fixed on the wall at the back of the board.

A 10-ton Morris hand-operated travelling crane has been installed in the engine room.

Under the contract the consumption of gas by the generating sets working at ordinary full load, with gas of 500 net b.th.u. per cb. ft. at a normal temperature and barometric pressure, is guaranteed not to exceed, for the 200-kw. set, 30·75 cb. ft., and for the 100-kw. set, 31·35 cb. ft. per unit generated, as registered by watt-hour meters; trials of the plant give warrant to the view that the guaranteed results will be excelled.

The supply is on the three-wire system at 240-480 volts.

Under the Wood Green Electric Lighting Order the streets scheduled for the compulsory mains were limited to High

Road and Myddleton Road, but the company has inaugurated the supply with a comprehensive system of distributing mains throughout the principal streets of the district.

All the cables are of the three-core type, paper-insulated, lead-covered and steel armoured, and were supplied by the Western Electric Co. There are three feeding centres where the feeder mains serve the distributors, one situated near the Town Hall, one in the High Road adjacent to Noel Park Station, and the other in the Alexandra Park district; at these centres feeder pillars have been erected, and similar pillars in other situations provide an easy means for dividing up the network of distributing mains into suitable sections. All the pillars, service boxes and consumers' fuse-boxes have been made by Messrs. Lucy & Co., while the service and station meters are of the Chamberlain & Hookham type.

The capital expenditure on the scheme, including Parliamentary costs, land, generating station and mains, amounts to about £30,000.

Responsibility for the preparation of the scheme is shared by Mr. A. E. Broadberry, manager of the Tottenham District Light, Heat and Power Co., and Messrs. May and Hawes, consulting engineers. The duties of directing and supervising the constructional operations have been performed by Mr. J. Fisher, assistant manager of the company, and Mr. L. W. Ballard, chief assistant to the consulting engineers, supervised the constructional work, &c.

NOTES.

(*Continued from page 728.*)

Gas Engine Tests.—In a paper read before the Institution of Mechanical Engineers on Friday last by Prof. A H. Gibson and Mr. W. J. Walker, of University College, Dundee, tests on an experimental gas engine made by the National Gas Engine Co., Ltd., are described. Town gas was used, having a lower calorific value of 520 B.TH.U. per cb. ft.

It was found that the mechanical efficiency of the engine, which had a maximum output of 36 B H P. at 250 R.P M., increased with increasing load, the highest value recorded with the richest mixture and at the lowest speed (150 R.P.M.) being 88 per cent. At the normal speed (200 R.P.M.) has the efficiency 85 per cent. The mechanical efficiency diminished as the ratio air : gas increased from 7 : 1 to 11 : 1, and diminished as the speed increased; it was independent of the ratio of compression.

The thermal efficiency, referred to the B H.P., increased with the load, and attained a maximum with an air : gas ratio of 8 : 1; it diminished as the speed increased, and increased with the compression ratio.

Special provision was made for separating and measuring the exhaust losses, which, at full load, lay between the limits 33·6 per cent. and 42·5 per cent. The former value corresponded to a weak mixture, high compression and low speed, and the latter to a rich mixture, low compression ratio and high speed.

Electric Vehicle Committee.—At the last meeting of this Committee held on May 11th, Mr. A. E. Collins, the city engineer of Norwich, took his seat as the representative of the Institution of Municipal and County Engineers; Mr. A. de Turckheim took his seat as representative, *pro. tem.*, of the Tramways and Light Railways Association, and Mr. G. F. Heath, of Heath's Garage, Ltd., as the representative of garage interests.

The Committee considered and passed the draft for the Committee's annual report and accounts, to be incorporated in the annual report of the I.M.E.A., and the Secretary submitted the draft of the report to be submitted for discussion at the annual meeting of the I.M.E.A. on June 17th, entitled "The Uses of the Electric Vehicle in Municipal Service."

The arrangements were discussed for the proposed parade of electric vehicles on June 17th, and the time was provisionally fixed for 5 p.m. If permission is obtained the parade will be held on the Embankment.

As the result of the circular letter sent to electric supply undertakings, a number of them have purchased publicity material; the Secretary, however, reported that he had received several letters which indicated apathy on the part of some undertakings in regard to the electric vehicle business.

The Technical Sub-Committee have now completed the preparation of the report upon "Methods of Charging and Charging Equipments," which is to be circulated to members of Committee. The Committee has decided to ask the Accumulator Section of the B.E.A.M.A. to consider the desirability of bringing about standardisation in regard to (1):—The clearance for the accumulation of sludge between the lower edge of the plates and the bottom of the cell container; (2) the size of the filler plug-hole and a design of plug for same; (3) the distance between the top of the lip of the plug hole and the top edges of the plates, so that one gauge may always be used in a garage for fixing the proper level of the electrolyte, measuring from the top edge of the filler hole lip; and (4) details of connectors between cells and method of connecting these to the plate terminals.

Lead Scarcity in Russia.—The scarcity of lead in Russia is one of the problems of the national electrical industry. Deposits of lead ore having been discovered in the district of Murman, it is announced that a furnace has been erected for smelting the ore in the Ulsen factory, Archangel. The lessees of the deposits are Stephanovitch and Ostrem.

Petrograd Electric Station: Oil Fuel Difficulties.—The introduction of petroleum as fuel at the Petrograd electric tramway power station has led to some irregularities in the supply of current. On May 5th a damaged valve in the tank whence the boilers received their supply resulted in these remaining without fuel. The petroleum had to be fed in by other means; but the result was a reduced supply of electricity and a temporary stoppage of the tramway service. Such is likely to recur at times till all the boilers are equipped for burning liquid fuel. Meantime fresh supplies of coal (the scarcity of which was the cause of the conversion of the boiler furnaces for liquid fuel) are being received.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Aylesbury U.D.C. has re-appointed Mr. W. A. Turnbull as resident engineer at the electricity works, on the same terms as his previous engagement. He has acted as clerk of works during the erection of the station.

Mr. H. Woolgar, fourth engineer at the Fulham B.C. electricity works, has been temporarily appointed to the position of shift engineer, at a salary of £3 per week, during the absence of Mr. A. Abdern on military service, and Mr. L. Float, junior engineer, has been appointed fourth engineer, at a salary of £2 2s. per week.

Mr. C. Handley, shift engineer at the Scottish Central Electric Power Co.'s generating station, Bonnybridge, Falkirk, has resigned his position in order to take up the duties of shift engineer at the Corporation electricity works, Motherwell.

General.—With reference to the notice that appeared in our last issue respecting Mr. Harry W. Nimmo's movements, we learn by this week's mail that the Government of Burmah has, on his being relieved of the duties of Electrical Inspector, retained his services for an indefinite period, for the purpose of getting out detailed estimates of a proposed electricity supply scheme.

Mr. Howard Eady, district telephone manager at Jersey for 15 years, has been appointed manager for the Exeter area. Prior to going to Jersey in 1900 he was at Bournemouth.

Prof. S. P. Thompson, F.R.S., delivered the Swarthmore Lecture at the Central Hall, Westminster, on Tuesday last, taking as his subject "The Quest for Truth."

Councillor Jackson has been elected chairman of the Swinton and Pendlebury Electricity Committee.

Mr. C. C. T. Eastgate has been appointed Electrical Inspector to the Government of the Punjab, Lahore. Mr. J. H. Cardew, electrical engineer, North-Western Railway, Lahore, has resigned the Government service, and Mr. D. A. Petruse, foreman electrician, has been placed in charge of the office of electrical engineer of that railway.—*Indian Engineering.*

Mr. J. Scrivener has resigned his position as director and manager of Messrs. Krupka & Jacoby, Ltd., having been appointed to control the sales organisation of the "Z" Electric Lamp Manufacturing Co., Ltd., Southfields, S.W. Mr. Scrivener's late co-directors have given him a gold watch as a mark of their personal esteem, and the staff have presented him with a suit case.

Mr. Walter F. Bradshaw has been appointed manager of Reuter's Telegram Co., Ltd., in place of the late Baron de Reuter.

Sir Edgar Speyer, consequent upon "charges of disloyalty and suggestions of treachery" that have been made against him in the Press and elsewhere, has asked Mr. Asquith to accept his resignation as a Privy Councillor and to revoke his baronetcy. He has also resigned his seat on the board of the Underground Electric Railways Co. of London, Ltd., and Lord George Hamilton, the deputy-chairman, has been appointed chairman in his stead.

Obituary.—Mr. G. Maurice.—There is, unhappily, no room for doubt that Mr. G. Maurice, of the General Electric Co., Ltd., must be numbered amongst the victims of the *Lusitania* disaster. A correspondent, who was in intimate touch with him, sends us the following personal appreciation:—"As one who was in close companionship with him for 18 years, I feel that some note of appreciation may be welcomed by his many friends in the electrical world. Many qualities go to the making of a man if his success is to be assured. Mr. Maurice most surely exhibited in his business career the possession of all those qualities that may be considered essential ones. Insight to direct him what to do, foresight to tell him how to attain, courage to enable him to overcome—these three virtues were his chief characteristics, and the successful application of them to his daily life may be said to be the foundation on which his career was built. His was a full life; a life largely devoted to the business to which he was attached, and with which his interests were bound up. His career was a singularly successful one; whatever came under his control prospered. His capacity for work was enormous, his ability insured success, his handling of large affairs was conducted with [illegible] judgment and will, and a firm belief in the righteousness of his action invariably carried him through, no matter how fierce the opposition against him. No man can go through life without meeting opposition in the course of his business career, and Mr. Maurice had many opportunities of crossing swords in the pursuit of his aims; but he was a good fighter who invariably earned the respect of his opponents. In estimating his personal expression as revealed to those who came in contact with him, I think the word "respect" most closely expresses the influence he exerted over others, over the staff, his competitors, in fact over all with whom he had business relations. The many warm expressions of regret received from business men all over the world show in how much respect he was held, and how deeply his loss is deplored. It is doubly sad since the many years of faithful, strenuous, and hard endeavour had but recently won him a seat on the Board of the G.E.C., in which position his characteristic ability would have found still greater fields in which to operate. Mr. Maurice leaves a wife and one child, a daughter." We may add our own personal appreciation of the late Mr. Maurice, as the result of editorial relations with him extending over many years, perhaps more particularly in connection with matters concerning the G.E.C. electric light fittings department, and latterly the heating and cooking department. There are few men in the electrical industry with whom it has been so genuine a pleasure to converse as with him; his was the perfection of courtesy—a quality which editors, who not infrequently come across something totally different, know how to value when they meet it.

Mr. H. F. Friederichs.—At the funeral of the late Mr. Friederichs, Corporation electrical engineer at West Hartlepool, there were indications of the affection and esteem in which he was held. Among the chief mourners were Mr. J. E. Dawson, chief assistant, Mr. C. W. Thompson (electrical engineer, Saltburn), the Mayor and many members of the Corporation, Mr. J. J. Smith (electrical engineer, Stockton), and the staff of the West Hartlepool electricity department. The body was borne to its last resting place in Stranton Cemetery by some of the oldest workmen. Among the wreaths was one from Sir John Snell, and one from the workmen and staff of the electricity works bore the inscription: "A tribute to our noble and unselfish master." A member of the staff, in writing to us, describes Mr. Friederichs as "one of Nature's gentlemen," and makes mention of his genial, kind and unassuming manner, which secured for him the passionate attachment and devotion of the whole of his staff.

Mr. Brodrick Cloete, a director of Messrs. Vickers, Ltd., was among those lost in the *Lusitania*.

NEW COMPANY REGISTERED.

Simplex Sleeper Syndicate, Ltd. (140,241).—This company [illegible] in 2,500 [illegible]

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Pernambuco Tramways and Power Co., Ltd.—Issue on [illegible]

Phœnix Electric Heating Co. (1914), Ltd.—Mortgage on [illegible]

Torquay Tramways Co., Ltd.—A memorandum of satis[illegible]

Barbados Electric Supply Corporation, Ltd.—Issue on [illegible]

Stella Conduit Co., Ltd.—Mortgage on land and premises, [illegible]

Harrow Electric Light and Power Co., Ltd. (44,529).—[illegible]

Isle of Wight Electric Light and Power Co., Ltd. (53,823).—[illegible] Return [illegible]

Oswestry Electric Lighting and Power Co., Ltd.—Issue on March 2[illegible], 1915, of £300 debentures, part of a series of which particulars have already been filed.

Newtons, Ltd.—Particulars of £10,000 debentures, created March 23, 1915, [illegible] Companies (Consolidation) Act, 1908 [illegible]

Novelty Construction Co., Ltd.—A memorandum of satisfaction [illegible] £200 on March 12, 1915, of debentures dated May 31, 1912, [illegible] £200 [illegible]

Carville Site and Power Co., Ltd.—Issue on April 28th, 1915, of £10,000 [illegible] been filed.

CITY NOTES.

Shanghai Electric Construction Co., Ltd.

The directors report for 1914 a profit of £33,602, compared with £51,726 for 1913. There has been transferred to reserve for renewals account £10,000, and in reduction of the preliminary expenses account £1,000; a dividend of 6 per cent. for the year (less income tax) absorbs £19,200, leaving to be carried forward £1,765.

The loss by exchange on subsidiary coinage in 1914 was £28,038, which is equal to 8¾ per cent. on the capital of the company. Profits have been converted into sterling at an average rate of 1s. 9¼d. to the Mexican dollar, as against 2s. for the preceding year. During the year the increased depreciation of subsidiary coinage, and the fall in the exchange of silver into sterling, reduced the net profits shown to the extent of over £7,000 as compared with the company's experience in these respects in 1913. For the first half of the year the number of passengers, and the amount of gross receipts and operating profit, showed a satisfactory expansion, which was to a large extent neutralised during the remainder of the year by the less favourable conditions following upon the outbreak of war. Thirteen new motor cars and 15 new trailer cars were completed during the year, and a further 10 new motor cars have been completed since the close of the year.

Endless traction was introduced with seven cars in Fokien Road in November last with satisfactory results as regards receipts, but was suspended in consequence of the road bed being found unsuitable. Fokien Road is accordingly to be reconstructed in concrete, to the initial cost of which the company will make a moderate contribution. Traffic conditions will be materially improved by the reconstruction, and the Municipal Council will reduce the charge to the company for road maintenance. The directors announce with great regret the death of their colleague, General Albert Thys.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

The directors in their report show that the drop in the profit for the year 1913 was due to exceptional causes, the result for 1914 is well up to the average of previous years. The dividend on the preference shares has been maintained at 4 per cent., and a debenture redemption fund has been inaugurated by the allocation of £7,000 for this purpose. The sum of £6,500 has been written off to depreciation for the year, leaving, after payment of the debenture interest, £846 on profit and loss account to be carried forward. The moneys set aside in previous years as a "reserve for depreciation and renewals" having been expended, has, with the approval of the auditors, been written off. The war has not interfered with the company's operations and did not add much to its operating costs during the past year. During the current year the company will be affected by increased taxation demands both in Australia and this country. Its operating costs will also be somewhat increased as nearly every item of stores and supplies is costing, and is likely to cost, a higher figure.

Annual meeting, May 25th.

Anglo-American Telegraph Co., Ltd.

Mr. F. A. Bevan (Chairman) presided on Friday, at Winchester House, E.C., over the annual meeting. He said that they had during the year received the rent payable under the lease with the Western Union Co., which sufficed to pay the dividends on the three classes of stock. As they were aware, the deferred dividend was payable at the end of each year, and the proportion of the quarterly rental that represented such deferred dividend was accordingly retained and invested on the best terms that the directors could secure. As a result, £1,[illegible] was received in respect of interest on bank balances and loans, which with the amount previously earned produced £5,625. That sum, subject to the requirements of the company from time to time, the directors were advised was available for distribution amongst the deferred stock holders and the ordinary stock holders. It had been suggested that the directors should make an immediate distribution of this sum, but they had come to the conclusion that the amount was too small, looking to the large number of deferred stock holders, and to the very small sum that would consequently pass to them. They thought it would be advisable to wait until they were able to distribute, say, ¼ per cent. upon the deferred stock, including, of course, the ordinary stock holders' interest in that stock, which would absorb £5,750, towards which, as he had said, they had £5,625 in hand. In the renewal fund account it would be seen that they had received the annual contribution of £20,000 from the Western Union Telegraph Co., as stipulated in the lease, and £2,487 as interest and dividends on investments, which with the amount brought forward from the previous year gave a total of £153,099. Out of that they had had to pay the cost of new cable inserted during the repair and renewal of the cables, amounting to £44,955, and they had also paid £15,800 on account of the new cable repair ship. In respect of that, there was a further liability of approximately £57,000 to be paid before the ship came into their possession. They had for several years been considering plans for a new cable ship to replace the old one, which was in such a condition that it was imperative that it should be replaced. Accordingly, under the agreement with the Western Union Co., they entered into a contract for a new ship, the total cost of which would at the outside be £81,000. In ordinary circumstances the ship would by now have been completed, but owing to the war, private contracts had to stand aside for Government work; but they hoped to get delivery of the ship before the autumn. They were fortunate in having concluded the contract before the war, or the price would have been increased 30 or 35 per cent. In order to make the payment for the new cable and ship, it was necessary to realise investments, and this resulted in a loss on the sale of £3,632. Whilst this was a matter to be regretted it was, of course, one they were powerless to prevent, and when one considered the heavy depreciation in all classes of securities they would agree they could congratulate themselves that the loss was limited to the small sum stated. As to the renewal fund, it could only be a matter of time when the balance would be eliminated from the accounts. At the moment the balance was £60,625, of which £41,867 represented the cost of investments. Since the date of the balance sheet the majority of the securities had been sold to make further payments on account of the new ship, and he need scarcely say that they had been sold at a substantial decrease on the cost price. The securities which had not been sold were for the time being practically unsaleable, and if disposed of in these times there was very little hope of their getting back the money paid for them. The £65,000 was based on the cost of investments, and required to be depreciated accordingly. What it would amount to no one could say, but at the present moment they might assume that they had an actual balance on the renewal fund of £75,000, of which £57,000 was required to complete the payment for the new ship, leaving approximately £18,000 to the credit of the fund. An arrangement had been come to with the Western Union Co. whereby the directors had agreed that so long as any balance remained upon the renewal fund the cost of new cable inserted in the course of repairs to the companies' cables should be paid for out of the fund. What the cost of cable so inserted in the current year would be he could not say. Last year it amounted to £41,000, and as the 1873 cable was interrupted now in deep water, he feared it might be necessary to insert a long length of new cable, and if this be so, then the cost of that new cable would absorb not only the £18,000 which remained in the renewals fund, but also the annual contribution of £20,000 to the fund payable by the Western Union Co. at the end of the year. If these amounts were insufficient to pay for the new cable, then, of course, it would devolve upon the Western Union Co. this year to find the balance, and in all future years to bear itself the whole cost of the repair and renewal of the companies' cables. The Chairman next dealt with the pension fund, and said that the report of the actuary showed that a contribution of £6,970 was required from the Western Union Co. In conclusion, he was pleased to say they remained on the friendliest terms with their lessees, who paid their rent with commendable promptitude.

Mr. R. H. Benson seconded the motion.

The report was adopted.

Replying to a vote of thanks to the board and staff, the Chairman said that next year he would complete 50 years as a director of the company.

Lisbon Electric Tramways, Ltd.

The annual meeting was held on May 12th, at the offices, 1, London Wall Buildings, E.C., Mr. Ludwig Breitmeyer presiding. The Chairman, after referring with regret to the death of the late Secretary, Mr. S. W. Jameson, said that during the last five months of the year a period of exceptional trouble came unexpectedly upon them, and although they escaped direct interference from the war, owing to the locality of their undertaking in a neutral country, they felt the reflex action by the increased cost of fuel and other supplies, and, further, by the great fall in the Portuguese exchange, which dropped from 46d. to about 36d. All those adverse factors, which were quite beyond their control, brought about a decrease in the profit of about £20,000. The traffic returns showed steady increase from year to year, and were an evidence that the business was on a sound and healthy basis. Unfortunately, in the current year the unsatisfactory conditions to which he had referred still prevailed, and until the war was brought to a conclusion they must expect to suffer under the higher cost of operation and the depreciation in the international exchange. It had not been possible out of the year's profits to make the usual appropriation of £25,000 to depreciation reserve. Only £15,000 had been set aside from this source, but in order to bring the amount to approximately the figure of £35,000, the sum of £19,012 formerly standing to the premium on ordinary share capital had been utilised for the purpose. In addition, as in former years, they had placed £5,000 to [illegible] account, bringing it up to [illegible]. [illegible] now see that the policy of creating this reserve was a wise one and [illegible] the policy of providing ample reserves in the past now enabled them to maintain the present [illegible]. Capital expenditure to the extent of £51,000 had been incurred during the past year, which should add to the [illegible]. Two of the [illegible] open to traffic, and the conversion of the remaining three inclines of this system to electricity was nearing completion. The extension of the [illegible] were it not for the high prices obtaining for fuel, a great saving in this connection over previous years would have resulted. The price of coal before the war was from 22s. 6d. to 25s. per ton; [illegible] annual consumption was between 19,000 and 20,000 tons. He regretted to say that the negotiations with the Lisbon Municipality regarding the interpretation of some clauses in the concession had made no further progress. A new Council had recently been nominated by the Government, and they hoped that their endeavours in the future for effecting an equitable settlement would be met in a more reasonable and conciliatory spirit. On the whole, he thought they could congratulate themselves on the outcome of the past year's working, for, although [illegible] as formerly, the actual business of the company was as good as ever, and the reduction of the profits from £129,000 in 1913 to £110,000 last year [illegible] brought about by the present European upheaval, and which they hoped would pass away with brighter days. From present indications he did not think he was too optimistic in anticipating a further increase in the revenue during the current year. [illegible] all depended on the duration of [illegible] hoped that before the next [illegible] a permanent and beneficial peace would have been obtained.

Mr. J. R. Taylor seconded the motion, which was adopted.

Subsequently, on the motion of [illegible], a resolution was passed [illegible].

West India and Panama Telegraph Co., Ltd.

Mr. W. B. Kingsford presided at Winchester House, E.C., on May 12th, over the annual meeting. He first referred in feeling terms to the loss sustained by the company by the death of Sir J. Cameron Lamb. The vacancy had been filled by the election of Sir A. F. King, K.C.B. The revenue was more than that for the corresponding period, and although the expenditure was somewhat heavy yet the ratio of expense to income was slightly less than in the December period of 1913. The half-year's working [illegible] increase of £5,641. Some part of the increased expenditure was of a permanent nature. There were certain items, however, which were directly due to the exceptional conditions that had prevailed during the last five months of the half-year under review, and they hoped that when peace returned they would be able to [illegible]. Since the outbreak of war they had [illegible] their business under such varied and unusual conditions that it was almost impossible to [illegible] forecast the future. The strict, but necessary, censorship which since last August had been in force [illegible] and the postal [illegible] the West Indies, had very much hampered business, and had so greatly disturbed their normal working conditions as to cause the directors [illegible] upon their [illegible] might [illegible] by the reduction in the rates which came into force on October 1st. [illegible] regretted to say that the growth in the volume of traffic gave little reason to hope that the lower rates would be compensated [illegible] and night, thus costing them very much extra expenditure [illegible]. Their clerks had worked admirably throughout this very trying emergency, and they felt that great praise was due to them for their loyal and willing service. As regarded their investments, [illegible] cases to obtain reliable quotations. As stated in the report, the directors [illegible].

Mr. H. W. Birks seconded the motion.

The report was adopted, and [illegible] to the board and staff.

Great Northern Telegraph Co., Ltd., of Denmark.

The receipts for 1914 amounted to £792,068, and the expenditure was £250,700, leaving a net profit of £541,447. It is proposed to put to reserve and renewal fund £111,111, to pension fund of staff £11,111, directors' remuneration £2,500, dividend and bonus 22 per cent. £550,000, carrying forward £8,725.

The annual meeting was held at Copenhagen on May 8th. Rear-Admiral F. C. C. Bardenfleth, D.R.N., rendered an account of the working of the company during the year 1914 on behalf of the Chairman (Commodore E. Suenson, D.R.N.), who was prevented by illness from being present. He said that the terrible war, which had not only set aflame the most important countries in Europe, but had also spread the conflagration to the Far East and to almost every other part of the globe, had compelled all the governments, belligerent as well as neutral, to adopt certain measures for the exercise of control over the telegraphic and postal services. As a result of these measures this company's accounts with other administrations had been much delayed, and for this reason the directors had been obliged to postpone the general meeting. The strict neutrality observed during the war by the Danish Government, as well as by the Governments of Sweden and Norway, had made it the plain duty of the company to follow similar principles in its dealings with the administrations of the several countries in which the company's cables were landed. They had always, however, in times of peace as well, followed these principles of neutrality and discretion, and had thereby gained the absolute confidence of the governments concerned in the perfectly impartial and loyal service of the company. This confidence had not been withdrawn during the war. In 1914 fifteen interruptions had occurred to ten cables in Europe, whilst, in the Far East, six cables had suffered 28 interruptions. The company's cables in the Baltic, between Denmark and Russia, became interrupted towards the end of November last year, and, unfortunately, owing to the war, it had not yet been possible to repair them. In Europe the cable steamer *H. C. Orsted* had been occupied for 105 days, of which 32 days were for the account of other administrations; in the Far East the cable steamers *Store Nordiske* and *Pacific* had been occupied for 188 days, of which 41 and 6 respectively were for the account of others. The Vladivostock and Kiachta routes had worked very satisfactorily and carried a considerable part of the traffic exchanged between Europe and the Far East; but the said traffic *via* the company's lines had sensibly decreased since the war broke out. The line in Mongolia between Kiachta and Peking had been overhauled during the year; a constant supervision was, however, required to keep the line in efficient working order. The Japanese Government cable between Shanghai and Nagasaki, to the establishment of which this company consented during the negotiations mentioned in the reports of the last two general meetings, was opened for traffic on January 1st, 1915, after the Japanese Government had secured the necessary consent of the Chinese Government. The cable, according to existing arrangements, is only to be used for the transmission of telegrams written in Japanese Kana characters and for Government telegrams exchanged terminally between Shanghai and Japan. In the spring of last year a convention was concluded between the Russian and Japanese Governments regarding the junction, at Sakhalien and at the frontier of Chosen, of the telegraphic systems of the two Governments. The rates for telegrams exchanged terminally *via* these new connections between Russia and Japan had been fixed at very low figures and in such a manner as to preclude the company's Vladivostock-Nagasaki cables from competing for the said traffic at equal rates. The traffic of which they were thus deprived, and which they had vainly tried to retain for their route by a heavy reduction of their rates, was not inconsiderable; in other respects the convention did not affect the company's rates or traffic. The negotiations with the Chinese Government were rather protracted, and it was only in the month of August last year that a final settlement was arrived at. The arrangements thus concluded mainly secured for the company the Chinese Government's approval of, and co-operation in, the arrangements entered into with Japan in 1913. The traffic over the company's cables had been extremely heavy during the war and continued so, especially in Europe. At the outbreak of the war all the direct connections between the telegraph systems of the United Kingdom, France and Russia on the one side and those of Germany and Austria-Hungary on the other side were naturally broken off. The burden of all the telegraphic correspondence between Russia and her allies was cast upon the company's system, whilst other classes of traffic also increased considerably over and above the normal, the average number of words contained in the telegrams being increased, owing particularly to the universal prohibition of the use of code. In these circumstances a very heavy task devolved upon the company's staff. The death of Colonel E. V. Tychsen, a director, occurred last December. Mr. W. Weimann had been asked to take his place. From the 1st July, Mr. F. C. C. Nielsen, after about 45 years' active service in the company, had, owing to failing health, tendered his resignation as the company's representative in England, a position which he had filled with conspicuous ability for over 24 years. Mr. Nielsen had consented to be retained in a consulting capacity and thus give the company the benefit of his great experience and intimate knowledge of its affairs in England. Although the financial results of the year 1914 had been eminently satisfactory, the increase of the receipts, being due to the war, was a temporary one only. "This fatal war, through which the company prospers for the time being, may still entail grave consequences; for nobody is able to foresee whether the fortunes of the war may not to-morrow prevent us from pursuing our peaceful work, nor is it possible to foretell whether the results of the war in Europe and in the Far East will allow us to continue the working of the cables under the same conditions as those which prevailed before the peace was broken." Notwithstanding that the company may at any moment be placed in a difficult position, the board of directors is glad that the unexpected increase of the receipts warrants the distribution of a total dividend and bonus for the year of 22 per cent. At the same time, the board proposes, as an exceptional measure, to add a further £55,556 to the reserve and renewal fund, a proposal which is justified by the continued depreciation of the investments, amounting to about £188,000, during the years 1912, 1913, and 1914.

Electric Construction Co., Ltd.

The directors report that for the year 1914 the net profit, after providing £6,800 for debenture interest and £5,000 for depreciation, is £35,567, plus £7,153 brought forward, making £42,721 available. After paying 7 per cent. on the preference shares for the year ended March 31st, 1915, a dividend at the rate of 6 per cent. per annum on the ordinary shares is recommended requiring £13,452, transferring to general reserve fund £17,403, and leaving £7,471 to be carried forward. "The directors are pleased to be able to report a good general demand for electrical machinery, which has been enhanced by special orders arising out of the declaration of war. The extension of the company's works, reported last year, has enabled these orders to be executed promptly and economically. The volume of unexecuted orders is satisfactory. The directors report with regret the death of their colleague, Mr. William Bulloch. Mr. David Willock, who has been in the service of the company for 18 years, has been elected to fill the vacancy on the board. As indicated at last general meeting, the directors have, by the transfer of a sum from general reserve, reduced the amount in 'shares in other companies' to what is considered the realisable value. The amount remaining at the credit of general reserve, after making the contribution recommended from last year's profits, will be £36,000."

Annual meeting: May 27th.

West African Telegraph Co., Ltd.

Presiding on May 12th at the annual meeting, held at Electra House, E.C., Sir J. Denison Pender, K.C.M.G., said that the gross receipts for the year amounted to £55,500, an increase of £9,600. That improvement in the receipts was mainly due to the naval and military operations on the coast which were taking place in connection with the war. The sum received in the year under review for messages was £42,600, as compared with £34,600, or an increase on message account of £8,000. The amount received as interest and dividends on the reserve fund investments was practically the same as in the preceding year. The total expenses were £26,100, against £29,600 in 1913, thus showing a decrease of about £3,500, chiefly owing to a smaller expenditure on cable repairs. The amount expended on cable maintenance varied considerably from year to year, and, as he had repeatedly pointed out, the expenses formed no criterion as to what the cost was likely to be. In 1913 they spent under that head £12,000; this past year only £7,000; yet the same care and foresight had been exercised in each case. The general expenses in London for the past year were £2,735, against £2,718, while the working expenses at stations were £11,490, as compared with £11,678. The only item which called for remark was £434, which represented the contributions made by the company to various war relief funds—an expenditure which he was sure would meet with their entire approval. The net result of the year's working was that, while maintaining the usual dividend of 4 per cent., they had been able to carry the very respectable sum of £19,000 to the general reserve fund, which now stood at the nominal figure of £315,000. It must, however, be borne in mind that the securities representing that fund had depreciated in value, although, owing to the present restriction in Stock Exchange operations, it was difficult to tell to what extent depreciation had actually taken place. Fortunately for them there was no necessity at this time to realise any part of the reserve fund, and the interest they received from it, which formed part of their revenue, was in no way disturbed.

Sir Henry C. Mance seconded the motion, and the report was adopted.

German Electrical Companies.

The Ver. Isolatoren Werke A.G., of Pankow, reports a declining period of prosperity in 1914. The provision made for depreciation amounts to £2,800, as compared with £5,900 in 1913, leaving net profits of £590, as against £6,600. It is not possible to pay any dividend, this result comparing with 9 per cent. in the preceding year. It is stated that owing to army orders the new financial year has started favourably.

The Hamburg Hochbahn A.G. records the transport of 36,478,190 passengers in 1914, as compared with 39,000,969 in 1913, and receipts amounting to £250,000, as against £263,000. After defraying working expenses of £140,000, as contrasted with £139,000, and deducting the necessary payments to the State and making provision for reserve fund, the accounts indicate net profits of £33,000, as against £47,000 in 1913. The directors recommend a dividend of 4 per cent., as compared with 5½ per cent. in the preceding year.

The Deutsche Kabelwerke A.G., of Berlin-Lichtenberg, states that the company was well employed during 1914, and realised slightly greater profits than in the preceding year. After allocating £14,000 to depreciation, as against £16,000 in 1913, the net profits are returned at £41,000, as compared with £34,000. It is proposed to pay a dividend of 6 per cent., as contrasted with 8 per cent., to devote £11,000 to the writing down of the machinery to the value of one shilling, and place £3,700 to a war reserve fund, and £4,000 to the special reserve fund, leaving £1,700 to be carried forward, as against £3,400 in 1913.

The report of the *C. Lorenz A.G., of Berlin*, shows, after writing off £22,000 for ordinary depreciation and £5,000 off a Russian investment in Petrograd, net profits of £80,000 in 1914 on a share capital of £70,000. It is proposed to pay a dividend of 25 per cent., as compared with 20 per cent. in 1913, and a bonus of 7½ per cent., as against 6 per cent., out of the net profits, which include those derived from the business connection with the High Frequency Machine Co. It is now intended to increase the ordinary capital to £150,000 by the issue of new shares at a premium, for the purpose of strengthening the company's financial resources.

The Elektrizitats Lieferungs Gesellschaft, of Berlin, which owns 21 electricity supply works and holds a lease of several others, reports that the development of business was satisfactory until the war, when a contraction took place; but shortly afterwards a favourable course was resumed by most of the works. The scarcity of petroleum which occurred exercised a stimulus on the supply of the electric light and brought many additional customers to the company, whose custom was doubtless permanently assured by the recognition that oil lighting could no longer compete with electric lighting with economical lamps. It was of advantage to the company that, with the exception of the works at Craiova, Rumania, all the undertakings were situated in Germany. The accounts indicate gross profits of £287,000, as against £310,000 in 1913, and net profits amounting to £179,000, as compared with £213,000. It is proposed to pay a dividend of 10 per cent. on ordinary share capital of £1,500,000, as contrasted with 12 per cent. in 1913, the loan capital totalling £1,450,000.

The Deutsch-Sudamerikanische Telegraphen Gesellschaft, of Cologne, reports net profits amounting to £52,000 for 1914, as compared with £56,000 in the previous year. It is proposed to distribute 6 per cent. as against 6½ per cent. in 1913, and to place £2,600 to the legal reserve fund, £7,500 to the contingency fund, and £2,500 to the benevolent fund, being the same sums respectively as in 1913.

The balance sheet of the *Heddernheimer Kupferwerk and Suddeutsche Kabelwerke, of Frankfort-on-Main*, after apportioning £18,000 to ordinary depreciation in 1914, as against £20,000 in 1913, shows net profits of £66,000, as compared with £57,000. It is intended to set aside £16,000 for reserve funds and extra depreciation, as in 1913, and to pay a dividend of 7 per cent. as in the previous year, leaving £11,000 to be carried forward.

The Felten and Guilleaume Carlswerk A.G., of Cologne-Mulheim, reports net profits of £300,000 for 1914, as contrasted with £321,000 in 1913. The former total has been arrived at after a careful valuation of the credit held abroad and the allocation of £25,000 to special depreciation of machinery and apparatus. A dividend of 8 per cent. is in contemplation, as in the previous year, and the sum of £50,000 is to be assigned to the disposition fund for works, as in 1913.

The Bergmann Elektricitats Werke A.G., of Berlin, record gross profits amounting to £555,000 for 1914, as compared with £579,000 in the preceding year. General expenses, interest charges, taxes, etc., absorb £215,000, as against £257,000, and depreciation requires £158,000, as contrasted with £135,000 in 1913. The balance permits the payment of 5 per cent., as in the previous twelve months, the appropriation of £50,000 for a war reserve fund, and the carrying forward of £17,000, as compared with £16,000 in 1913.

The report for 1914 of the *Kabelwerk Wilhelminenhof, of Berlin*, states that the working results did not remain uninfluenced through the outbreak of the war. Nevertheless, the company could again submit satisfactory accounts, and as it did not appear necessary further to strengthen the reserve fund it was possible to recommend the same rate of dividend as in the preceding year. Including the balance brought forward, and after allocating £2,800 to depreciation, as against £1,500 in 1913, the net profits are returned at £10,500, as contrasted with £13,600. The dividend amounts to 15 per cent., as in 1913.

The directors of the *Land und Seekabelwerke, of Cologne-Nippes*, whose share capital of £300,000 is held entirely by the Felten & Guilleaume Co., state that satisfactory results were obtained in 1914, although a portion of the year stood under the influence of the war. The gross profits were £67,000, as compared with £73,000. After defraying general expenses and setting aside £12,000 for depreciation, as against £15,000, the accounts indicate net profits of £35,000, as contrasted with £38,000 in 1913. A dividend at the rate of 10 per cent. has been declared, this comparing with 11 per cent. in the previous year.

The Gesellschaft fur Elektrische Unternehmungen, of Berlin, which has an ordinary share capital of £3,000,000 and loan capital of £2,023,000, owns, or is otherwise financially interested in, many lighting and tramway undertakings both in Germany and in Russia, France and other countries. The directors' report for 1914 states that, with few exceptions, the supply works in the homeland had been prejudiced in their development through the war, whilst those in neutral countries had been similarly affected to a lesser degree. The tramway undertakings had suffered to a greater extent. On the other hand the undertakings in hostile countries, particularly in Russia, had been placed under State control, although it was impossible to form a definite opinion as to their ultimate fate. The accounts indicate net profits amounting to £261,000, as against £318,000, and it is proposed to pay a dividend of 6 per cent., as compared with 10 per cent. in each of the three preceding years.

The report of *Voigt und Haeffner A.G., of Frankfort-on-Main*, states that working was unfavourably affected in the first months of the war in consequence of the decisive stagnation in railway traffic, and it was only possible to provide some compensation towards the close of the year by embarking upon the production of parts of munitions of war. The requirements in peace manufactures also increased to some extent. But taken as a whole there was a substantial decline in the results over the previous year owing to the large reduction in the turnover, which was all the more comprehensible as it was impossible to curtail the expenses, and the army orders would only appear in the accounts for 1915. As gross profits the accounts indicate the sum of £110,000, as compared with £164,000 in 1913; and general expenses absorb £52,000, as against £50,000; and depreciation £11,000, as contrasted with £13,000. The net profits and balance forward total £49,000, as compared with £104,000; and the dividend is 8 per cent. on a share capital of £250,000, being 4 per cent. less than in 1913.

The report of the directors of the *Deutsch-Atlantische Telegraphen Gesellschaft*, for 1914, states that during the first seven months an increase in the traffic took place over the corresponding period in the previous year, and an advance was also recorded in the receipts. It was possible for the company to secure a further acceleration in the speed of transmission through the cables. Later on August 5th both cables between Emden and Fayal, in the Azores, and the cables between Emden and Vigo were cut in the Channel beyond the limits of English and French sovereignty and, in point of fact, evidently on the part of the English. It was at present impossible to foresee when the restoration of the cables and the resumption of working could be effected. The Norddeutsche Seekabel Werke, in which the company is interested, would pay a dividend of 4 per cent. for 1914, but the share devolving upon the Atlantic Co. would first be included in the latter's accounts for 1915. The accounts show the following figures for 1914 as compared with those in the preceding year:—

	1914	1913
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

The fact that the rate of dividend has only been reduced by 1 per cent. is due to the larger amount brought forward in 1914 as contrasted with 1913; the allocation to the reserve fund is less by £11,000, [illegible] lower by £28,000 than in 1913. The liabilities of £81,000, as against [illegible] in 1913, consist of unsettled accounts with the Eastern Telegraph Co., the Europe and Azores Telegraph Co., the Commercial Cable Co., [illegible], and certain other debts.

Anglo-Argentine Tramways Co., Ltd.—The directors report that owing to the decrease in traffic receipts for the current year as compared to 1914, and the uncertainty of the outlook, they do not recommend any dividend on the ordinary shares. [illegible] is being carried forward, as compared with [illegible] brought in from 1913.

United River Plate Telephone Co., Ltd. — Final dividend on the ordinary shares, 5 per cent., making 8 per cent. for the year. £6,563 is to be carried forward.

Eastern Telegraph Co., Ltd.

The annual meeting was held on May 12th, at Electra House, E.C., Sir J. Wolfe Barry, K.C.B., who presided, said that the gross revenue for the year was £1,645,000, which was about £15,000 in excess of the previous year. On the other hand, the total expenses during the same period had been exceptionally heavy. From one cause and another they exceeded those for 1913 by about £167,000. There was also an increase of about £3,500 in the interest on 4 per cent. mortgage debenture stock, due to the issue of £103,294 of this stock in November, 1913, to meet some additional capital expenditure. The result of the year's working, therefore, was that after providing for the usual dividends on the various stocks, and the same bonus as formerly—viz., £2 per cent. for the year on the ordinary stock—they were able to carry to the general reserve fund £390,000, the same amount as in 1912. This fund had been charged during the year under review with about £274,000 in respect of new cables and other special expenditure, so that the net addition to the fund for the year was about £116,000. There still remained to be charged £200,000, being the balance of cost of the Aden-Colombo cable. This would be dealt with during the current year. They would no doubt have noticed that the amount set aside as a provision on account of investment fluctuations, which now stood at £325,000, had not been altered this year. When he last had the pleasure of addressing them he pointed out that the operation of varying some of their investments had resulted in an actual realised loss on securities sold of about £66,000, which had been charged against the general reserve fund. Although after having done this the approximate depreciation was still slightly in excess of the provision made, there had subsequently been an improvement in the total value of the securities, and they did not think it necessary to increase the provision of £325,000. As the Stock Exchange was closed on the date to which the present accounts were made up, the usual method of valuation could not be adopted, and they felt that even now it was difficult to arrive at anything like an accurate appraisement. They had therefore decided to hold the matter over until the end of the current year, when it was hoped that they might be able to arrive at something more definite; and if the depreciation of the securities seemed to require that course, they would then consider the desirability of increasing the provision now made. He might incidentally remark that the renewals of some of the older sections in the Red Sea, and the new cable from Aden to Colombo, had materially assisted them in maintaining a satisfactory service to India and the Far East during the exceptional times of pressure which they had experienced, and which still existed, more especially as the alternative route to India by the Indo-European Co.'s system had been continuously interrupted since July 31st last, and the Government Pacific cable to New Zealand and Australia was also interrupted from September 8th to November 5th. If further proof were required of the importance of maintaining a substantial reserve fund, it could be found in the example now before them, which showed that they had been able to carry out this important work at a cost of about one million pounds, the whole of which had been met by appropriations from the reserve fund. This policy, which the directors had so consistently followed throughout, enabled them to meet any exceptional and unforeseen demands whigh might arise, more particularly at a time such as the present, when so much pressure of work had been so suddenly placed upon them. This great war had been so far reaching, that practically every part of our widespread Empire had been seriously affected, and the necessity for rapid trustworthy means of communication between the Mother Country and the Oversea Dominions had been more than ever realised. Their aim had been not only to improve the speed of their service, but to render it as secure as possible against total interruption. With only a single cable this might occur at any time, either from natural causes or, in the event of war, from the malicious acts of enemies. In order, therefore, to provide an efficient permanent service they had taken, for years past, the precaution of connecting the most important points of their system by several cables laid along widely different routes. He knew that their work was appreciated by the Government, and they were glad to feel that they were able to render a useful service to the country. Although certain restrictions had necessarily been imposed by the Government in the regulations affecting commercial, Press and social telegrams, it must be a satisfaction to all concerned that they had been able to maintain a constant service throughout their system. Having referred to the action of the Government in taking possession of the company's offices and controlling the traffic, and the consequent restrictions placed upon private and public telegraphing, as outlined at the meeting of the Eastern Extension Co., the Chairman said there was another matter arising out of the war which he ought to mention. By an agreement dated May 28th, 1878, certain arrangements were made between the company and the Indo-European Telegraph Department of the Indian Government and the Indo-European Co., for maintenance of alternative routes, pooling traffics and dividing receipts in agreed percentages, with the usual provision that in case of interruption of either route for a specified time, the interrupted company should cease to participate in the receipts. The advantages of the agreement were fully explained by his predecessor in the chair to a general meeting held on July 11th, 1878, when the agreement was signed and the approval and full powers were given to the board to carry it into effect, or modify details. Part of the Indo-European route passed through enemy territory, and that service to India was completely interrupted; but the maintenance, or rather re-establishment, of an allied route was as much to their interest now as in 1878. The directors had, therefore, decided to extend the rates and continue the payments mentioned in the agreement, so as to give the Indo-European group a reasonable opportunity of establishing an efficient alternative route after the war. Before concluding, he wished to record their appreciation of the patriotic devotion and the high sense of duty shown by the staff on shore and on board their cable repairing ships during a time of such great anxiety to them all. The good results to which he had referred could not have been achieved without their whole-hearted co-operation under trying and sometimes risky conditions. The ships' staff had done valuable work in maintaining communication, and the shore staff had dealt with the traffic as expeditiously as possible under the conditions of censorship imposed by the Government. They had been working long hours during week-days, Sundays, and holidays, and all, both on board ship and on shore, had cheerfully given up their periodical furloughs in order to meet the demands of their country. In saying this, he included not only the staff abroad, ashore and afloat, but also in a marked degree the head office staff and their employés at the stations in Great Britain. It being impossible speedily to replace their highly trained and technical staff, the authorities did not desire them to enlist; and although many of them would have liked to take a more active part in the war, they had—with some few exceptions—accepted the ruling of the Army Council, who had expressed the view that, having regard to their special qualifications, they were serving their country better by remaining at their posts than by joining the fighting forces. A large percentage of the administrative staff at head office had, however, joined the Forces, and although their work was more or less of a special character, they had given every facility to the eligible men to join the active services, and had agreed to reinstate them when they returned. They were at present granting them full pay. The temporary vacancies thus created had, to a large extent, been filled by the employment of experienced female clerks who had lost their permanent situations owing to the war. They would be glad to hear that at the cost of their stations', ships', and head office staff, a very efficient repairing ambulance car had been equipped and placed at the disposal of the Red Cross organisation for the service of the British Forces, and that the staff had made, and were making, regular and handsome contributions to the Prince of Wales' Fund.

Sir J. Denison Pender, K.C.M.G., seconded the motion, which was adopted without discussion.

Calcutta Electric Supply Corporation, Ltd.

The annual meeting was held, on May 13th, at the offices, 2, Broad Street Place, E.C. Mr. Paget V. Luke, who presided, said that the capital expenditure during the year (£61,443) had been necessitated by the normal expansion of the business and was an indication of satisfactory progress. In order to provide the funds necessary for capital expenditure on additional plant and mains, the directors issued £100,000 of additional capital last January; half in ordinary shares at a premium of 10s. per share, and half in preference shares at par. The shares were fully subscribed and the premium on the ordinary issue, amounting to £5,000, had been added to the reserve fund and invested. In regard to the revenue account, it was particularly gratifying to note the reduction in generating costs, which was a very satisfactory result of the very large capital outlay involved in the high-tension scheme completed in 1913. It would be a sufficient indication of the good results to say that, roughly speaking, in 1914 2½ million more units were generated than in 1913, while the generating costs were 63,500 rupees less. The principal item in generating costs was coal; and the quantity used had been reduced from 40,064 tons in 1912 to 23,330 tons in 1914, notwithstanding an increase of nearly seven million units generated in that period. The Trades Association of Calcutta recently presented a petition to the Corporation praying for a reduction of charges, both in the price of current and meter rent. The desire for a reduction in the price of current had been already anticipated by the lowering of the cost for lighting purposes, and a reduction of ½d. per unit came into force from July 1st last. The directors had now decided to reduce the meter rent by one-half as from July 1st next. That concession would mean an annual difference to the corporation of some £7,000. A still further reduction in the price of current for lighting was now under consideration, and it was hoped that shortly it might be possible to arrange for this, but in the present unsettled state of affairs it was necessary to weigh future possibilities very carefully. With regard to the effect of the war upon their prospects, owing to difficulty in obtaining tonnage for shipments, etc., there was a considerable contraction of general business in Calcutta, and a consequent diminution in the sale of current for power purposes for the second six months of the year. On the whole, however, the war had not, so far, affected them to any great extent so far as revenue was concerned, for, notwithstanding the adverse conditions, the amount of current sold for light, fans, and small motors was well maintained. The full influence of the war was hardly felt in 1914, but the increased cost of materials, higher freights, and increased taxation would no doubt cause it to be more felt during the current year. So far, he was glad to say, the revenue showed no signs of decreasing. Street lighting had made good progress, and was likely to increase as the advantages of the electric light became appreciated. In order to stimulate a new demand that seemed capable of development the directors had sanctioned a special rate of one anna per unit for current for cooking and heating purposes. At the last meeting an inquiry was raised as to the large number of units classed as "unaccounted for." That matter had received the close attention of the directors and the consulting engineer, and a certain improvement was shown in comparing the figures for 1913 with those for 1914, and there was a still further improvement in the current year. Taking everything into account, the results for the past year could not be considered as other than quite satisfactory. Seeing that the profits were sufficient, the directors had decided to recommend the same dividend as last year; but in view of possible contingencies resulting from the war, they would carry forward a larger sum than usual, and they had also decided to place a sum considerably above the normal to the depreciation and renewal fund.

Sir Guilford L. Molesworth seconded the motion, and the report was adopted.

Delhi Electric Tramways and Lighting Co., Ltd.

The directors report that the gross receipts for 1914 were:—Tramway undertaking £9,798, electric supply undertaking (including £2,981 on account of current sold to tramways) £18,887. The revenue from the tramway undertaking shows an increase of 10 per cent. over 1913. The increase is due to the policy of lower fares. The gross revenue from the electric supply undertaking (excluding the supply to the tramway) shows an increase of 19 per cent., and further expansion in the revenue from this branch may be hoped for as soon as additional mains can be installed. The demand for supply for power purposes is satisfactory, and efforts are being made to develop this department of the business. The combined undertakings show a net revenue of £8,163, as compared with £6,252 in 1913 and £2,990 in 1912. After charging general expenditure in London and Delhi, and debenture and loan interest, the profit and loss account shows a profit of £3,938, plus £214 brought forward. There has been put to depreciation reserve account £4,000, to renewals reserve account £74, and £78 is to be carried forward. The result may be regarded as encouraging, in view of the fact that during the latter period of the year a reduction in revenue in both branches of the undertaking has been experienced, due to the war. The whole of the plant and equipment, including rolling stock, has been systematically overhauled during the year, and the expenditure charged to revenue. The upkeep of the cars is still a heavy item, owing to the single motor equipments, and, as soon as funds can be provided, it is the intention to instal cars with double motor equipments, the cost of which will, to some extent, be off-set by economies in maintenance. The new Diesel engine and generator have given satisfaction since their installation in June last. Owing to the continually increasing demand, it has become necessary to provide further plant, and arrangements have been made to provide a link with the Government power-station. The cost of the necessary plant, together with additions to feeder cables which are being installed, will have to be met out of surplus revenue, as it is at present impossible to place the contemplated issue of second debentures.

Annual meeting, May 19th.

United River Plate Telephone Co., Ltd.—The directors recommended a final dividend of 5 per cent. on the ordinary share capital, making, with the interim dividend paid on November 2nd last, a return of 8 per cent. for the year to December 31st, 1914, free of income-tax, carrying forward £6,562.

River Plate Electricity Co., Ltd.—The directors announce that the net revenue for 1914 amounted to £31,000, against £42,201 in 1913. A dividend of 8 per cent. on the ordinary stock is recommended, carrying forward £20,512.

Mirrlees, Bickerton & Day, Ltd.—The directors report that for the year ended March 31st the net profit, after providing for depreciation and directors' fees, was £15,608. After paying 7½ per cent., less income-tax, on the ordinary share capital, and placing £5,000 to the reserve fund, £1,753 is being carried forward.

New British Ever-Ready Co., Ltd.—The directors recommend a final dividend of 6½ per cent. on the preference shares, making the maximum of 10 per cent. for the year to March 31st, and 10 per cent. on the ordinary shares for the year, plus a bonus of 2 per cent.

Aron Electricity Meter, Ltd.—A meeting of first mortgage debenture-holders (5 per cent.) is being held to-day at Cannon Street Hotel to consider resolutions modifying the rights of these holders until the end of the war.

Brisbane Electric Tramways Investment Co., Ltd.—The revenue account for 1914, consisting of the dividend received from the Brisbane Tramways Co., Ltd., amounting to £143,904, together with sundry receipts and the amount brought forward from the previous year amounting to £3,809, less charges in London and Brisbane amounting to £3,649, shows an available balance of £144,063, which the directors have dealt with as follows:—Reserve fund (bringing it up to £100,000), £50,000; accidents insurance fund (bringing it up to £10,000), £7,000; debenture stock interest, £18,689; preference dividend, £17,305; interim dividend on the ordinary shares, £24,000. Out of the remaining balance the directors now recommend that a balance dividend of 4s. per share, free of income-tax, be paid on the ordinary shares (making a total dividend for the year of 8 per cent.), and that £3,070 be carried forward. After the above appropriations the renewal and reserve funds of both companies will amount to £230,000, with an aggregate of balances carried forward of £5,952.

Mexican Northern Power Co.—Mr. W. J. Ross, the new president of the Mexican Northern Power Co., has issued a circular to the first mortgage bondholders urging them to subscribe for $1,000,000 prior lien bonds at the rate of $77.50, or $775 for $1,000 of bonds. The money is required to pay debts, complete the Boquilla dam, transmission lines to Parral and Santa Barbara, the sub-station at Parral, and distribution lines, at a total cost of $775,000.—*Financier.*

Castner-Kellner Alkali Co., Ltd.—The directors have declared an interim dividend at the rate of 16 per cent. per annum for the six months ended March 31st, 1915.

Craigpark Electric Cable Co., Ltd.—The annual meeting was held in Glasgow on May 12th. Mr. W. S. Brown, who presided, said the company, like other firms, had suffered through the war. Their output was somewhat down, but that was because a great number of their men had gone to the front, and they were unable to fill the vacancies. They had made some little provision for the dependents of these men, and he thought they were very well able to do so. Their works were now, however, fully occupied. The material turned out at present was of a very solid and good character. It was principally work for the Government, and he understood was giving every satisfaction. Although somewhat down, the output, as a whole, was quite satisfactory. The report was adopted, and Mr. G. A. Buchanan, who it was stated, was at the front engaged in motor ambulance work, was re-elected a director.

Change of Address.—The address of the following companies has been altered to Electric Railway House, Broadway, Westminster, S.W.:—London and Suburban Traction Co., Metropolitan Electric Tramways, London United Tramways, South Metropolitan Electric Tramways and Lighting, North Metropolitan Electric Power Supply, North Metropolitan Electrical Power Distribution, Tramways (M.E.T.) Omnibus, and Gearless Motor Omnibus.

STOCKS AND SHARES.

[illegible]

This week's sentiment has gone some way towards banishing the gloom, amounting to depression, which weighed upon markets after the sinking of the *Lusitania.* The United States Note to the German Government was welcomed as being about as much as could have been expected from the Americans at the present time. Its firm tone and the absence of diplomatic verbiage produced a favourable impression after the first hasty generalisations about a blow having been struck at America which the latter could only avenge by declaration of war. With the calming of men's minds, there has returned that normal hopefulness and confidence which have animated the nation throughout; and the Stock Exchange barometer of public feeling already gives signs of improving markets and better prices.

At home, the domestic difficulties of London, brought about by the tramway strike, have followed so closely upon the heels of the anti-German riots that the horrors of the previous week have been to some extent removed to the background. The country, as a whole, has started again to invest money, and once more there are buyers for all the best-class securities.

The tramway strike would in the ordinary way have been held as a bull point for the omnibus companies, but the lurking fear lest the trouble might extend to the ranks of the omnibus employés has prevented any advantage accruing to the stocks and shares connected with the 'bus business. It has been denied, of course, that these undertakings will be affected; and so far as limited personal observation goes, most people will probably agree that they have found the 'bus men well contented with their present lot. It may be recalled that quite recently the employés of the Tube companies received advances in wages, so that the further hint that they, too, might be drawn into the tramway disaffection, savours more of a threat from the promoters of the latter than of inherent likelihood. No particular surprise will be felt at the intention of the London County Council to oppose the Bill for the proposed closer agreement between the Tubes and the London General Omnibus Companies.

Prices of London Tramway [illegible]

some time past. The [illegible] per cent. Debenture stock of the London United Tramways was only 55 when war broke out, and is now about 52. London and Suburban Traction Ordinary stand about 2s. 6d., the Preference at 8s. 9d., and the 4½ per cent. Debenture stock is nominally 63. Metropolitan Trams 4½ per cent. Debenture stock last changed hands at [illegible], and the Fives at [illegible], while South Metropolitan Electric Tramways Debenture stock, which was 66 at the end of last July, has not been dealt in since the Stock Exchange re-opened. Tramways (M.E.T.) Omnibus 4½ per cent. Guaranteed Debenture keeps its price fairly well at 90.

London General Omnibus Debenture stocks stand at 97 and 87½ for the 4½ per cent. Firsts and the 5 per cent. Income Debentures respectively. Underground Electric 6 per cent. Income Bonds have receded a trifle to 79. The £10 shares have fallen to 32s. 6d., and the shilling shares keep fairly firm, about 5s. 6d. Metropolitan Railway Consolidated stock is dull at 29. Districts remain at 17, there being no sign of animation in Home Rails, except the stocks of the "Heavy" lines. Buyers still want the offer of Central London issues, of the assented variety; and the Ordinary has risen a little to 79.

Sir Edgar Speyer's retirement from his various public positions, including that of the chairmanship of the Underground Electric Railways Company of London, may have something to do with the dulness of the issues in this particular company. From the market point of view, however, it is not thought that the company is likely to suffer materially, inasmuch as it is fully expected that Sir Edgar will continue to exercise his influence upon the direction of the company's affairs, though in a less prominent capacity than that which he has occupied hitherto.

Electric Lighting shares are extremely quiescent, and throughout the list there is not a single change this week. Of the manufacturing issues, Edison & Swan of both classes are rather easier, the fully-paid dropping to 1⅞. Electric Constructions, however, are better at 14s. for the Ordinary and 1$\frac{1}{16}$ for the Preference, thanks to the declaration of a dividend on the first-named of 6 per cent., which is an increase of 1 per cent. for the year. Anticipation had looked for a continuance of the 5 per cent. rate, so that the improvement came as a pleasant surprise. There is rather more doing in Castner-Kellners, the company having declared an interim dividend at the rate of 16 per cent. per annum, as against 10 per cent. a year ago; the price of the shares holds steadily to 3¼.

The group of Latin-Canadian companies has been further upset by the death of Dr. F. S. Pearson, who was one of the victims of the *Lusitania*. Dr. Pearson was well known in the City here, and his activities covered a huge range. Many of his interests lay in Mexico, but prices have remained much about the same as they were previously, only the tone of the market showing a certain weakening from what it was before. Mexico Tramway bonds went back 2 points to 56. Mexican Light Preferred eased off to 41. Brazil Tractions lost a point, owing to the unpleasant crumble in the Rio exchange rate, which got back to 12$\frac{13}{32}$d., but recovered again to-day (Tuesday). The Argentine Tramways Debentures have drooped also, the Firsts to 81, so that the yield on this stock at the present time is practically 5 per cent. on the money; having regard to the solid nature of the security, the price now must be considered cheap.

Brisbane Electric Tramways Investment Company has declared a dividend of 4s. per share, making the usual 8 per cent. for the year, and the price keeps very steady about 7½, while the 5 per cent. Preference shares are a few pence under their par value of £5. The 4½ per cent. First Debenture stock stands at 98¼. The River Plate Electricity Company has reduced the dividend on its Ordinary stock from 10 per cent. to 8 per cent., but the carry forward of £20,512 is £7,500 better than it was a year ago. The last transaction recorded in the stock was four months ago, when the Ordinary changed hands at 190—some 50 points lower than it stood when the war broke out. No doubt the Company has been affected by the financial and commercial difficulties with which the Argentine Republic has been beset owing to the war.

Telegraph stocks are a little hesitating. Great Northerns are *ex* 34s. dividend, and Indo-Europeans are *ex* 52s. 6d., allowing for which the latter show a rise of 10s. on the week, while Great Northerns are a shade easier. The last-named points out in its report that at any moment the Company may be placed in a difficult position as a result of the development of hostilities. The Company, as mentioned here before, has just raised its dividend from 20 per cent. to 22 per cent.; but the carry-forward of £86,700 is £23,000 less than that for 1913.

The changes in the Eastern group are of insignificant proportions. Cuban Submarines have eased off to 8½ in consequence of the reduction in the dividend to 5 per cent. Cuban Telephone 5 per cent. Bonds came into the market the other day at 80¼. West India and Panama shares have given way a little. The Telephone group keeps very steady. United River Plate Ordinary are to receive their regular dividends of 5 per cent., making 8 per cent. for the year: and the £5 shares changed hands a few days ago at 6$\frac{3}{16}$, which is almost exactly the same price as they were at the end of last July. New York Telephone bonds and the Marconi group have fallen upon very quiet days.

Rubber shares are better, thanks to a gradual hardening in the price of the raw material, until now it stands at a shade above 2s. 5d. per lb. A good deal of business is being done in the leading shares, and rather a feature of the past few days has been the improvement in certain of the florin variety which have been standing round about their par price. Copper shares have been on the rise. The giant Amalgamated Company, by the way, is to be dissolved next month, when its assets will be distributed—chiefly in the shape of Anaconda shares. Armaments show comparatively trifling changes. Prices keep hard, but there is scarcely a shilling movement in any of them from the beginning of a week to its end.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price May 18, 1915.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.				
Brompton Ordinary	10	8¼	—	£6 1 3
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4½	—	5 11 1
do. do. do. 4½ Pref.	4½	4⅛	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	14¼	—	6 6 4
do. do. 6 per cent. Pref.	6	12¼	—	4 18 0
do. do. 5 Deb.	5	112	—	4 9 3
do. do. 4½ Deb.	4½	98	—	4 11 10
County of London	7	11½	—	6 1 9
do. do. 6 per cent. Pref.	6	11⅝	—	5 3 6
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	95 xd	—	4 14 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1¾	—	6 18 0
do. do. 6 per cent. Pref.	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	3½	3⅛	—	5 12 5
do. 4½ per cent. Pref.	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	75	—	4 13 4
St. James' and Pall Mall	10	[illegible]	—	6 5 0
do. do. do. 7 per cent. Pref.	7	6⅜	—	5 9 10
do. do. do. 3½ Deb.	3½	75	—	4 13 4
South London	5	8	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7½	—	6 0 0
do. 4½ Pref.	4½	4⅞	—	4 12 4
TELEGRAPHS AND TELEPHONES.				
Anglo-Am. Tel. Pref.	6	106½ xd	—	5 12 8
do. Def.	1½	22⅝	—	6 12 10
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8½	— ¼	5 17 8
do. Pref.	10	15½ xd	—	6 8 7
Eastern Extension	7	13⅛ xd	— ⅛	*5 17 5
do. 4 Deb.	4	92	—	4 7 0
Eastern Tel. Ord.	7	132 xd	— 1	*5 1 3
do. 3½ Pref.	3½	73½ xd	—	4 15 3
do. 4 Deb.	4	93	—	4 7 0
Globe Tel. and T. Ord.	6	11¼	—	*6 2 0
do. Pref.	6	12	—	5 0 0
Gt. Northern Tel.	22	30 xd	— ¼	7 6 8
Indo-European	65	54 xd	+ ½	6 0 4
Marconi	20	1$\frac{11}{16}$	—	11 17 0
New York Tel. 4½	4½	98	—	4 11 6
Oriental Telephone Ord.	10	2	—	5 0 0
do. Pref.	6	1$\frac{3}{16}$	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 3
United R. Plate Tel.	8	6½	—	6 3 1
do. Pref.	5	5	—	5 0 0
West India and Pan.	1	1$\frac{5}{16}$	— $\frac{1}{16}$	7 11 0
Western Telegraph	7	13¼	—	*5 16 5
do. 4 Deb.	4	91	—	4 6 6
HOME RAILS.				
Central London, Ord. Assented	4	79	+ ½	5 1 3
Metropolitan	1¼	29	— ½	4 6 2
do. District	Nil	17	—	Nil
Underground Electric Ordinary	Nil	1⅝	—$\frac{3}{16}$	Nil
do. do. "A"	Nil	6/6	—	Nil
do. do. Income	6	79	—1	*8 14 0
FOREIGN TRAMS, &c.				
Anglo-Arg. Trams, First Pref.	5½	4$\frac{7}{16}$	—	6 4 0
do. 2nd Pref.	5½	3⅞	—	7 2 0
do. 4 Deb.	4	81	—2	4 18 9
do. 4½ Deb.	4½	88	—	5 2 3
do. 5 Deb.	5	90	— ½	5 11 1
Brazil Tractions	6	54	—1	11 2 2
Bombay Electric Pref.	6	10⅜	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	40	—	Nil
do. 5 per cent. Bonds	—	56	— 2	Nil
do. 6 per cent. Bonds	—	37	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	41	—1	Nil
do. 1st Bonds	—	51	—	—
Adelaide Sup. 6 per cent. Pref.	6	5$\frac{1}{16}$	— $\frac{1}{16}$	5 19 0
do. 5 Deb.	5	103	—	4 17 1
MANUFACTURING COMPANIES.				
Babcock & Wilcox	14	51/-	—1/-	5 9 8
British Aluminium Ord.	5	20/6	—	4 17 7
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	11½	—	6 10 5
do. Pref.	6	6⅛	—	5 0 0
British Westinghouse Pref.	7½	1[illegible]	—	7 15 0
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	99	—	6 1 3
Callenders	15	12	—	8 6 8
do. 5 Pref.	5	5	—	5 0 0
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	3¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	12/9	— 3d.	Nil
do. do. fully paid	Nil	1⅞	— ⅛	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5 [illegible] Deb.	5	60	—	8 6 8
Electric Construction	6	14/-	+ 6d.	8 11 6
do. do. Pref.	7	1$\frac{1}{16}$	+ $\frac{1}{16}$	6 11 9
Gen. Elec. Pref.	6	10[illegible]	—	5 17 8
Henleys	20	14½	—	*7 17 8
do. 4½ Pref.	4½	4⅞	—	4 12 4
do. 4½ Deb.	4½	97	—	4 12 9
India-Rubber	5	9⅛	—	5 9 7
Telegraph Con.	20	37	— ¼	6 9 10

* Allowance made for dividends being paid free of income-tax.

Melbourne Electric Supply Co., Ltd.—The directors announce an interim dividend at the rate of 10 per cent. per annum, free of income-tax, on the consolidated ordinary stock for the half-year.

Willans & Robinson, Ltd.—The annual meeting was held on May 13th at Rugby, when the report was adopted. We shall report the proceedings next week.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING APRIL, 1915.

The April returns of electrical exports from this country must be considered satisfactory, being but little below the comparatively high level of the previous month.

The actual totals were for April £382,610; for the previous month £391,850.

The April imports, valued at £230,752, show a considerable increase on the March total of £203,759; and the re-exports for April, at £11,167, compare with £8,297 last month.

While the previous month's export total benefited considerably from the inclusion of over £100,000 worth of telegraphic business, the satisfactory April total is due to improved export business in machinery, cables, telephonic material, lamps, &c.: the value of electrical machinery exports was approximately £150,000 for the month.

Practically every branch of the electrical imports expanded in value during April, but while Continental imports fell off on the whole, our American cousins increased their business with us by some £54,000 as compared with March.

Our best customers during the month were India, Argentina, and France, while good business was also done with our Australasian Colonies.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,686	3,296	172	74	430	1,546	10,622	737	744	77	411	766	20,561
Germany	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies ...	220	5,406	356	28	110	57	100	...	70	36	...	1 390	7,773
Belgium	...	...	...	...	...	...	...	...	...	...	...	...	...
France	863	...	684	261	936	189	3,479	954	233	22	16,297	11,708	35,626
Portugal	...	476	...	173	...	...	207	...	53	...	757	1,267	2,933
Spain, Canary Isles and Spanish N. Africa...	380	205	86	21	...	174	4,128	...	...	...	17	54	5,065
Switzerland, Italy and Austria-Hungary ...	772	...	40	23	...	123	3,430	...	80	81	4,386	612	9,547
Greece, Roumania, Turkey and Bulgaria ...	49	...	153	...	...	52	...	...	33	...	15,452	415	16,154
Channel Isles, Gibraltar, Malta and Cyprus...	24	...	153	98	...	14	299	154	17	20	56	66	901
U.S.A., Philippines and Cuba	210	...	163	22	...	...	1,936	...	655	...	48	352	3,386
Canada and Newfoundland	201	64	151	1,287	...	784	936	...	1,895	4	...	840	6,162
British West Indies and British Guiana ...	61	...	41	26	...	...	45	...	...	...	20	30	223
Mexico and Central America	145	383	...	17	...	35	92	...	...	...	...	...	672
Peru and Uruguay	...	621	13	...	...	...	...	...	14	...	89	14,510	15,247
Chile	197	...	155	250	...	16	4,703	175	...	...	...	1,285	6,781
Brazil	248	703	215	203	14	348	5,219	...	73	5	...	94	7,122
Argentina	454	9 476	2,209	663	...	268	2,689	24,699	820	15	2,692	1,363	45,348
Colombia, Venezuela, Ecuador and Bolivia...	...	248	31	32	...	...	...	...	14	...	21	23	369
Egypt, Tunis and Morocco	681	190	75	59	...	130	1,211	257	16	...	86	486	3,191
British West Africa	94	47	182	35	19	...	522	175	11	...	13	486	1,584
Rhodesia, O.R.C. and Transvaal	295	207	613	664	...	473	462	...	118	67	30	...	2,929
Cape of Good Hope	743	1,711	853	1,687	46	102	1,871	2,587	221	14	264	1,326	11,425
Natal	285	3,486	220	283	28	...	1,651	...	93	...	490	216	6,752
Zanzibar, Brit. E. Africa, Mauritius & Aden	116	260	120	211	...	...	2,051	...	153	...	93	238	3,242
Azores, Madeira and Portuguese Africa ...	33	207	...	100	...	20	440	13	...	21	...	381	1,215
French African Colonies and Madagascar...	...	...	...	...	...	...	181	...	...	...	...	16	197
Persia	...	15	...	...	...	...	220	38	...	...	...	...	303
China and Siam	120	229	102	52	...	51	2,249	1,752	62	34	141	271	5,063
Japan and Korea	439	242	18	...	...	423	7,639	...	387	...	...	175	9,323
India	4,781	5,393	3,690	3,037	632	1,309	16,437	4,249	2,665	53	2,574	1,929	46,749
Ceylon	51	65	34	23	...	11	198	151	39	...	16	...	588
Straits Settlements, Fed. Malay States and Sarawak	651	1,732	199	433	111	...	547	808	408	77	194	448	5,608
Hong Kong	58	49	690	125	...	67	98	185	106	67	90	476	2,011
West Australia	144	503	110	59	...	33	161	...	108	...	19	67	1,204
South Australia	40	3,702	199	197	...	313	1,840	...	83	...	1,015	...	7,389
Victoria	4,551	3,403	1,451	1,200	...	963	16,577	479	716	15	2,227	2,254	33,836
New South Wales	1,233	4,589	792	1,508	28	694	4,686	7,612	1,837	...	3,844	719	27,542
Queensland	138	2,036	235	175	12	170	526	200	181	18	78	...	[illegible]
Tasmania	59	...	...	48	...	...	112	4,960	...	...	86	...	5,265
New Zealand and Fiji Islands	925	4,403	1,707	861	...	215	2,228	3,210	1,019	33	4,080	874	19,555
Total, £	20,947	53,377	15,912	13,935	2,366	8,580	99,792	53,395	12,924	659	55,586	41,137	382,610

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	391	...	16	35	589	...	1,941	109	876	794	739		5,490
Germany	...	...	...	...	...	...	...	...	...	...	...		...
Holland...	...	...	19	7,113	25	...	390	...	23	...	...		7,570
Belgium	...	...	...	...	...	...	...	...	...	...	...		...
France	428	...	416	207	81	461	1,302	...	4,568	2,810	95		10,368
Switzerland	1,342	...	4	265	...	1,345	4,408	768	18	1,029	95		9 274
Italy	993	7,280	...	...	50	51	729	446	...	186	159		9,894
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...		...
United States	10,258	7,411	886	1,365	7,459	192	17,452	119,364	2,373	10,333	7,109		184,202
Total, £	13,412	14,691	1,341	8,985	8.204	2.049	26,222	120,687	7,858	15,152	8,177		226,778

Additional imports.—Spain, electrical goods, £567; carbons, £3,017. South Australia, goods, £10. Canada, glow lamps, £190; arc lamps, £190.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above... ...	1,479	...	...	391	25	362	2,440	...	303	761	5,406		11,167

Total Exports: £382,610 Total Re-Exports: £11,167 Total Imports: £230,752

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

STANDARDISATION RULES FOR ELECTRICAL MACHINERY.

(Excluding Railway and Tramway Motors.)

In April, 1913, the Council of the British Electrical and Allied Manufacturers' Association adopted a code of rules for the standardisation of electrical machinery, which was published in our issue of May 23rd, 1913. These rules have now been re-issued, without alteration, as it is expected that the Engineering Standards Committee will shortly issue the first section of the new British standard rules—otherwise certain changes would have been made.

When the rules were first published, it was stated that additional sections were under consideration; these have now been incorporated in the code in the form of a supplement, which is reproduced below.

SUPPLEMENT.

Section VII.—Tolerances.

(1) A tolerance is the amount of permissible difference between the observed results and the guaranteed results.

(2) When the difference between the observed and the guaranteed results is not greater than the tolerance, it shall be considered that the guarantees have been met.

(3) In the event of the observed results differing from the guaranteed results by an amount greater than the tolerance, the penalty or bonus (if any) shall be taken only on the amount by which the observed deviation from the guaranteed results exceeds the tolerance.

(4) The "guaranteed" figure referred to is the figure written in the contract documents, and not that figure plus a margin or tolerance.

The following tolerances are recommended:—

(5) *For observations of temperature rise*, 2° Centigrade.

(6) *Efficiency.*—

(*a*) By steam consumption, 2½ per cent. on the guaranteed efficiency.

(*b*) Transformers (by summation of losses)—

Full-load efficiency.	Tolerance.
98 p.c. or higher	0.25 p.c.
Below 98 p.c.	0.4 p.c.

(*c*) Generators, motors, converters—

Note.—The following values apply to determination of efficiency by summation of losses. If the efficiency is to be determined by method of input-output test, the tolerances as shown should be increased one-half of 1 per cent. for guaranteed efficiencies not lower than 88 per cent., and they should be increased by 1 per cent. when the guaranteed value of efficiency is below 88 per cent.

Full-load efficiency. Per cent.	Tolerance. Per cent.
95 or above	½
Below 95	
not „ 93	¾
„ 93	
not „ 90	1
„ 90	
not „ 85	1½
„ 85	
not „ 75	2
„ 75	
not „ 65	3
„ 65	4

(7) *Power Factor.*—

Full-load power factor. Per cent.	Tolerance. Per cent.
90 or above	2
Below 90	
not „ 85	3
„ 85	
not „ 75	4
„ 75	
not „ 65	6
„ 65	8

(8) *Guarantees at Fractional Loads: Average-Load Guarantee.*—When guarantees are required upon performance at fractional loads, they should be given in the form of an "Average-Load" guarantee, thus:—

Full-load efficiency	× 4
Plus ¾ load	× 3
Plus ½ load	× 2

The sum of these divided by 9 gives the "Average-Load" value.

The tolerances for "Average-Load" guarantees are those shown opposite similar values in the first column of the corresponding tables above.

(9) *Speed of Motors.*—

(*a*) With shunt characteristics (above 3 H.P.).—Tolerance, 5 per cent. above or below guaranteed speed at the temperature of full-load.

(*b*) With series characteristic.—Tolerance, 7½ per cent. above or below guaranteed speed at the temperature of full load.

(*c*) Slip of Induction Motors.—Tolerance, 50 per cent. on the listed value of slip.

(10) *Inherent Pressure Regulation Rise.*—

Tolerance, two-fifths of the value specified for regulation.

Section VIII.—Parallel Operation of Synchronous Machines.

In order to guard against unsatisfactory operation when alternators are run in parallel, it is necessary to satisfy two conditions:—

(1) There must be a limit to the amount of angular displacement from uniform running due to periodic irregularity in the turning moment of the prime mover. Such recurring angular displacement causes objectionable swinging of the ammeter needles, and, if excessive, will cause fluctuation in lighting, and throw out of step synchronous machines running on the system.

Note relating to Condition (1).

A periodic angular displacement of 2½ electrical degrees from position of uniform rotation with a machine of ordinary type will cause 15 per cent. to 20 per cent. exchange current; the angular displacement should not exceed this limit of 2½ electrical degrees. This limit will be exceeded if the cyclic speed-irregularity of the engine exceeds that given by the expression:—

$$\text{Cyclic speed-irregularity} = k/6p$$

where k = engine impulses per revolution
p = number of poles.

It is important that the expression indicating the degree of irregularity should be correctly understood. As most firms have approved the term "cyclic irregularity" with the definition

$$\frac{\text{Maximum speed minus Minimum speed}}{\text{Mean speed}}$$

members are recommended to adopt this term.

The irregularity should not in any case be worse than 1/150, otherwise there may be objectionable flickering in lamps and difficulty in running other synchronous machinery on the system. (In the case of a continuous current generator the limit of 1/150 to cyclic speed-irregularity also applies, but there is no further limit depending on the resulting angular displacement.)

(2) It is necessary to safeguard against hunting due to resonance between any periodic impulses of the engine and the natural oscillating frequency of the electro-mechanical system of which the generator forms a part. This may be met in either of two ways:—

(*a*) By providing a fly-wheel of such weight that the natural oscillating frequency is sufficiently different from the frequency of the engine impulses.

(*b*) By providing dampers on the generator to check the development of hunting due to resonance.

Note relating to Condition (2*a*).

The natural frequency of the machine when connected to the system should be at least 20 per cent. lower than the frequency of a possible irregular impulse. In a steam engine, either single or double-acting, and also in a two-stroke cycle, internal-combustion engine, this latter frequency corresponds to the crankshaft R.P.M., while in a four-stroke cycle engine the frequency is one half the crankshaft R.P.M. To meet this condition with machines of ordinary regulation, the total amount of fly-wheel effect required is given in foot-tons of stored energy at normal speed by the following formula:—

$$\text{Foot-tons} = 1.3 \times \text{poles} \times (\text{strokes per engine cycle})^2 \times \text{K.V.A.} \div \text{R.P.M.}$$

Note relating to Condition (2*b*).

Method 2*b* can only be relied upon so long as the coefficient of fluctuation of energy is kept within the limit specified below, but when this method is employed it avoids the necessity for the heavy and expensive fly-wheels required by method 2*a*, particularly in the case of slow-speed, gas-engine driven sets.

Electrical manufacturers guarantee satisfactory parallel operation only so long as the limit specified herein is not exceeded; if the limit is exceeded due to the engine misfiring, valves leaking, or other abnormal cause, method 2*b* cannot be relied upon.

The limit referred to above is as follows:—

The coefficient of fluctuation of energy should not exceed 10 per cent.

This coefficient is defined in the following manner:—

If a mean-effort line should be drawn, then the largest of the areas lying above or below the mean-effort line is called the fluctuation of energy, and the ratio of this area to the total area bounded by the mean-effort line over one complete cycle is the coefficient of fluctuation of energy.

Section IX.—Commutation.

D.C. machines must operate throughout the range from no load to the highest specified overload with fixed brush setting.

The operation must be practically sparkless from no load to full load, and without injurious sparking up to the maximum specified overload.

Section X.—Short-Circuit Tests on Alternators.

Sudden short-circuit tests should not be undertaken, nor guarantees given against short circuits in service, upon alternators which are required to have close inherent regulation, since such machines, due to their large flux and weak armature reaction, suffer most severely in case of short circuit.

Any regulator which will give close voltage regulation throughout the entire load range, will permit of the machine being designed with the proportions best suited to withstand short circuit. Hence close inherent regulation is an unnecessary requirement.

When, in the absence of restrictions as to regulation, it is still difficult to produce a design sufficiently self-protective, reactances may be employed, external to the machine, to assist in limiting the severity of the short-circuit current. (In case of machines wound for high voltage, external reactances are sometimes employed to protect the windings from voltage surges. Reactances, employed to limit the short-circuit current, may be arranged to serve as reactance screens for the last-mentioned purpose also.)

The severity of short circuit in any particular machine depends on the amount of flux, and not on the amount of excitation or load present at the instant. Tests should never be undertaken at a voltage higher than the normal for the machine.

When making short-circuit tests, a solid contact should be made, as an arcing contact might cause puncture between the machine windings. If it is desired to reduce the effect of short circuit, reactance in preference to resistance should be used, or the voltage of the machine reduced, as resistance tends to improve the power-factor of the short circuit, and thus increase the mechanical shock upon the shaft.

Machines.

Arrangement and Markings of Terminals (see Section XII.).

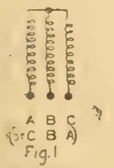


Fig. 1
3 Phase Neutral not brought out

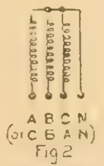


Fig. 2
3 Phase Neutral brought out

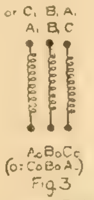


Fig. 3
3 Phase Both ends of each phase brought out but to different terminal boards

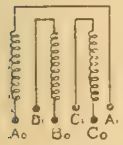


Fig. 4.
3 Phase. Both ends of each phase brought out to same terminal board

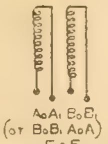


Fig. 5.
2 Phase Both ends of each phase brought out to same terminal board

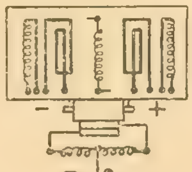


Fig. 6

Instrument Outline Symbols (see Section XIII., Rule 3.

Fig 1

Fig 2

Fig 3

Fig 7
(Synchroscope & Lamps)

Fig 4

Fig 5

Fig 6

Note.—Other outlines may be made to indicate instruments of special shape.

Section XI.—Transformers Terminal Markings.

Three-phase Transformers.

(1) *Lettering.*—The different phase windings are to be distinguished by the letters A, B, C, indelibly marked on their respective terminals.

Note.—It is recognised that with some standard makes of transformers it is not possible to arrange the terminals in the order A, B, C on both high-pressure and low-pressure sides, without introducing objectionable crossings amongst the leads within the transformer. Provided the terminals are properly marked in accordance with these rules, their actual position upon the case is of secondary importance.

(2) *Similar Letters on High and Low-pressure Windings.*—The same letters are to be used on the high-pressure and low-pressure terminals of similar phases.

(3) *Distinction between High and Low-pressure Markings.*—The distinction between "high-pressure" and "low-pressure" terminals in any phase shall be made preferably by using small letters for the low-pressure markings, and capitals for the high-pressure markings. It is, however, permissible to indicate the low-pressure winding by the use of capital letters with a circle around each letter.

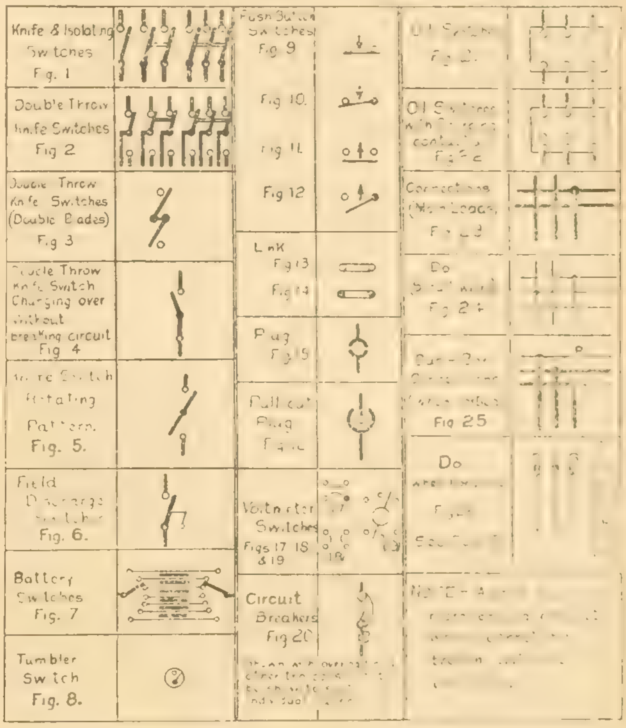
(4) *Marking of Polarity.*—The relative polarity of the two ends of every winding will be shown by the addition of the markings 0 and 1 after the phase letters.

(5) *Polarity of Low-pressure with respect to High-pressure Markings.*—The terminal marked 1 will be referred to as the positive end of the winding.

The polarity of the corresponding high-pressure and low-pressure windings must be so marked that the progression of the e.m.f. at any instant from A₀ towards A₁ is in the same direction as from a₀ towards a₁, and similarly for phases B and C. That is to say, the negative terminal of

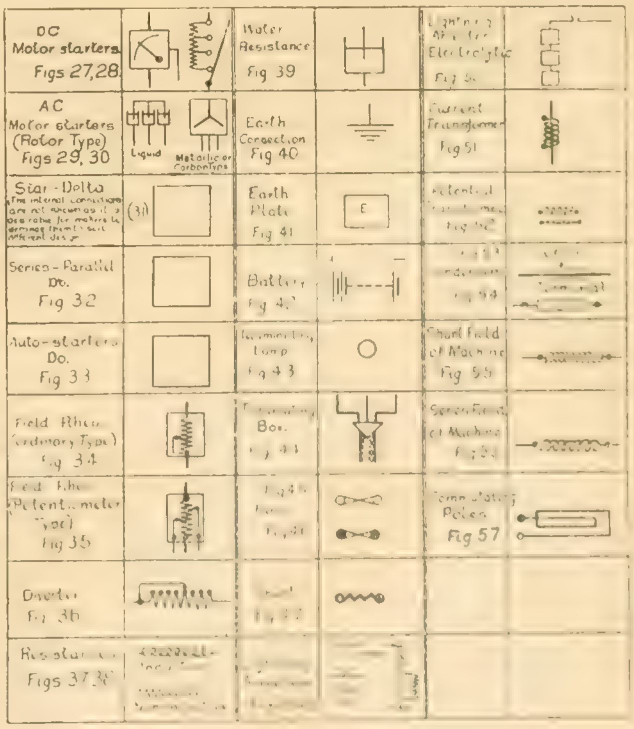
Symbols for Switches and Connections.

(See Section XIII., Rule 5.)


Knife & Isolating Switches Fig. 1
Double Throw Knife Switches Fig 2
Double Throw Knife Switches (Double Blades) Fig 3
Double Throw Knife Switch Changing over without breaking circuit Fig 4
Rotating Pattern Fig. 5.
Field Discharge Switch Fig. 6.
Battery Switches Fig. 7
Tumbler Switch Fig. 8.
Push Button Switches Fig 9
Fig 10.
Fig 11
Fig 12
Link Fig 13
Fig 14
Plug Fig 15
Pull out Plug
Voltmeter Switches Figs 17 18 & 19
Circuit Breakers Fig 20
Connections
Do
Fig 25
Do

Symbols for Miscellaneous Gear and Parts of Machines.

(See Section XIII., Rule 6.)


DC Motor starters Figs 27,28
AC Motor starters (Rotor Type) Figs 29, 30
Liquid
Metallic or Carbon
Star-Delta
Series-Parallel Do. Fig 32
Auto-starters Do. Fig 33
Field Rheostat (ordinary Type) Fig 34
Field Rheostat (Potentiometer Type) Fig 35
Fig 36
Resistances Figs 37 38
Water Resistance Fig 39
Earth Connection Fig 40
Earth Plate Fig 41
E
Battery
Incandescent Lamp Fig 43
Box
Lightning Arrester Electrolytic
Current Transformer Fig 51
Fig 54
Shunt Field of Machine Fig 55
Series Field of Machine
Commutating Poles Fig 57

the high-pressure winding is connected to the positive terminal of the low-pressure winding, the E.M.F. across the two remaining terminals will be more than that across the high-pressure winding alone.

(6) *Marking of Tappings.*—The markings 0 and 1 are placed on the two terminals which give normal voltage. Each tapping terminal will be marked with its fractional value in terms of the normal voltage; or with an arbitrary number, referring to the diagram under Rule 7. The employment of fractional-value markings upon the terminals when adjustment tappings are provided is left optional. When this marking is employed, the terminal marked 1 need not be at the extreme end of the winding. If this method of marking is not employed, the taps must be numbered arbitrarily, and the diagram to be provided must show the values of the different tappings. When the adjustment tappings are provided in connection with an independent section of the winding which may be reversed in polarity, this auxiliary winding shall take the same phase letters as the section to which it belongs, and its various leads and tappings will be indicated by arbitrary numbers.

(7) *Diagram Permanently Attached to Transformer.*—It is recommended that a diagram of internal connections showing the position of all leads and tappings shall be permanently attached to each transformer.

(8) *Marking of Tappings on the Switchboard Diagram.*—On the switchboard diagram adjustment tappings need not be shown.

SINGLE-PHASE TRANSFORMERS.

The high-pressure terminals will be marked T_0 T_1 and the low-pressure terminals will be marked t_0 t_1 in accordance with Rules 3 and 4.

The markings will be so applied as to give the relative polarity of high-pressure and low-pressure windings indicated in Rule 5.

Rule 6 regarding the marking of tappings applies also to single-phase transformers.

SECTION XII.—MACHINES—MARKING AND ARRANGEMENT OF TERMINALS.

(1) For A.C. machines, the letters A B C should be adopted to indicate the external connections of a three-phase machine, and the letter N should be used to indicate a neutral connection.

Where both ends of each phase are brought out, A_0 A_1 B_0 B_1 C_0 C_1 should be used to denote the three phases.

(2) The terminals of a synchronous generator should be arranged and lettered consecutively in the order of actual phase progression.

The lettering will therefore progress from either left to right, or from right to left, according to the direction of rotation (see figs. 1 to 5, p. 743).

(3) In the case of a standard A.C. motor, where the actual order of phase progression is usually not known, it is recommended that the phase terminals shall always be arranged and lettered in the order from left to right (see figs. 1 to 5, p. 743.)

Note.—Induction motors used with rotary converters are regarded as special, and are not subject to these rules.

(4) Terminals on large D.C. machines should be arranged in order of polarity from right to left, looking at the commutator. A standard generator has its positive terminal on the right and should be so marked (see fig. 6, p. 743).

(It is not necessary to mark polarity on motors.)

SECTION XIII.—RULES FOR SWITCHGEAR SYMBOLS.

(1) *Diagrams.*—In general diagrams, the apparatus should be drawn as viewed from the main operating position. Machines and cables in the station should be drawn as viewed from above.

(2) *Colouring and Arrangement of Phases.*—

(*a*) The arrangement of bus-bars should be such that the red and blue phases are outside, and the bars should be indicated in the order of the National Colours—Red, White (or Yellow), and Blue (R, Y, B).

(*b*) When arranged horizontally, the red phase should be at the top, or the bar farthest away as viewed by the operator from the main control position in any direction.

(*c*) When arranged vertically the red phase should be to the left, or the bar farthest away, as viewed by the operator from the main control position in any direction. (See figs. 25 and 26, p. 743).

(3) *Outline Symbols for Instruments.*—

(*a*) From the outline symbols shown on p. 743, a shape should be selected to suit the instrument. Within this outline will be placed the symbol letter or letters selected from the list, Rule (4).

(*b*) Instrument terminals if shown should be indicated by dots, the positions of which are varied to suit different makes of instruments.

(*c*) Any further features which are desired, such as auxiliary switches, instrument windings, instrument terminals, should be indicated by showing their appropriate symbols within the outline.

(4) *Symbol Letters for Instruments* (referred to in Rule 3*a*).

Ammeter	A
Voltmeter	V
Wattmeter (indicating)	W
Ampere-hour meter	A H
Recording (graphic)	
Wattmeter	G W
Ammeter	G A
Voltmeter . .	G V
and others similarly	
Integrating wattmeter	W H
Overload relay	O R
Overload constant time limit relay ...	O T R
Overload inverse time limit relay ...	O I R
Reverse relay	R R
Additional letter may be added if desired to indicate a special feature, as	R P R (Reverse power) R C R (Reverse current)
Power factor indicator	P F I
Synchroscope	S
Frequency indicator	F
Earth plate	E
Neutral (D.C.)	±

(5) *Symbols, Switches, and Connections.*—

(*a*) The symbols to be employed for switches and connections are shown on p. 743.

(*b*) Fixed contacts are represented by dots; movable contacts are represented by circles. A solid dot represents a contact which cannot be broken without unbolting.

(6) *Miscellaneous Gear.*—The symbols to be employed for miscellaneous gear are shown on p. 743.

TECHNICAL EDUCATION IN INDIA.

[FROM OUR SPECIAL CORRESPONDENT.]

A good deal has been said and written about this subject of recent years in India; and a good deal has been done by the various technical colleges to turn out the sort of Indian engineer required to fill vacant engineering posts. The colleges which perhaps have done most are the Victoria Institute, in Bombay; the Sebpier Engineering College, in Bengal; the Thomason College, in Roorkee; and, of more recent date, the Engineering College in Madras and Mysore. Much, however, remains to be done, and it is due to the Roorkee College to say that serious efforts are being made to induce the right kind of students to come forward and prepare themselves for a useful engineering career, in which there are increased openings year by year. An official note is just being issued from Roorkee relating to the new technical classes for students who care to take up a thorough course of mechanical or electrical engineering. The note states as follows:—

"There is known to be a demand in India in the mechanical and electrical engineering profession for men who, after training in a properly equipped institute, are willing to gain their practical experience by apprenticeship on a living wage, to work with their hands, and to observe factory hours and rules. For the civil engineering profession men can be trained in an institute directly for the various grades, the engineer and the subordinate, but even then they will require a certain amount of practical training. In the mechanical and electrical engineering professions, which require very great practical qualifications, however carefully a man may be trained in a technical institute, he is useless to an employer of labour till he has had practical experience; all must work alike and must in all cases begin at the lowest stage and work up gradually in time. This employment is open to Indians of every caste and creed, grade of social position or education, provided the above conditions are observed, and the position to which a man can rise depends on his individual ability and perseverance. Students must thoroughly understand that they are totally unfit for any position of authority on leaving the institute, and that they must first of all be subjected to workshop discipline and learn under practical conditions the details of the work which they eventually hope to supervise. They must be prepared to go into mills, factories and workshops with the full knowledge that they will meet with serious opposition from men, perhaps socially and educationally their inferiors, but who, because they have worked themselves up from the point at which the apprentices are now starting, are of much greater value to their employers than they are at present.

"Given equal practical qualifications a man with a sound education at a technical institute must in time rise to the higher posts of authority over those who have not had these opportunities; but with all, practical knowledge and grit must be present. It is to provide men of this calibre that the technical class is formed.

"The students in this class will be required at the end of their first year's course to specialise in one of the following branches:—

"1. Mechanical Engineering.

"2. Electrical Engineering.

"(1) Mechanical Engineering.

"The course in mechanical engineering is intended to qualify students, after a practical apprenticeship, for employment in engineering workshops, belonging to Government, railways, or private firms. The training at the College will be as practical as possible, giving students a working knowledge of the principles of power generation and transmission, of workshop processes and machine tools, of modern methods of workshop production and cost, and the preparation of working drawings and estimates. As the College cannot give a student a complete practical and commercial training, they must serve an apprenticeship in workshops after their college course, to qualify them for posts of responsibility. If the two years' apprenticeship is served in direct connection with the working of prime movers and steam boilers, apprentices on the conclusion of their apprenticeship, will, on the recommendation of their employers, be permitted to sit for the second-class engineer's certificate under the United Provinces Boilers Act, without previously sitting for the driver's examination. As there are openings for real mechanical draughtsmen in India, the course will also aim to qualify students to take up posts of responsibility in engineering drawing offices. It is not intended to train tracers or copyists, but men who, after acquiring experience, can initiate and improve designs and prepare estimates and working drawings for the shops.

"(2) Electrical Engineering.

"The course is arranged to prepare students for employment on electrical installation for lights, fans, and motors for machine driving, pumping, traction, and general power purposes.

"After obtaining the necessary practical experience by a two years' apprenticeship on commercial works, they should be qualified for employment as follows:—

"(*a*) Taking charge of electric light, fan and power installation (isolated plant), requiring knowledge of connecting-up, starting and running the various items of the plant, the application of working tests to keep the plant in good running order, and the making out of specifications for renewals and extensions arising in the ordinary course of working.

"(*b*) Contracting and tendering for supplying, wiring and fitting electric bells and telephones, lamps, fans and motors, where a public or private supply is available, requiring a knowledge of the use and fitting up of the above apparatus, and the special advantages of different types, also the tests which the work must satisfy in order to be passed.

"(*c*) Appointments in charge of sections of the plant or business of supply companies of engineering firms (shift engineers, mains engineers, etc.), requiring a general knowledge of erection, maintenance, testing and repairs.

"Candidates will be statutory natives of India not under 17 and not over 21 years of age. Having furnished certain testimonials as to character and proved certain educational qualifications, candidates will be required to pass an entrance examination, which will be held in June at Roorkee, Allahabad, Lucknow, Naini Tal, Mussoorie, Lahore, Rangoon, Nagpur, Shillong or Bankipur. The course will extend to five years. Three years will be spent at the College. At the end of the first session students will be required to choose one of the following branches to specialise in (1) mechanical engineering; (2) electrical engineering. For the remaining two years of the course students will, if possible, be formally indentured out to some employer in the branch they have chosen. On the conclusion of the five years' course a college certificate will be issued."

If the above opportunities succeed in attracting the right kind of man, then a real want will in due course be supplied. Some very first-rate Indian engineers have undoubtedly been turned out of the various Indian colleges, but the percentage of first-rate men to the total number of engineering students on the rolls is small indeed. It is to be hoped that the wide scope of the new Roorkee syllabus will gather in young men with the engineering instinct, and eventually send them forth fully equipped to take important positions in engineering posts in India, of which there are many.

There will for very many years yet be a good demand for European engineers from home to fill the more important posts.

THE POWER SUPPLY OF THE CENTRAL MINING-RAND MINES GROUP.

By J. H. RIDER, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 15th*, 1915.)

(*Concluded from page* 707.)

Electric Distribution.

The power company's electric supply is given at normal pressure of 2,100 volts and 525 volts at the consumers' terminals. The distribution switch-houses belonging to the mines are built either at right angles or parallel to the power company's transformer houses, and the supply terminals are brought just through the party wall. In parallel switch-houses the 2,100-volt switchgear is arranged in line at one end and the 525-volt switchgear in the same line at the other end. In right-angled switch-houses the 2,100-volt switchgear is arranged on one side and the 525-volt switchgear on the other, with a common operating passage between them.

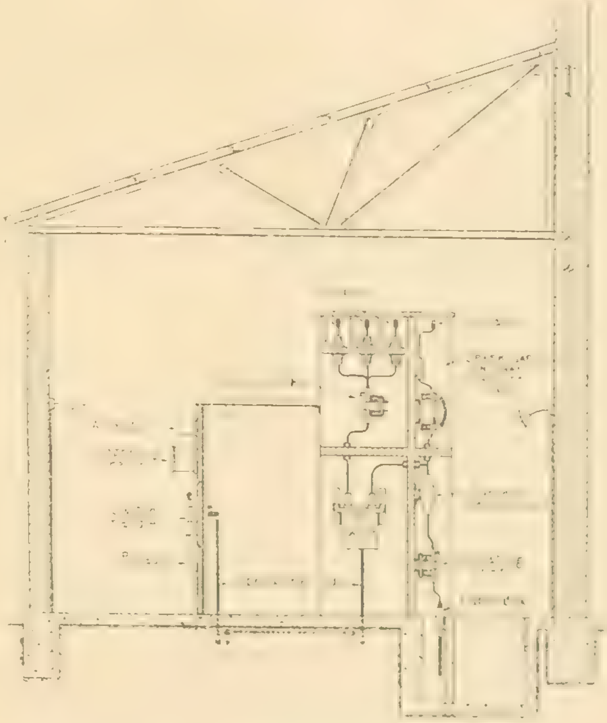


Fig. 7.—Section of Switch-house.

The arrangement of the original switchgear was very defective. There were no barriers between the different sets of apparatus, so that any arcing which might accidentally occur, either in a switch, transformer, or isolating link, was most likely to spread to adjacent apparatus. The bus-bars were quite unprotected, and there was nothing either to prevent the attendant, who might have to enter the passage behind the switchgear, from touching any part, or to save him from falling into the gear.

The need was obvious, but the difficulty was to provide a remedy without interrupting the supply. In those switch-houses which had any vacant space, new switchgear was erected at the end, and the circuits were changed over one at a time, so that as an old switch section was removed a new one could be built in its place. In other switch-houses an extension to the building had to be made before anything could be done. The whole change-over was a long process, but the result has well repaid the trouble.

In the majority of the switch-houses now in use the three bus-bars are carried in brick compartments at the top, and a separate brick cubicle is provided for each line of switch parts. The front slate panels are 2 ft. wide and contain an ammeter, an integrating watt-hour meter, and the switch control lever with its overload trip coil.

The latest form of switch-house is built parallel to the substation, and fig. 7 shows the design of switchgear employed. The cubicle arrangement has been developed to provide isolated sections for the different parts of the gear, so as to limit the result of any accident as far as possible. The cubicles are made of reinforced concrete. The new arrangement requires more space, but as the security of the whole supply depends upon the reliability of the switchgear, the little extra expense is thoroughly warranted.

The oil switches first used had been provided merely on a current-carrying basis for the full load of the circuit which they were to control. This is a very common but most erroneous practice, because it is so often forgotten that an automatic switch should be able to open the circuit with safety to itself under the worst conditions, which will probably be a short-circuit on the cables just beyond it. Frequent switch failures naturally followed. The rules now are: (a) that all oil switches in a switch-house shall be of the same size, (b) that such switches shall be rated for a current of 800 amperes at 15,000 volts, and (c) that no difference shall be made between the equipment of cubicles for 2,100-volt and 525-volt circuits, except in the current transformers and the meters. Since the above practice was instituted, trouble in switch-houses has practically disappeared.

Three-core, lead-covered and armoured cables, laid in trenches, are universally used between the main switch-house and the various sub-distribution points on each mine. The points are arranged to suit the local conditions, and are generally interconnected so that the failure of any main cable does not stop the supply. Link cages, without switches, are provided at the sub-points, so that the sub-circuits can be isolated at any time and the feeders interconnected as may be required. The largest cable used is of 0.5 sq. in. section per phase, and a separate panel for each feeder cable is provided in the switch-house. Where necessary several cables are run from the switch-house to individual link cages, and are operated in parallel.

Many and varied troubles have been experienced since the beginning of the power supply, quite apart from those which can be laid to the charge of the power company. They have been very costly in some cases and very annoying in all, and each and every one could have been avoided. The troubles have arisen from two main causes: (a) faults in design, and (b) faults in manufacture.

(a) *Faults in design.*—Want of stiffness in the stator frame has been found both in low-speed direct-coupled motors and in geared motors. The fault is a most serious one, and the remedy is obvious.

Some makers secure the stator core stampings by means of dovetailed strips screwed to the inside face of the frame. This is not nearly such good practice as to machine dovetailed slots out of the solid metal of the frame, into which the dovetailed projections of the stampings fit, as there is always the risk of the screwed strips getting loose under the severe racking strains to which the stator of a winding motor is always subject.

A number of 3-phase winding motors were supplied in which the dovetailed strips were "secured" by means of studs with nuts on the outside of the frame within the housing. No lock nuts or even spring washers were provided, and as the practice of the makers was to adjust the air-gap by means of the studs, the results can be imagined.

In motors by the same maker, the stator and rotor core-plates were clamped sideways by bolts passing right through, and the nuts were entirely hidden by the end loops of the coils. One motor was delivered in which the width of the stator core was 18⅜ in. on one side and only 18 in. on the opposite side, while the corresponding dimensions of the rotor core were 18⅛ in. and 17⅝ in. It was impossible to get at the nuts to tighten up the core-plates without first removing the windings. The proper way to secure core-plates sideways is to clamp them between stiff end plates and to use circumferential locking keys.

Cases were found in which the dovetailed slots were so wide that packing strips had been inserted to keep the core-plates from shaking. When complaints were made the maker asserted that it was not possible to machine so accurately as to avoid the use of such packings!

It is the practice of some makers to make semi-enclosed winding slots in the core plates by first punching a closed slot and then, when the whole core has been clamped up, to cut through the periphery of the core at the top of each slot by means of a saw. Quite a number of motors have been made in this way, and it was found that the result of the saw-cutting was to spring out the tips of the teeth on each side of each ventilating space, so that the spaces were almost closed in many cases. It was only by taking out the rotor that the fault could be seen. The correct way to make semi-open slots is to punch them out at one operation.

Difficulties were experienced in many cases from the type of distance piece used to form the ventilating spaces in the stator and rotor cores. This was a plain, thin steel strip, placed radially on edge and secured to one of the adjacent core-plates by simple riveting. The necessary pressure used in clamping up the core-plates was too much for many of the distance pieces and, instead of remaining firmly at right angles to the spaces, they bent over and partially collapsed. The area of contact between the edge of the strip and the face of the plate was in most cases found to be too small to take the pressure, and particularly where the core teeth were wide the teeth at the ventilating spaces were badly bent. Distance pieces of I section which are stiff and have a good bearing face on each side are now insisted on for all motors, and they should be spot-welded to at least one of the adjacent core-plates. They are easily obtained, as instanced by the fact that some makers never use any other form, but from the objections raised by other firms one would think their provision was not only impossible but also meant bad practice.

With a view to produce a 3-phase motor with a very high power factor, it is the almost universal custom to make the air-gap exceedingly small, and in many cases this is carried to excess. Instances of rotors of 6 ft. diameter with a radial air-gap of only 1 mm. are not unknown on the Rand, and when such motors also have stator frames which will not retain their shape without external struts, the matter becomes very serious from the operating point of view. Bearings will wear, and rotors and stators sometimes get out of truth; and it does not take very much in some cases to let the rotor down on to the stator. Then the customer blesses the motor maker.

A minimum radial air-gap = square root of rotor diam. in mm./20 − 0.25 in. mm. is now demanded for all moderate-speed motors, and manufacturing errors are not accepted.

A serious fault with many 3-phase winding motors is in the sizes of the rotor slip-rings and brushes. Contact areas which are large enough for motors in which the slip-rings are short-circuited and the brushes lifted as soon as full speed is reached, may be, and frequently are, quite insufficient when the brushes and rings are in use the whole time. A current density of not more than 60 amperes per square inch should be the maximum for carbon brushes.

A similar fault is to be found in the motors and generators of some Ward Leonard winders, and in this case the R.M.S. rating is not the controlling factor. The brush area should be based on the maximum current passing on accelerating the winder, which current is frequently twice the normal.

That slip-ring short-circuiting arrangements are generally very defective has already been mentioned. It would appear to be a difficult matter to design them so that a large area of contact can be provided in the space usually available, and so that the sliding collar which carries the contacts can be accurately centred and held free from shake and side movement when the brushes are lifted. A great deal of the difficulty would, however, be removed if the slip-rings were made only a few inches larger in diameter. The fact that the peripheral speed would be increased would be of no consequence, as the brushes are lifted at full speed. Flimsiness of design is the usual characteristic of 3-phase motor brush-gear.

The rating of oil switches was referred to in dealing with the switch-house arrangements. Is it too much to ask of makers of switchgear that they will rate their oil switches, not only at the maximum currents which these switches will safely carry continuously, but also at the maximum kilowatts at which they will safely break the circuit under normal voltage? They would probably burn up a few switches in obtaining the information, but they would then be in a position to supply apparatus which would really stand up to the conditions of actual service.

A fault in the design of some motors which have end-shield bearings is that the oiling ring is placed in a position where it can neither be seen nor reached.

Perhaps the most important point in connection with the design of motors and generators is that of the safe maximum working temperature. The altitude of the Witwatersrand is about 6,000 ft. (barometer 24.5 in.) above sea-level, and as the reiteration of that fact in hundreds of inquiries for plant seemed to have no meaning for some makers, recent specifications have had to call for a maximum temperature under test at sea-level which would give a safe working temperature at the mines.

The clause provides that no part of the motor, when working continuously at full load at sea-level, shall have a temperature rise exceeding 30° C., with the surrounding air at a temperature of 25° C. This corresponds approximately to a temperature rise of 35° C. at an altitude of 6,000 ft., with a surrounding air temperature of 35° C., or a total temperature of 70° C. (158° F.), which is quite high enough for any machine to work at continuously if a long life is to be obtained.

As the supply voltage can, and frequently does, vary between limits of 10 per cent. up and down from the normal, the lowest supply pressure must be taken for the purpose of the test.

The Engineering Standards Committee recently proposed that "a machine intended to operate between two limits of rated pressure shall have its rated current determined at the higher pressure." This would be fatal for motors intended for the Witwatersrand, or any other place where the supply pressure has considerable variations, as they must be able to work continuously with the larger current which is entailed by the lower voltage limit.

The great objection which most makers put forward to a lower temperature limit is that it would increase the cost of the motor, or it would mean the use of a larger frame, or any other reason which they can find to avoid giving the purchaser what the latter requires. Unless the customer insists on his requirements being met, the great competition between various makers will probably result in machines being supplied which are cut finer and finer every time. It is, of course, always assumed that the purchaser has an intelligent knowledge of his requirements, and that they are always reasonable. As an instance of the extent to which some firms will go in under-cutting, the representative of a very well-known firm once remarked to the author, relative to the sizes of the motors kept in stock by that firm, "Output plates are cheap."

Some manufacturers have not yet learned the important lesson, that in order to succeed they must be prepared to supply what the customer wants and in the manner that the customer wants it, and not try to prove to the customer that he does not want what he wants, but what the manufacturers make. As a matter of fact few manufacturers make any real attempt to find the requirements of any particular market, and a still smaller number make any real attempt to meet such requirements. Then they express surprise when the market leaves them.

(*b*) *Faults in manufacture*.—For faults in design there may be the slight excuse that the designer is limited in his experience of the particular duty that will be required of the plant which he is designing. For faults in manufacture there can be none. What then can be said of the under-mentioned list, the items of which are a few of many that have come under the personal knowledge of the author during the last four years, and all of which occurred in the work of firms of world-wide repute?

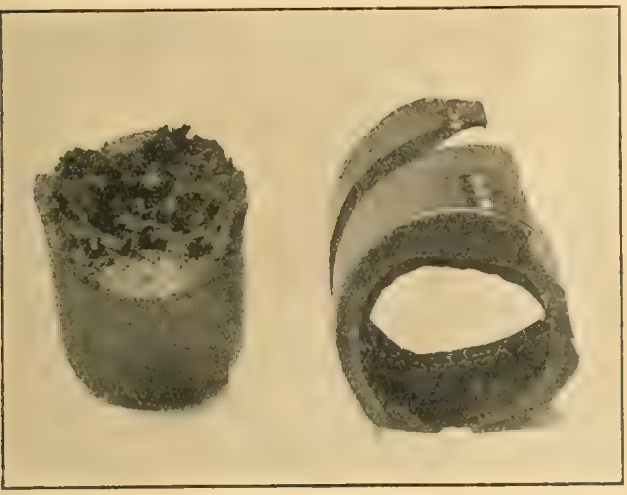


Fig. 8.—Broken Shaft and Broken Brake Pin.

In one case the several sections of a cast-iron bedplate of an electric winder would not fit together, even by persuasion, although the maker seriously stated that they had been perfectly fitted in his shops. Doubtless the higher temperature and relative dryness of the atmosphere on the Rand had something to do with it.

The shaft of a 100-h.p. motor, driving a tube mill, broke off just outside the coupling. The method of manufacture can only be guessed at from the right-hand object in fig. 8. The shaft had layers just like an onion, and these layers had apparently been wound on spirally and then welded together.

A steel pin, 3 in. diameter, supplied for part of the brake gear of an electric winder, showed one or two surface flaws when inspected on delivery. A slight blow with a hammer broke the pin in halves, with the result shown in the left-hand object in fig. 8. It proved to be made of cast-steel instead of forged steel, with a blowhole covering almost the full diameter. When it is remembered that men's lives would in all probability have been lost when the brakes had been applied a few times, some idea of the seriousness of the case will be obtained.

The instance of the 3-phase winding motor in which the dovetails were adjusted from outside has been mentioned. As no spring washers were supplied an attempt was made to make the nuts more secure by using them, and, for this purpose, the nuts were removed one at a time. On taking off one of the nuts the bolt end came away with it, and on examination it was found that the original bolt was only projecting through the stator frame for a depth of about two threads. A short bolt end had been screwed into the top of the nut to make it appear sound from the outside. There could be no mistake, as the two abutting ends did not in any way match.

Trouble had been experienced with the stator coils of some 3-phase, 2,000-volt winding motors, and the external taping of some of the end loops was removed. It was found that the slots were only three-quarters filled with wires, the rest of the space being empty. To make it appear that everything was all right, pieces of tape had been carefully screwed up and pushed for a short distance into the slots. These pieces were gradually tapered off where they followed the coil out, so that the external wrapping of tape gave a smooth finish right up to the core. Every other motor of the same size and make was then examined and found to be in a similar condition. It cost the maker a considerable sum to make the motors even passably right.

All stator coils for 2,000-volt motors are now required to be either semi- or completely-former wound, and to fill the slots completely.

The most costly trouble to either of the mines was the case of the breakdown of the motors of two large Ward Leonard winders, which failed from the same cause within a few hours of each other, and completely shut down a large shaft for four or five days. The spaces between the turns of the main-circuit coils on the auxiliary field poles had been filled up with some kind of pitch, and the whole was taped over. The armatures had open slots without wedges, and the coils were held down by a number of steel-wire bands. These bands broke away on two of the motors, some of the coils came out, and very bad breakdowns resulted.

When the top halves of the field magnet-systems were removed, lumps of hard pitch were noticed on the faces of the auxiliary poles, and these showed heavy scoring marks where they had rubbed on the armature bands. An examination of what was left of the bands showed that the first layer had been rubbed right through in some places. There could be no doubt that the pitch inside the coils had melted and run down, that it had set hard during the night and that when the winders were started up in the morning the wearing of the bands began. A further examination showed the original source of the trouble. The external connections between the auxiliary pole coils had been carefully taped up by the maker before the motors were delivered. They were found to have been made as shown at the top of fig. 9. The windings consisted of four copper tapes in parallel, and the cross-connections from pole to pole were made up from similar tapes. Each set of four had been bunched together, one set was laid on the other with a copper plate at the top and bottom, and four ocuntersunk-headed screws, ½ in. in diameter, were used to draw the parts together by a screwdriver. The surfaces of the tapes had been left dirty, the burrs made by the drilling had not been removed, and a number of the screws were found melted off. As the current was frequently as high as 5,000 amperes, this is not to be wondered at. The heat at the contacts had evidently made the whole coil so hot that the pitch had melted out and the breakdown quickly followed. The remedy was a simple one. The faces of the individual tapes were carefully cleaned and then interlaced as shown at the bottom of fig. 9. Hexagon-headed bolts and nuts instead of screws enabled a heavy pressure to be applied, and the joints now run quite cool.

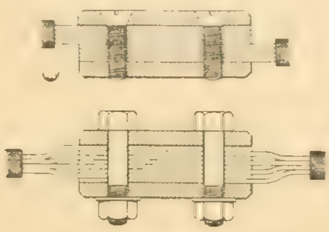


Fig. 9.—Connections on Winding Motor.

Many other instances of bad work could be cited, but the above examples are characteristic and serve to shew what even big firms will sometimes do if they are not carefully watched.

INSTITUTION OF ELECTRICAL ENGINEERS.

Annual Report.

The annual report of the Council, to be presented to the general meeting of the Institution on May 27th, has been published in the *Journal*, and states that at May 1st the membership amounted to 6,811 of all ranks, a decrease of 234 during the year. New members elected numbered 171, mainly students and graduates, and 16 were reinstated. 51 died, 126 resigned, and 244 (including 129 students) lapsed. Sixty candidates for Associate Membership have been approved subject to their passing the examination.

Military distinctions have been conferred upon Brigadier-General A. M. Stuart, C.B., R.E., Commander E. G. Robinson, R.N., and Second-Lieutenant G. W. Williamson, for their services during the war.

Three past-presidents have died during the year, namely: Prof. W. Grylls Adams, Mr. R. Kaye Gray, and Sir Joseph Wilson Swan. Seven members have died on active service, namely: Sapper J. A. Donald, Henry Labour, Major H. H. S. Marsh, Sec.-Lieut. J. L. Moffet, Sapper W. W. Pullen, Captain Guy L. Sclater, and Sec.-Lieut. Eric W. Wilson.

Premiums have been awarded as follows:—Mr. C. J. Beaver, Institution Premium; Mr. J. H. Rider, Ayrton Premium; Mr. H. G. Brown, Fahie Premium; Mr. E. B. Wedmore, John Hopkinson Premium; Dr. S. P. Smith and Mr. R. S. H. Boulding, Kelvin Premium; Mr. C. P. Sparks, Paris Premium; Messrs. W. M. Selvey and N. Shuttleworth, Extra Premiums; and Students' Premiums to Messrs. H. Hobson, A. Arnold, and H. S. Marquand. Salomons Scholarships have been awarded to Messrs. L. M. Barlow and C. D. Farmer, and a David Hughes Scholarship to Mr. P. D. Morgan.

A revision of the Wiring Rules is in progress. Over 2,500 copies of the revised Model Conditions for Contracts have been [illegible] The Research Committee has made further progress, and interim reports have been published in the *Journal* on the heating of buried cables and the properties of insulating oils. The effective steps taken by the Council to assist the authorities are described, and it is stated that 928 members are serving in the Navy or the Army. The appointment of a committee to deal with the expansion of British trade is explained, in a passage which we reproduce in our leading columns.

A committee appointed to consider the periods of repayment allowed by the Local Government Board for loans to municipal authorities has recommended periods of 30 years in the case of underground cables, 60 years for conduits, 15 years for batteries, and 30 years for reinforced concrete, and the Council will make representations to the Board on these lines.

The Committee of Management of the Benevolent Fund reports that the capital account of the fund stood at £4,642 at the end of 1914. In response to a special appeal by the President, £318 has since been raised.

The annual accounts show an excess of income over expenditure of £1,624, compared with £2,833 in 1913. Mortgages have been reduced by £710 and now stand at £34,232, and the balance of assets over liabilities stands at £71,570, compared with £69,523 in 1913, an improvement of £2,047. There are now 11,085 volumes in the Library; there were 1,585 readers during the year, and 602 books were issued from the lending library.

Practical Aspects of Visibility.—In opening a discussion on this subject at a recent meeting of the ILLUMINATING ENGINEERING SOCIETY, MESSRS. C. C. PATERSON and B. P. DUDDING communicated the result of inquiries into conditions which, in some practical cases, prevent good visibility. The more interesting of the cases considered were: (1) The visibility of distant lights at night. (2) The visibility of objects illuminated by the beam of a searchlight or motor headlight. (3) The visibility of objects in close proximity to bright lights. (4) The relative visibility of objects by direct and indirect light. The question of visibility as distinct from invisibility is frequently bound up with the behaviour of the eye on the "threshold of vision." A variety of unusual factors exert their influence under very faint illumination, and, in such cases as the above, they are of great practical importance.

Sailors and railwaymen are concerned with the visibility at night of very small point sources of light. White masthead lights carried by steamers are supposed to be visible at 5 miles, and the red and green side lights have to be visible at 2 miles, which is about the limit attainable by oil burners; electric lighting is now common even on tramp steamers, and is subject to no such limitation. On an ordinary clear dark night, 1·6 C.P. is visible at 2 nauts, atmospheric absorption is unimportant and the inverse square law holds good. The intrinsic brilliancy of the source has no effect on its visibility. It is only the total flux of light that counts, until the source becomes so large or near that it subtends more than one minute of arc at the eye. The energy received per second from 1·6 C.P. at two miles is about 6×10^{-15} watt, and it is possible to stimulate vision with one-fourth of this power when the eyes are dark adapted.

In connection with motor headlamps and searchlights, if an object be visible at a certain distance under one illumination, more than four times that illumination is needed to make it visible at twice the distance, because the object itself then appears much smaller. From a series of interesting investigations, Messrs. Paterson and Dudding find that brightness for equal visibility must be proportional to the square of the distance from the observer so long as the object subtends less than $10'$ arc (1 ft. at 100 yards); but for objects subtending a larger angle, the law suddenly changes and brightness for equal visibility is simply proportional to distance. This result, which does not accord with usual assumptions, appears to be well established by the authors' tests, and a reasonable theoretical explanation for it was advanced by Dr. Chalmers in the discussion. Probably for long-distance searchlight work 16 times the intensity is required to render objects visible at twice the distance.

It is interesting to note that under very severe conditions of "glare"—looking from a distance of 6 ft. at a point only 8 in. from a bare 20-C.P. lamp—no appreciable effect whatever was produced on ability to discriminate detail, so long as the equivalent surface brightness of the object was not less than 1 ft.-candle. These results do not affect the undesirability of glaring lights from other points of view, but indicate that glare has little effect on visibility of detail under ordinary conditions of lighting.

In conclusion, the authors pointed out that discrimination of detail on textile and other materials of uniform colour depends entirely on shadow, or the direction of incident light, so that indirect lighting is practically worthless in this respect. For discrimination of detail, and to avoid a monotonous effect, indirect lighting needs "helping out" by direct lighting.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

6,580. "Incandescent electric-lamp luminous and non-luminous resistances." J. J. RUSSELL & F. L. HARRISON. May 3rd.

6,586. "Thermic telephones and like instruments." R. AERNOUT, BARVON VAN LYNDEN, & NAAMLOOZE VENNOOTSCHAP DE NEDERLANDSCHE THERMO-TELEPHOON MAATSCHAPPIJ. May 3rd.

6,592. "Lamps." BRITISH THOMSON-HOUSTON CO., LTD. May 3rd. (General Electric Co., United States.)

6,593. "Sparking plugs." M. POGNON. May 3rd. (Convention date, May 28th, 1914, France.) (Complete.)

6,618. "Electric motors or dynamos." W. H. SCOTT. May 3rd. (Divided application on 16,093/14. July 6th.)

6,619. "Brush-gear for electric motors or dynamos." W. H. SCOTT. May 3rd. (Divided application on 16,093/14. July 6th.)

6,635. "Carbon holder for electric arc lamps." L. GREENROYD. May 4th.

6,642. "Combined electric switches and connecting plugs." R. MOORE. May 4th.

6,665. "Means for regulating electric circuits." H. LEITNER. May 4th.

6,674. "Leakage-protection device for electric cables." C. J. BEAVER & E. A. CLAREMONT. May 4th.

6,685. "Coin-operated electric supply apparatus." P. WESSEL. May 4th. (Convention date, May 4th, 1914, Norway.) (Complete.)

6,708. "Sparking plugs." J. A. KENNEDY-MCGREGOR. May 5th.

6,715. "Electrical generators for lighting mechanically-propelled vehicles." H. C. H. SMYTH. May 5th. (Divided application on 22,062/14, November 5th.)

6,723. "Equalizing field windings for multipolar dynamo-electric machines." E. ROSENBERG. May 5th.

6,731. "Windings for electrical apparatus." BRITISH THOMSON-HOUSTON CO., LTD. May 5th. (General Electric Co., United States.)

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THE
ELECTRICAL REVIEW.

VOL. LXXVII. MAY 28, 1915. No. 1,957.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: May 28, 1915. [No. 1,957.

Page
The Smithy Bridge Railway Collision ... 749
'Lest we Forget" ... 750
Arbitration in Municipal Contracts: Architect *v.* Engineer ... 750
Lead ... 751
"When in Rome——" ... 751
Some Notes on Shunt Regulating Resistances, by Thomas Carter (*illus.*) ... 752
The Pliotron in Wireless Telegraphy and Telephony (*illus.*) ... 753
Notes from Canada ... 755
Legal ... 756
New Electrical Devices, Fittings and Plant (*illus.*) ... 756
War Items ... 757
Business Notes ... 758
Main-Motor-Starting Switchgear used on Modern German Submarines (*illus.*) ... 763
Notes ... 764
City Notes ... 767
Stocks and Shares ... 771
Share List of Electrical Companies ... 772
Market Quotations ... 772
A Motor Searchlight Plant (*illus.*) ... 773
Single and Multiple Ground-Wire Antennæ (*illus.*) ... 773
Electric Power in India, by H. R. Speyer ... 774
Load Factor, Output and Cost, by C. Ashmore Baker (*illus.*) ... 775
Correspondence—
  Cab Signalling ... 777
  Cable Shortage ... 777
  Automatic Lift Accidents (*illus.*) ... 777
  Automatic Electric Lifts ... 778
Indian Notes ... 778
The Power Supply of the Central Mining-Rand Mines Group 779
The Bombay Hydro-Electric Scheme ... 780
New Patents Applied for, 1915 ... 780
Abstracts of Published Specifications ... 780
Contractors' Column ... Advertisement page xx

THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 939; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:
ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
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MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
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WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
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THE SMITHY BRIDGE RAILWAY COLLISION.

THE report of Lieut.-Colonel Druitt on the collision on the Lancashire and Yorkshire Railway at Smithy Bridge on March 18th shows that, whilst the accident was generally similar to that at Ilford on January 1st, it yet had some features in which it differed from the earlier occurrence. The collision was, fortunately, not attended by so great a loss of life as that at Ilford, but one of those killed was the driver of the express, who seems to have been responsible for the disaster.

The collision took place during a snowstorm, as to the intensity of which, and the necessity for change of procedure in signalling operations, there seems at the time to have been some diversity of opinion amongst those engaged in working the traffic. The evidence given at the inquiry covers the working over four block sections and some of the operations at another, and clearly brings out several interesting points—not necessarily for the first time.

The train which was run into was an empty stock train, which had been standing at Smithy Bridge East box for over twenty minutes at the time of the collision. The fireman had complied with the regulation which required him to proceed to the signal box. The driver and fireman of this train both said they had difficulty in seeing the signals when approaching the point at which the train ultimately stopped. The light of one signal could not be seen on account of the spectacle being blocked with snow, and that signal was treated as at danger. Much of the difficulty in seeing the signals was due to the engine cab windows being covered with snow, which necessitated looking outside the cab to see the signals.

The first evidence with regard to the express, in the order of the progress of the train, is that of the guard in charge, who stated that he noticed the outer distant signal for Summit West was off when he passed it. The signalman at Summit West box said there was some delay in accepting the train by Littleborough Station, and that the express passed his box before he could remove his hand from the lever operating the outer distant signal. He was of the opinion from the speed at which the train was travelling that it would have passed all his signals at danger, had he not lowered them immediately before the train passed them. This signalman also stated that the windows of his box on the side from which the train was approaching were covered with snow. The outer distant, however, is some distance inside the tunnel and not, therefore, affected by the snow.

The fireman of the express stated that he saw the home signal for this box, and that it was off.

The signalman at Littleborough Station stated that the express passed through the section controlled by this box with the signals all off, but that he noticed that the distant signals for the box in advance (Littleborough West) were at danger, and he was so impressed by the speed of the train that he called the attention of the signalman in advance, and told him he thought the express was going to run past the latter's stop signals.

The fireman of the express stated that he advised the driver that the Littleborough Station distant was off, and the driver answered: "Right."

The express did pass the stop signals at danger at Littleborough West, and continued into the next section. The signalman at that box had a special lever for placing a detonator on the line run over by the express, but did not use it. He admitted that it "would have been better" if he had placed the detonator on the line when the section ahead was blocked, and if he had used "fog block," it would have added to the safety of the working.

The next direct evidence is again that of the fireman, who said: "I . . . . had just finished firing when my mate shut the regulator and applied the brake, but did not say anything to me." "My driver appeared to be all right and had not shown any signs of illness. I think he was looking out over the side of the cab before the collision occurred. . . . The windows of the cab were snowed over, and when I observed the signals I was looking outside the cab."

Here we have a number of conditions contributing to the accident, and some of them in more ways than one. A snowstorm of some magnitude blocks the line with traffic between certain places. A train is held up at a place already so choked with traffic that it is impossible to get the train off the main line. Some of the signalmen fail to realise all the conditions, and do not bring into operation the modifications of block working which are intended to meet the conditions set up by the snowstorm, and one of them fails, although specially warned, to actuate emergency mechanism, provided to deal with overrunning. The driver of the train following that which has been brought to a stand overruns all the signals in one section and the non-stop signals of the section occupied by the standing train, with the known results.

Three points seem to stand out clearly from this short recital of the circumstances in the order of their occurrence. The first is that the value of any apparatus provided for manual operation in cases of emergency depends entirely upon the readiness with which the circumstances are grasped by the operator. The second is that it seems undesirable to leave the initiative for bringing modifications of operation into use in the hands of those whose instructions for the purpose are dependent upon their local conditions. The third is the necessity for further information being afforded to the driver under such conditions as obtained in this case.

The first point relates to the emergency detonator placer at Littleborough West, which is said to be one of a large number installed. In this case infrequency of use had apparently a good deal to do with the failure to operate it when such operation would have been of peculiar value. The second point refers to the conditions under which signalmen are to commence fog-block working and to call out fog-signalmen. Fog signalmen are called out when the signalman cannot see, or has difficulty in seeing, some designated "object" in his neighbourhood from his box. The degree of clearness with which the signalman can see his "object," and upon which he must decide upon the need for fog-signalmen, is obviously a matter personal to individual signalmen, and is governed, moreover, by local conditions. But this measure of visibility tells the signalman nothing with regard to the effects of the storm on the driver of an approaching train, such as the covering of the engine-cab windows, as in this case, nor does it tell him anything with regard to the obscuring of the lights of signals on the indicating side of those signals which lie in the direction from which trains approach his box. After all, it is the effects in so far as they relate to the driver that count.

On the third point it seems hardly necessary to enlarge. There are few who at this date will not concede that the driver's duties are of too onerous a character under such conditions, without means of ascertaining the positions of signals in addition to that of direct vision. The evidence of the driver and fireman of the stock train and that of the fireman of the express shows clearly the difficulties experienced in sighting the signals. The evidence goes to show that the express driver's condition was normal. What caused him to pay no observance to the signals exhibited in the comparatively short run necessary to bring about the collision will never be known, but the lesson—one of many of the same class—is clear.

Colonel Druitt concludes the report in much the same terms as Colonel von Donop concluded the report on the Ilford collision. Both would seem to be content with "an unmistakable warning as to the position of the distant signal." Both refer to other railway companies (not by name) which have already made trials of devices designed for this purpose, and the further remarks are only diversified because the L. and Y. Co. have made experiments with "more than one kind for warning drivers when passing distant signals," and the Great Eastern have not. One is led to infer from the almost identical phrasing of the concluding paragraphs of the two reports that the Inspectors have come to an agreement with regard to the requirements. But surely the paragraphs quoted do not represent all that the Inspectors consider necessary?

"Lest we Forget."

The frightful disaster which took place near Carlisle on Saturday last, far surpassing in magnitude and horror any railway accident previously recorded in Europe or America, has sent a thrill of grief and dismay throughout the nation. The saddest feature of the accident is the fact that not only its appalling accompaniments, but also its very occurrence might have been prevented. The use of electric signals giving warning to the driver of the troop train of the presence of the local train on the up line would have enabled him to stop in time, and as our pages have fully shown, the only question is not whether there is a practical system of track-circuiting available, but which of the various systems extant is the best. As for the burning of the trains, there is only too much reason to believe that it was due to the use of gas on two at least of the three trains that were involved. We almost despair of arousing the British public to the realisation of the dangers of this practice. We have constantly dwelt upon the terrible risk incurred by it, though abused by the organs of the gas industry and mocked at by our electrical contemporaries, and we have urged that the bitter lessons taught us from time to time should not be forgotten, but should be taken to heart and acted upon. Unfortunately the public has a short memory, and after a few days' agitation takes up some other sensation. We fear that the war news will occupy its mind to the exclusion of all else, and that the railway authorities will be permitted as usual to ignore the teachings of the past.

Arbitration in Municipal Contracts: Architect v. Engineer.

The Melbourne City Council recently discussed a motion in which it was suggested that the arbitration clauses contained in the conditions of contract framed by the Royal Victorian Institute of Architects should be inserted in all contracts to be entered into by the Council to which such clauses would apply. The notice of motion rightly brought a communication from the Victorian Institute of Engineers pointing out several important things. First, it was asserted that by far the greater proportion of the Council's contracts related to matters of civil, mechanical, and electrical engineering. Next, that a large proportion of the items of building contracts also related to engineering issues in respect of steel and reinforced concrete construction. Lastly, and by no means least important, it was remarked that the conditions of contract of the Royal Victorian Institute of Architects required that arbitrators should be members of that Institute. The engineering profession not unnaturally protested against any attempt to prevent its members from acting in a capacity in which it had previously been recognised that they were fully entitled to act. Objection was with equal justice raised on the ground that the motion, if passed, would make no provision whatever for arbitration in respect of a large class of work concerning which engineers alone were competent to act. In the course of the City Council discussion it transpired that the Master Builders' Association had resolved not to tender for any of the Council's contracts unless there was an independent arbitrator to appeal to, and the suggestion referred to in the motion was based on the belief that members of the Institute of Architects had had the largest experience of arbitration matters. That an independent arbitrator should be appointed is altogether the correct thing—we have advocated it in season and out of season for many years—but to imagine that because an architect is a member of a certain Institute he is therefore fully qualified to arbitrate upon more or less extensive engineering operations is, from the engineering point of view at any rate, little short of ludicrous. We should more readily regard a highly qualified professional engineer as being by training and experience fitted to arbitrate in regard to the contracts concerning which the architect had been acting. However, the original proposal appears to have been brought forward with the most innocent of motives, under pressure of the Builders' Association, as competitive tenders could not be obtained without independent arbitration being secured, and the points advanced by the Victorian Institute of Engineers had seemingly not been foreseen. The upshot of the matter was the withdrawal of the original motion and the substitution of an amendment which would avoid the principle proposed being applied to every department dealing with contracts. The amendment which was agreed to contented itself with requesting the Legislative Committee of the Council to revise the conditions of contract, with the special object of providing for an arbitration clause. There the matter ends for the present, but the incident shows how necessary it is for engineering organisations to be on the alert, watching for opportunities to safeguard the interests of their members, and how timely interventions to that end may be successful in preventing undigested and misunderstood propositions from being adopted which, if permitted to pass, could only lead to a state of things most unsatisfactory for engineering contractors, and derogatory to the best interests of professional engineers.

Lead.

There have been heavy arrivals of lead during recent weeks, the total imports during April being 23,400 tons, making a total of about 81,000 tons compared with about 77,000 tons last year. There has been a large increase from Spain, nearly 5,000 tons, while the United States is 9,600 tons up, but the imports from Australia show a decrease of about 6,000 tons, and those from other countries of about 4,000 tons. Consumers in England, at all events, do not care much about American lead, and there have been a considerable number of complaints regarding some of the metal which has been delivered on the London market. It is generally complained that the metal does not roll well, and is not sufficiently pure to please the corroders, hence the general dissatisfaction which has been voiced in connection with deliveries of lead designed, for use in these particular directions. This has accounted for an increased demand for Spanish and Australian brands, and as much as 10s. a ton premium has been paid for some of these during the past week or so.

There has been a moderate inquiry experienced in all directions, but the general consuming trade is admittedly rather quiet. There is still considerable faith felt in the development of large demands for the Allies, but, so far, they have not reached an important level just lately, though it is thought the indications point to an improvement before long. America has rather been holding back from the market lately, in consequence, no doubt, of the fall in prices which has been sustained, but an advance in London would, no doubt, induce sellers to come forward with much more freedom.

There will probably be no material increase in the world's production of lead in the near future, and if this proves to be the case, demands may be fully able to take care of the supplies. Many people, indeed, think it possible that the whole of the available material may be swept up by consumers before long, and if this should be the case, an advance in prices would be inevitable.

"When in Rome —."

We suppose there are few words of foreign trade counsel that have been so frequently reiterated in the ears of the British manufacturer as those which urge the necessity for studying the peculiar characteristics of markets in which our foreign competitors have been successful, and we have not. Sometimes it has seemed to be little short of a heinous offence to dare to say such things. Yet that such advice has not been proffered without abundant justification is being proved in many directions in these days of war. It is true that most of our engineering factories are engaged to the extent of a considerable percentage of their productive capacity upon war requirements, but it is equally true, as the Chancellor of the Exchequer has so recently told us, that it is of vital financial importance to the nation that we maintain our exporting activities. The great volume of our trade must be kept flowing as far as labour and transport and shipping facilities will permit. The amount of business actually available is large, and it is to be hoped that we shall be able to cope with it notwithstanding the increasing calls for recruits for the fighting line. But the fact that there is business doing does not allow us to shut our eyes to the need for preparations for the future. We have said so much on this matter that we hardly like to touch it again so soon, but it is imperative that we should give heed to these oft-repeated words of counsel, which are now being used by those who are anxious to do business with us. We have secured for ourselves an unenviable reputation in too many countries for assuming a high and mighty independent attitude toward those with whom we affect to desire to open business connections. We are prepared to offer for sale the things that we make but are charged with being too ready to turn down requests for articles that are out of our usual run of manufactures—things that in many cases might well be made in British factories. We believe that that habit is changing, and that it will have to undergo further development in the coming days. But for some markets, perhaps, that "take it or leave it attitude" has not been so serious an obstacle to our success as our failure to understand the people with whom we desire to trade, and their systems of doing business.

In Russia, we read, British trading authorities have been dwelling upon the necessity for our traders adapting themselves to the system of credit that obtains there. This is, of course, not a new point, but it is one of prime importance.

One of these authorities says that English people have not hesitated to confess their ignorance of the Russian system, and to admit that in that ignorance lay the reason of their inability to comply with many of the requirements of Russian commercial men. Long credit and easy credit are stated to be essential, and German firms have noted that circumstance, and by meeting the position strengthened their hold. "The Teutons had a whole army of *commis voyageurs* who captured hosts of clients by studying the customs of Russian traders and conforming with the credit system." M. Timiriazeff, whose name is quite familiar to our trade readers, says (*Financial Times*): "I am certainly not one who states that all is good in our Russian methods, but still I must say that the most dangerous competitors of Great Britain, the Germans, always understood how to adapt themselves to existing conditions, and as a consequence they got together an important trade." We have frequently shown how German firms have practically flooded with commercial travellers, efficiently trained and capable men, markets which we have left to the care of a handful of men. It is easy to see that our rivals have been better able to meet the requirements of markets when their numerous representatives have so thoroughly studied the people, their systems and their general conditions. The warning may be familiar, but it is none the less necessary and none the less timely on that account.

SOME NOTES ON SHUNT REGULATING RESISTANCES.

By THOMAS CARTER.

(Continued from page 717.)

II. *Regulators with Protective Resistances.*—These are used probably less frequently than potentiometer regulators, but they are equally interesting from a theoretical point of view, and are capable of a similar general treatment in terms of E/s and multiples of s.

The standard connections of a regulator of this type are shown in fig. 3.

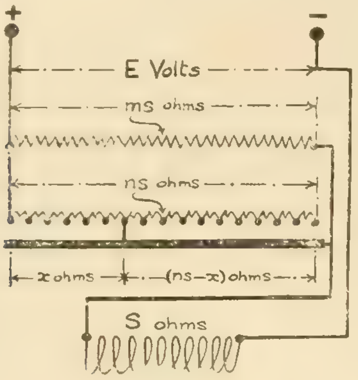


FIG. 3.

The exciting voltage, E, has across it the field winding, whose resistance is s, in series with a loop consisting of the protective resistance, $m\,s$, in parallel with x, which is part of the regulator, $n\,s$.

The total resistance between terminals is—

$$s + \frac{m\,s\,q\,n\,s}{m\,s + q\,n\,s}$$

$$= s\,.\,q\,n/(m + q\,n)\,.\,(m + 1 + m/q\,n).$$

The total current in the circuit, which is the current in s, *i.e.*, the field current, is—

$$\text{E}\,s\,.\,(m + q\,n)/q\,n\,.\,1/(m + 1 + m/q\,n).$$

The current in x is $m\,s/(m\,s + x) = m/(m + q\,n)$ of the total current, and the current in $m\,s$ is $x/(m\,s + x) = q\,n/(m + q\,n)$ of the total, so that—

$$\frac{\text{E}}{s}\,.\,\frac{m}{q\,n}\,.\,\frac{1}{m + 1 + m/q\,n} \text{ is the current in } x,$$

$$\text{and } \frac{\text{E}}{s}\,.\,\frac{1}{m + 1 + m/q\,n} \text{ is the current in } m\,s.$$

A tabular statement can now be made as follows, showing the varying values of the currents in the three parts of the circuit, with m and n as yet indeterminate, for values of x from zero to $n\,s$, *i.e.*, for values of q from zero to unity.

x $q\,n\,s.$	Current in $m\,s$ (protective resistance)	Current in x (regulator).	Current in s = field current.
0	0	E/s	E/s
·1 $n\,s$	E/s . $1/(m+1+m/{\cdot}1n)$	E/s . $m/{\cdot}1n(m+1+m/{\cdot}1n)$	E/s . $(m+{\cdot}1n)/{\cdot}1n(m+1+m/{\cdot}1n)$
·2 $n\,s$	E/s . $1/(m+1+m/{\cdot}2n)$	E/s . $m/{\cdot}2n(m+1+m/{\cdot}2n)$	E/s . $(m+{\cdot}2n)/{\cdot}2n(m+1+m/{\cdot}2n)$
·3 $n\,s$	E/s . $1/(m+1+m/{\cdot}3n)$	E/s . $m/{\cdot}3n(m+1+m/{\cdot}3n)$	E/s . $(m+{\cdot}3n)/{\cdot}3n(m+1+m/{\cdot}3n)$
·4 $n\,s$	E/s . $1/(m+1+m/{\cdot}4n)$	E/s . $m/{\cdot}4n(m+1+m/{\cdot}4n)$	E/s . $(m+{\cdot}4n)/{\cdot}4n(m+1+m/{\cdot}4n)$
·5 $n\,s$	E/s . $1/(m+1+m/{\cdot}5n)$	E/s . $m/{\cdot}5n(m+1+m/{\cdot}5n)$	E/s . $(m+{\cdot}5n)/{\cdot}5n(m+1+m/{\cdot}5n)$
·6 $n\,s$	E/s . $1/(m+1+m/{\cdot}6n)$	E/s . $m/{\cdot}6n(m+1+m/{\cdot}6n)$	E/s . $(m+{\cdot}6n)/{\cdot}6n(m+1+m/{\cdot}6n)$
·7 $n\,s$	E/s . $1/(m+1+m/{\cdot}7n)$	E/s . $m/{\cdot}7n(m+1+m/{\cdot}7n)$	E/s . $(m+{\cdot}7n)/{\cdot}7n(m+1+m/{\cdot}7n)$
·8 $n\,s$	E/s . $1/(m+1+m/{\cdot}8n)$	E/s . $m/{\cdot}8n(m+1+m/{\cdot}8n)$	E/s . $(m+{\cdot}8n)/{\cdot}8n(m+1+m/{\cdot}8n)$
·9 $n\,s$	E/s . $1/(m+1+m/{\cdot}9n)$	E/s . $m/{\cdot}9n(m+1+m/{\cdot}9n)$	E/s . $(m+{\cdot}9n)/{\cdot}9n(m+1+m/{\cdot}9n)$
1·0 $n\,s$	E/s . $1/(m+1+m/n)$	E/s . $m/n(m+1+m/n)$	E/s . $(m+n)/n(m+1+m/n)$

This type of regulator, in contrast to the potentiometer type, which is capable of giving zero field current, is useful in cases where the ratio of maximum to minimum values of shunt current is not abnormally great. Let this ratio be p. The value of p clearly depends on experimental data, and is not arbitrary. The values of m and n are, however, arbitrary, but they are connected with each other in a definite way, according to the value of p. For it is evident from the last column of the table that—

$$p = n\,(m + 1 + m/n)/(m + n)$$

$$= (m\,n + n + m)/(m + n)\;;$$

$$\text{or, } p - 1 = m\,n/(m + n).$$

This can be transformed into—

$$\{m - (p - 1)\}\,\{n - (p - 1)\} = (p - 1)^2,$$

which is a rectangular hyperbola, with asymptotes $m = p - 1$ and $n = p - 1$.

Just as the value of n was the starting point for the potentiometer regulator curves, so the value of p is the starting point for the curves for regulators with protective resistances; and a set of curves for various values of p, with possibly one or two different pairs of connected values of m and n for the same value of p, if found useful, may be drawn. Fig. 4 shows the curve connecting m and n for the value $p = 2$. The whole curve is drawn, including negative values, which are not usable for the present purpose, but are given to show the full shape of the curve. The asymptotes are $m = 1$ and $n = 1$, and the only part of the curve practically useful is the part close to the right of the vertical asymptote with values of m just over 1·0, and fairly high values of n. In other curves, the practically interesting part would be where m is just greater than $p - 1$, whatever be the value of p. The reason for making m just greater than $p - 1$ is to make it fulfil the condition that should the regulator become damaged, and its circuit be broken, the protective resistance will not reduce the field current much below its normal minimum value. The protective resistance is alone in series with the field winding under such circumstances, and if m is nearly equal to $p - 1$, the resistance between terminals becomes very nearly $(p - 1)\,s + s = p\,s$, so that the field current is just under its usual minimum value, and there is no danger of an abnormal reduction of volts in a dynamo or increase of speed in a motor.

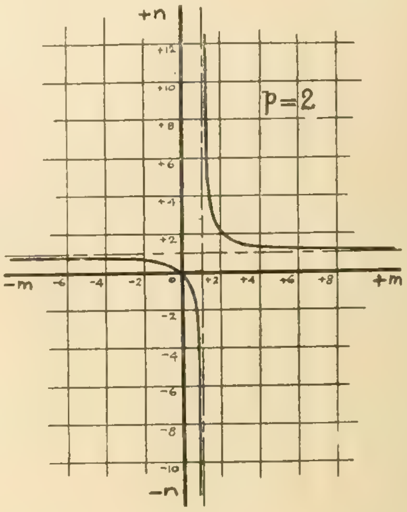


FIG. 4.

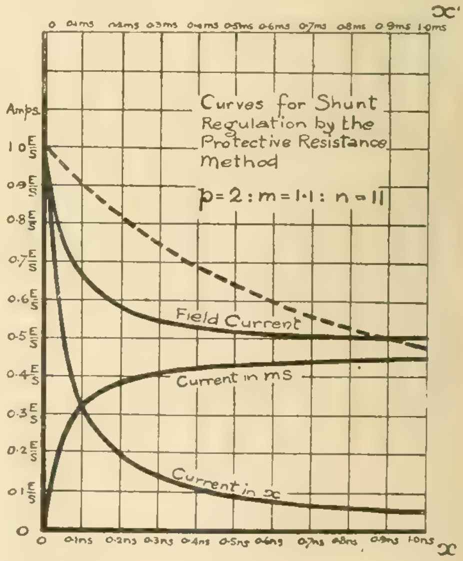


FIG. 5.

For the present case, $(m - 1)\,(n - 1) = 1$, or $m\,n - m - n = 0$, or $n = m/(m - 1)$:

i.e., if $m = 1{\cdot}00 - 1{\cdot}02 - 1{\cdot}04 - 1{\cdot}06 - 1{\cdot}08 - 1{\cdot}10$,
$n = \infty - 51 - 26 - 17{\cdot}7 - 13{\cdot}5 - 11{\cdot}0$.

Choose the pair of values $m = 1{\cdot}1$ and $n = 11$, and plot the curves shown in fig. 5, in which, as in Section I, ordinates represent currents in terms of E/s, and abscissæ represent values of x for $q = 0$ up to $q = 1{\cdot}0$. These curves are typical of the whole set which can be plotted for various values of p. Experience again will show the most suitable values of m and n for a given value of p; but the curves, once plotted, are of universal application, as has already been explained in the previous section. The determination of the current capacity and resistance of successive steps in the regulator is carried out on a similar principle to that already described for potentiometer regulators.

The higher values of p will occur in the case of motors with large speed ranges, and particularly in those with an appreciable amount of series winding on the field in addition to the shunt winding, it being necessary in certain cases to use compound-wound motors with a speed range of fairly large amount. After a certain value of p is reached, depending on the energy to be dealt with in the regulator, and other practical considerations, it becomes no longer suitable to use a regulator of this type or the ordinary type, and it is necessary to go over to the potentiometer type already described. No general rule is available for the correct point of change-over: experience, again, is the only guide.

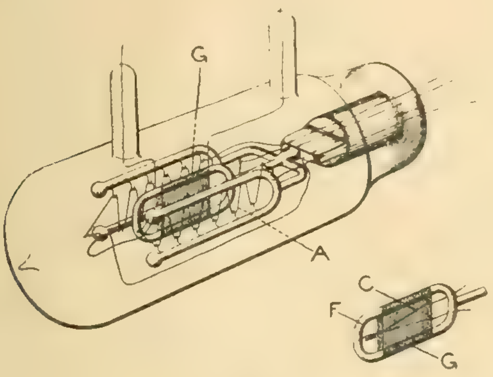
If, as is indicated in the earlier article already referred to, the protective resistance has to be used for shunt regulation as an ordinary series type regulator in case of emergency, should the regulator become broken, the current it carries will be the whole field current, as there explained. The curve of field current in this case is quite different from the curve indicating normal conditions. The latter is shown by a full line curve in fig. 5, plotted, as are the other two full-line curves, against the lower scale of $x = 0 - 1{\cdot}0\ n\,s$. The field current curve, and therefore also the curve of current in $m\,s$ for the abnormal condition, is shown by a dotted line, and is plotted against the upper scale of $x' = 0 - 1{\cdot}0\ m\,s$, indicating the variation in current as more or less of $m\,s$ is cut out in the special case under consideration. If, then, the protective resistance has to fulfil this emergency function, it must have a capacity equal to the dotted curve in its various sections, according to the way in which these can be temporarily short-circuited, and not merely equal to the maximum value indicated in the full-line curve. This shows the actual amount of the increase in size indicated in the earlier article. The dotted curve also clearly shows by how small an amount the minimum shunt current is reduced should the regulator be out of action.

(*To be concluded.*)

THE PLIOTRON IN WIRELESS TELEGRAPHY AND TELEPHONY.

A further application of the thermionic current by the Research Laboratory of the General Electric Co., U.S.A., is described in the current issue of the *General Electric Review*, by Dr. Irving Langmuir, who, we believe, has conducted the researches on this subject.

After outlining the history and fundamental principles of the emission of electrons from heated metals *in vacuo*, and briefly describing the kenotron (see Elec. Rev., May 7th, 1915), the author states that in a pure electron discharge, as the temperature of the filament is raised, a point is always reached where the current becomes limited by the space charge between the electrodes. Under these conditions, only a small fraction of the electrons escaping from the cathode reach the anode, whereas the majority of them are repelled by the electrons in the space, and therefore return to and are absorbed by the cathode. From this viewpoint it is evident that if a negatively charged body is brought into the space between the anode and cathode, the number of electrons which then return to the cathode will increase, so that the current to the anode will decrease. On the other hand, if a positively charged body is brought near the cathode, it will largely neutralise the negative charges on the electrons in the space and will therefore allow a larger current to flow from the cathode. In this way it is possible to control the current flowing between the anode and cathode by an electrostatic potential on any body placed in proximity to the two electrodes. This controlling effect may be best attained by having this controlling member in the form of a fine wire mesh, or grid, placed between the electrodes.



A, anode; G, grid; C, cathode; F, frame.

Fig. 1.—Pliotron (Amplifier).

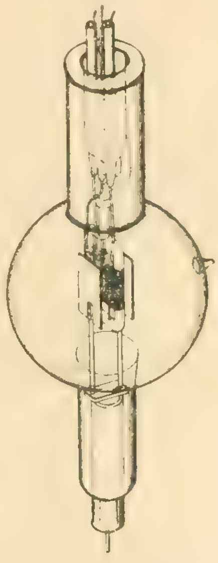


Fig. 2.—Pliotron (Controller).

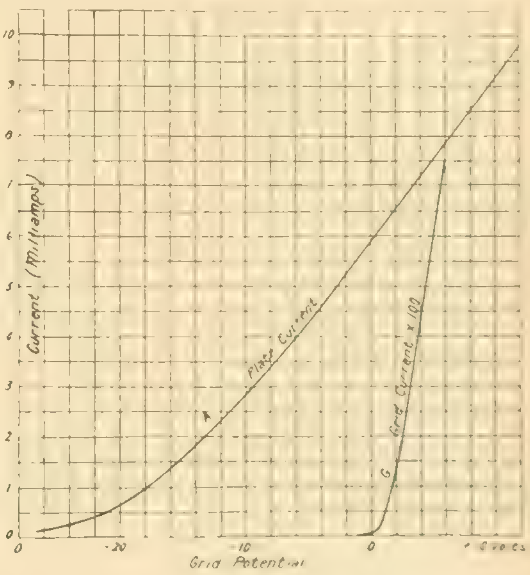


Fig. 3.

The term "Pliotron" has been adopted to designate a kenotron in which a third electrode has been added for the purpose of controlling the current flowing between the anode and cathode. This word is derived from the Greek "pleion" signifying "more." A Pliotron is thus an "instrument for giving more" or an amplifier.

The three elements, hot filament cathode, grid, and anode, are, of course, similar to the elements of the De Forest audion. However, the operation of the audion is in many ways quite different from that of the pure electron device operating in the way described above.

In the audion, as well as in the Lieben-Reisz relay, the amplifying action appears to be largely dependent upon gas ionisation, even when the device operates well below the point at which blue glow occurs. The action is probably somewhat as follows: there is normally present a small amount of gas ionisation due to the passage of the electrons between cathode and anode. The presence of the positive ions partly neutralises the space charge which limits the current flowing between the electrodes. If a small positive potential is applied to the grid, the velocity of the electrons passing by it is somewhat increased and they therefore produce more ions in the gas. Besides this, as the potential on the grid is increased, the number of electrons passing the grid is increased, and this again tends to increase the amount of ionisation. A very slight increase in the amount of ionisation brought about in this way very greatly reduces the space charge, and therefore largely increases the current that can flow between the electrodes. Thus, with a given construction of grid, filament, and plate, the relaying action may be very greatly increased beyond that which would occur if no gas were present. The amount of gas ionisation which is necessary, in order to eliminate practically completely the effects of space charge, is often much too small to produce a visible glow in the gas.

If too much gas is present, or if the potential on the plate or the current flowing to the plate is too large, then the amount of positive ionisation may reach such values as almost entirely to neutralise the space charge and thus allow a large current to flow. Under these conditions, the relaying action of the audion is lost. This is the case, for example, when the audion gives a blue glow. In the border land between these two conditions, there is a region of instability in which the sensitiveness of the audion may be enormously great, but it is usually not found very practicable to operate the device in this region, because of the difficulties in maintaining adjustment, for any lack of adjustment may cause the audion to go over into a condition of blue glow.

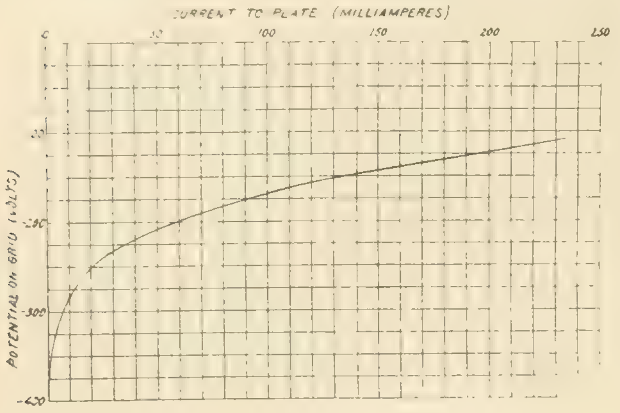


FIG. 4.

The audion is often used with a condenser in series with the grid. Under these conditions, the audion requires the presence of a certain amount of gas ionisation so that the positive ions formed may prevent the accumulation of too large a negative potential on the grid. With the pliotron, owing to the absence of positive ions, if it is desired to use a condenser in series with the grid, this condenser must be shunted by a high resistance, and often a source of potential must be placed in series with the high resistance, in order to supply positive electricity to the grid as rapidly as this tends to be taken up from the electrons given off by the filament.

In the construction of pliotrons, it has been found desirable to make the wires constituting the grid of as small cross-section as possible. In this way, even when a positive potential is applied to the grid, the current that flows to the grid may be made extremely small. The use of very fine wire is made possible by using a frame of glass, metal or other suitable material, to support the grid. Thus, in figs. 1 and 2 the filament is mounted in the centre of a frame made of glass rods, on which the fine grid wire is wound by means of a lathe. The grid may thus consist of tungsten wires of a diameter as small as 0.01 mm., and these may be spaced as close as 100 turns per centimetre, or even more.

In figs. 1 and 2 are shown two types of pliotron. Fig. 1 shows a pliotron such as is used for amplifying radio-signals in a receiving station. Fig. 2 shows a large pliotron which may be used for controlling as much as 1 KW. for radio-telephony.

The characteristics of the pliotron depend upon the length of filament used, the distance between filament and grid, the spacing between the grid wires, the diameter of the grid wires, the distance between grid and anode, and the size and shape of the anode. The important elements in the characteristics of a pliotron are, first, the relation between the current flowing between anode and cathode as a function of the potential on the anode and of that on the grid; second, the current flowing to the grid, as a function of the potential of the grid and the potential of the anode.

Fig. 3 gives the characteristics of a small pliotron such as that shown in fig. 1. Curve A gives the current flowing to the anode for different grid potentials, while the potential of the anode is maintained constant at 220 volts. Curve G gives the current flowing to the grid under the same conditions. For different anode potentials, these curves are shifted vertically, by amounts proportional to the change in anode potential.

Fig. 4 gives similar characteristics for a large pliotron like that shown in fig. 2. In this case, the anode potential was 8,500 volts.

By using a fine grid, the current to the anode can be stopped entirely by even a very slight negative potential on the grid. On the other hand, a rather low positive potential will then be sufficient to draw a large current to the anode. The amount of current taken by the grid would be only a very small fraction of that flowing to the anode, in case the diameter of the grid wires is small compared to the distance between them. On the other hand, with a coarse grid—that is, a grid in which the spacing is large, a rather large negative potential may be necessary in order to stop the current flowing to the anode. Similar results to those obtained by changing the spacing of the anode may be obtained by changing the relative distances between the electrodes.

By using a fairly coarse grid, consisting of fine wire, it is possible to obtain a control of the current to the anode, always using a negative potential on the grid. Under these conditions, since there are no positive ions present, no current flows to the grid, except that necessary to charge it electrostatically to the required potential. It thus becomes possible to control very large amounts of energy in the anode circuit, by means of extremely minute quantities of energy in the grid circuit.

There does not seem to be any upper limit to the voltages that may be used in the pliotrons. With voltages over 30,000 it is often necessary to space the electrodes further apart and to use heavier wires for the grid, in order to reduce the danger of breakage of the parts by the large electrostatic forces which then occur.

The current-carrying capacity of the pliotron is limited only by the size of cathodes that it is found convenient to use and by the voltage available. Large currents cannot be readily obtained with low voltages because of the space charge effects described previously. With voltages above 500 volts, however, it is found practicable to use currents of 300 or 400 milliamperes for a pliotron of the type shown in fig. 2. With high potentials, there is no difficulty in using currents as large as this, provided the energy is consumed in some device in series with the pliotron. On the other hand, if the full voltage is applied to the anode while the current is flowing to the anode, the energy liberated in the form of heat may be so great as to volatilise the anode or cause it to radiate so much heat that the glass parts of the apparatus are softened. In a pliotron with a 5-in. bulb the amount of energy that may be so consumed within the pliotron is about 1 KW. Still larger amounts of power may be dissipated if the bulb is immersed in oil and if the grid frame is made of quartz, or other heat-resisting material.

It is evident from the characteristics of the pliotron that any number of these devices may be placed in parallel, and that in this way very large amounts of power may be controlled.

Pliotron as Wireless Detector.—If the antenna of a receiving set is coupled directly to the grid of a pliotron and a telephone receiver is placed in series with the anode, signals may be readily detected, but the results obtained in this way are usually very poor. Under these conditions, the sensitiveness of the arrangement is proportional to the curvature of the curve A, fig. 3 (or, more accurately, proportional to the second derivative of the anode current with respect to the grid potential). This curvature may be somewhat increased by applying a negative potential to the grid, but even under these conditions the sensitiveness of the arrangement is usually not very high.

If it is attempted to use a condenser in series with the grid and thus use the pliotron in the way that the audion is often used, it is found necessary to shunt the condenser with a resistance and often place a battery of a few volts in series with the resistance, in order to prevent a large negative charge from accumulating on the grid.

It has been found, however, by W. C. White, that a very minute trace of certain gases may very greatly increase the sensitiveness of this device as a detector. For example, by placing within the bulb a small quantity of an amalgam of mercury and silver, the characteristics of the tube show a kink, as indicated in fig. 5. With a detector of this sort, if the grid potential is adjusted so that its average value is approximately that at which the kink occurs, there is a very marked increase in sensitiveness. This is due to the fact that under these conditions either an increase or a decrease in the grid potential causes a decrease in the anode current. The sensitiveness of this detector is then very high. The

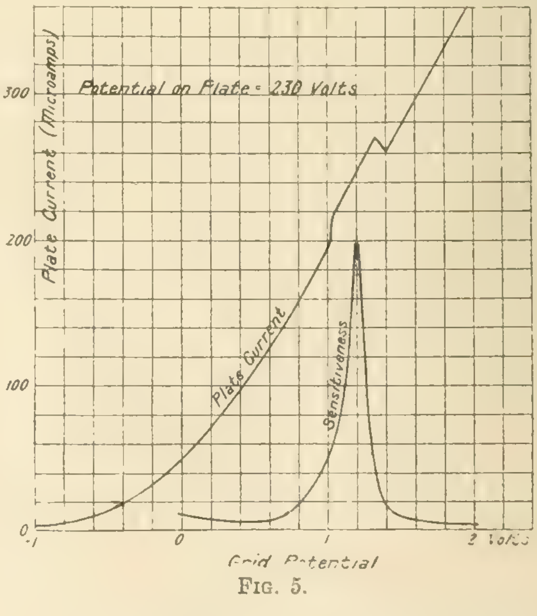


FIG. 5.

quantities of mercury vapour necessary to give this effect are so low that anode voltages of 200 or more may be used without any indication of glow discharge.

Pliotron as Amplifier.—The value of a pliotron as an amplifier is dependent primarily upon the slope of the curve between anode current and grid potential; for example, curve A, fig. 3. A second factor of importance is the magnitude of the current taken by the grid. In order to get the greatest amplifying effect it is desirable to have this current as low as possible. In a pliotron of the type shown in fig. 1, the current to the anode increases at the rate of about 1 milliampere per volt change in the grid potential.

By using larger anode potentials, the slope of the curve can be made very much greater, since it becomes possible to use grids of finer mesh. For example, in fig. 4 it is seen that the slope of the curve corresponds to two milliamperes increase in anode current per volt change in grid potential.

It has been found that there is no sluggishness in the characteristics of the pliotron, even at the highest frequencies.

By connecting the pliotron as amplifier, as shown in fig. 6, the high-frequency currents received from the grid may be amplified from one hundred to six hundredfold. In this arrangement, it is the high frequency or radio-frequency that is amplified, and not the audio-frequency. This amplification of the radio-frequency possesses the marked advantage that the detector circuit may be tuned to the same frequency as the amplifier circuit, and in this way a very marked increase in selectivity is obtained. In fact, it has been shown by Mr. Alexanderson that the resonance curve of an outfit consisting of amplifier and detector, both tuned to the radio-frequency as shown in fig. 6, may be obtained from the resonance curve for the detector alone, by squaring the ordinates. For example, if with a single detector, the signals from one station (*A*) are received one hundred times as strong as those from another station (*B*), then, with the above arrangement with the amplifier, the signals from *A* will be received one hundred times squared, or ten thousand times as strong as those from station *B*. If two amplifiers be used in this way, the signals from station *A* can be obtained one million times as strong as those from station *B*.

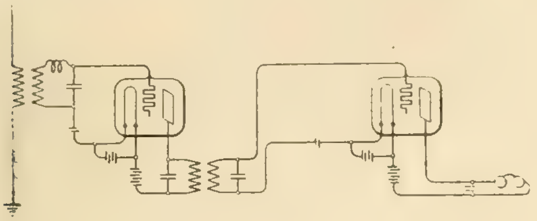


Fig. 6.

In practice, this arrangement has been found to give a wonderfully high degree of selectivity.

Of course, a pliotron may also be used for amplifying the audio-frequency, coupling the circuits together by means of an iron core transformer. A single pliotron, under these conditions, gives an amplification of current of several hundred-fold, when voltages of from one to two hundred volts are used on the anode.

Pliotron as Oscillator.—By placing inductance and capacity in the grid and plate circuits and coupling these two circuits together, it is possible to use the pliotron as a source of continuous oscillations. Small pliotrons of the type shown in fig. 1 may produce oscillations up to a few watts, and these may be used in a receiving station, according to the Heterodyne principle, for receiving continuous oscillations. One pliotron may be used for both amplifying or detecting, and for producing oscillations.

With the larger pliotrons, using voltages of a few thousand volts, up to a kilowatt of high-frequency oscillations may readily be produced by a single tube.

Use of the Pliotron in Radio-Telephony.—By means of a single large pliotron, it has been found possible to control about two KW. of energy in an antenna, by means of the currents obtained from an ordinary telephone transmitter. There are many arrangements by which this may be accomplished. For example, a two-KW. Alexanderson alternator (100,000 cycles) may be loosely coupled to the antenna and the anode of the pliotron may be connected to a point on the antenna where the potential is normally high. As long as the potential on the grid of the pliotron is strongly negative, no current flows to the pliotron and, therefore, the full energy is radiated by the antenna. If, however, the negative potential on the grid is decreased, a sufficient current may be drawn from the antenna to strongly damp the oscillations, and thus greatly decrease the energy radiated. With sufficiently high potential on the grid, practically the whole of the energy may be diverted from the antenna.

It is thus possible to control the output of the antenna by varying the negative potential on the grid of the pliotron. Since the grid is always negative, no current flows between filament and grid, and therefore practically no energy is required to maintain the charge on the grid. In this way, therefore, by connecting the secondary of the transformer between the grid and filament, and placing the primary of the transformer in series with a telephone transmitter, it is possible, by means of the variations in the currents from the telephone transmitter, to obtain potentials on the grid of several hundred volts, and thus to control the output of the antenna.

Instead of using an arc or alternator as a source of high frequency current, the pliotron may also be used as generator of the oscillations. One pliotron may be used both for producing the oscillations and for controlling the amplitude of the oscillations, in accordance with the sound waves acting on the telephone transmitter. It is usually preferable, however, to use a large pliotron for producing the oscillations and to connect a small pliotron in the grid circuit of the large pliotron for controlling the output of the latter.

With the above arrangement an extremely simple and efficient radio-telephone outfit can be made. Since the pliotron for producing oscillations requires comparatively high direct-current voltages, it has been found convenient to combine the pliotron oscillator with a kenotron rectifier. Two types of apparatus of this type have been in use a considerable time.

In the first outfit, which is a small outfit having a capacity of about 20 watts in the antenna, the source of power is the local city supply, which is 118 volts, 60-cycle alternating current. This is connected with the primary of a small transformer, having two secondary windings. One of the secondaries is designed to give about 5 volts, and furnishes the current used for heating the filaments of the kenotrons and pliotrons. The other secondary of the transformer is wound to furnish a potential of about 800 volts. This is rectified by means of a kenotron, and serves to charge a condenser of about six microfarads. In this way a source of high-voltage, direct current is obtained in a very simple manner. The plate of the pliotron oscillator is then connected to one of the terminals of the condenser, while the filament is connected to the other. The plate of the second pliotron is connected to the grid of the first, while the grid of the second is coupled by means of a second small transformer to the microphone circuit. With this outfit, both pliotrons may be relatively small, and in order to obtain about 20 watts in the antenna, it is found that the current drawn from the condenser is so small that the potential supplied by it does not vary sufficiently to be audible in the signals sent out. The different parts of this apparatus may be made very compact, and no adjustments are found necessary in operating the system unless it is desired to change the wave length. In this case, it is only necessary to change the inductance or capacity.

In the second outfit, which is suitable for use up to 500 watts or more, the high-voltage direct current is obtained from a small 2,000-cycle generator. The current from this is transformed up to about 5,000 volts, rectified by kenotrons, and smoothed out by means of condensers. By the use of 2,000-cycle alternating current instead of 60-cycle, it is possible to store up large quantities of energy and thus obtain as much as a kilowatt or more of power in the form of direct current with condensers of moderate size. This high-voltage direct current is then used, as before, to operate a pliotron oscillator, the output of which is controlled by means of a small pliotron connected to the telephone transmitter.

By means of this system of control the amount of energy in the telephone transmitter circuit need be no larger than those commonly used in standard telephone circuits. It has thus been found possible to connect up this radio-telephone outfit with the regular telephone lines, so that conversation may be carried out between two people, both of whom are connected with the radio-stations by means of the regular land lines. It has also been found possible to communicate both ways over these lines.

NOTES FROM CANADA.

[From our Special Correspondent.]

Some time ago it was pointed out in the Review that the sign commonly used to denote cycles, viz., ~, is without a name, which, of course, is a very inconvenient state of affairs. To get over this difficulty, the writer would suggest the use of a ready-made Spanish word, "tilde," which is the name used for the sign, of almost exactly similar shape, used over one of the letters of the Spanish alphabet, thus, ñ; this name is not a hard one to remember, and its pronunciation—teeldeh—presents no difficulty whatever.

Whether the B.E.A.M.A. has perused these "Notes" during the last year or two is not known, but it would appear that action is likely to be taken before long on the lines indicated more than once herein, namely, the establishment of branches in the Colonies, especially in Canada, so that the local representatives of British firms may combine together for their common good and secure recognition, and effect reforms of certain existing conditions where individual efforts are bound to be ineffective.

The Dominion Government, through the Water Powers Branch of the Department of the Interior, has during the last few years been amassing information regarding water-power possibilities, which will prove very useful in the future, as the records of rainfall, run-off, stream levels, watershed areas, and storage possibilities, &c., extend over a sufficient length of time to give reliable maximum, minimum, and average figures. The following are two brief extracts showing the kind of information which is published by the Department from time to time:—

1. "*Bridge River.*—A head of 2,000 ft. could be developed at Bridge River by driving a tunnel through the ridge separating it from Seton Lake. The water would be diverted into the tunnel from Bridge River and conveyed from the other portal by steel penstocks to the power-house situated on Seton Lake. A great amount of power could be developed here, but the cost of the tunnel would render a large initial development necessary."

2. "*Chehalis River.*—The plan of development of this stream includes a storage and intake dam near the lower end of Chehalis Lake and a large concrete pipe line, some 10 miles in length, to an equalising reservoir near the mouth of the river. The penstocks would lead from the reservoir to the power-house, and would give a head of about 400 ft. Chehalis Lake would give splendid storage."

An immense amount of information in the form of tables of stream flow data, &c., is embodied in these reports, as well as maps showing the location of the various water powers.

The Electrical Development Co., at Niagara Falls, on the Canadian side, is the first company to have installed plant up to the maximum capacity of its available water power. There are now four generators of 13,000 H.P. each, and seven of 15,000 H.P., making a total of 157,000 H.P.; of this amount, 125,000 H.P. represents the available water power, and the remainder is spare plant. All the power is to be used in Toronto.

Owing to the war, Toronto, which last year ordered large numbers of electricity meters from Germany, has this year arranged to buy British-made meters instead. *Sic transit gloria Germaniæ.*

LEGAL.

A Westinghouse Employé Fined.

At Manchester on Thursday, May 20th, the British Westinghouse Electrical and Manufacturing Co., Ltd., Trafford Park, claimed £5 from Thomas Henry Hargreaves, a surface grinder in their employ, for unlawfully absenting himself from work.

Sir Wm. Cobbett, for the company, stated that his clients had two surface-grinding machines, and defendant worked on one of them. The machines were used for putting a very fine finish on tools which were used for working upon shell fuses. The firm were under contract with the Government to supply munitions of war, and if one of the two surface grinders absented himself from his work it meant that 50 per cent. of the production of tools was stopped, the production of fuses for shells was impeded, and the company suffered substantial loss. The claim now brought was merely nominal; no attempt had been made to estimate the loss which had been sustained through defendant's action, but the magistrates would readily believe that it must have been substantial. Ordinarily the defendant worked 52½ hours per week, and was paid £2 4s., but he and the other surface-grinder sometimes worked as long as 80 hours per week, when their earnings were very much more than the figure mentioned. Unfortunately Hargreaves would not attend regularly to his work, and he was afraid the cause was drink. On several occasions he had absented himself, and had been warned, and the company had even taken him on when he was obviously not in a condition to do his best work.

Robert W. Wroe, foreman in the tool department, said the tools were absolutely necessary for the making of munitions of war, and surface grinding was highly skilled work. For some months past the company had been working at the highest pressure they had experienced since the works were opened. On one occasion when defendant returned to work after being absent he admitted that his absence had been due to drink, and he expressed his regret and said he would try to be teetotal. Later defendant was absent six days, with a consequent loss of 52½ hours. On April 12th they had to search for him, and when he was eventually found he returned to his work in a state of collapse after a drinking bout. The present summons referred to defendant's absence from May 3rd to May 8th inclusive.

The Bench ordered defendant to pay £4, and he was allowed a month to pay the money.

Glasgow Tramway Accident Claims.

Several cases arising from tramway accidents are pending in the Court of Session against the Glasgow Corporation. In one case a Dennistoun man sues for £500 damages for personal injuries. He was in the act of descending from one of the Corporation cars when, he says, the car was suddenly set in motion, and he was jerked off the platform. Fault is denied. In another case where a "violent jerk" is alleged as the cause of the injuries the Corporation pleads that the motorman brought the car to a standstill, preventing a collision. Yet another case in which a contractor sues for £500 is the sequel to a collision between a car and a lorry. The Corporation denies that the lorry was showing any lights, and says that the accident was due to pursuer's negligence.

Re W. T. Glover & Co., Ltd.

In the Chancery Division on Friday last week Mr. Justice Astbury sanctioned the proposed extension of the objects of W. T. Glover and Co., Ltd., of Trafford Park, manufacturers of electrical cables, wires and apparatus. Mr. Peterson, K.C., said the company was a prosperous one, and for the economical and convenient working of the existing objects as well as for the advantageous combination with other classes of business, it was proposed to acquire and work lead, copper and coal mines, and to smelt the ore and refine and treat the copper, lead and bitumen. The company also took power to sink wells, and with other companies to construct bridges across the Bridgewater Canal for the purpose of the extension of its works.

Traffic at Tramway Stopping Places.

Bailie Barrie, at Glasgow Southern Police Court, heard the first of the prosecutions under the new city by-law for the regulation of vehicular traffic near tramway stopping stations, which came into operation on May 1st, a taxi-cab driver being charged with having, at a point near a tramway stopping place, failed to draw up his cab before the roadway was clear of passengers entering or leaving a tramcar. In imposing a fine of one guinea, the magistrate said that the practice of driving in among passengers boarding or leaving tramcars must be stopped.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

B.T.H. Automobile Accessories.

Some interesting devices are described in a recent list (No. 10,780) of the British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C., in connection with the use of electricity on automobiles. We illustrate in figs. 1 and 2 a switchboard with a single handle, which performs all the necessary operations by actuating the controller shown in fig. 2. The various positions of the switch are indicated at a small window in the aluminium cover (fig. 1). The switch is so arranged that mishandling of the charging of the battery is impossible; whenever the head lights are put on, the charging switch is automatically closed; only the side and tail lamps can be used without charging, thus avoiding any overload on the battery. Ampere and voltmeters are provided, and a two-pin plug for connecting an inspection lamp. A tail lamp indicator in the shape of a small lamp giving a subdued light shows when the tail lamp is burning, and lights up the switch indicator and instruments sufficiently to enable them to be read from the driver's seat; this lamp is not in series with the tail lamp, so that if anything goes wrong with it the tail lamp is not affected. The switchboard can be used with any standard dynamo, or with accumulators alone. A smaller set without instruments, but with a charging indicator and automatic cut-out, is also made.

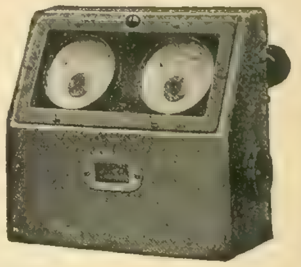


Fig. 1.—Switchboard Closed.

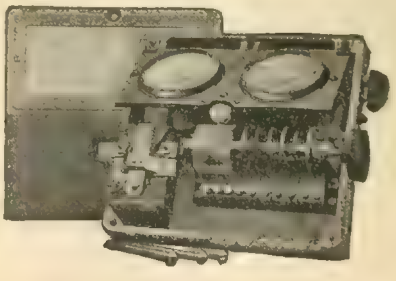


Fig. 2.—Switchboard Open.

Various other devices, such as car lighting and ignition batteries, meters, lamps, electric horns, sparking plugs, &c., as well as, of course, Mazda automobile lamps, are included in the list.

Spinning Extraordinary.

The name of the Benjamin Electric, Ltd., has always been associated with metal stampings and spinnings, their most well-known product in this direction being the Benjamin steel line of reflectors and reflector fittings, all of which are produced at their London works, 1a, Rosebery Avenue, E.C. A large amount of special work in the spinning line has been executed by the firm from time to time, and its latest effort on war material calls for particular attention, constituting as it does (as far as can be ascertained) a record for large spinnings. This consisted of a large quantity of aluminium covers and was executed for Government use. Fig. 3 gives a fairly adequate conception of the size of these spinnings, which were spun from aluminium blanks of 14 G metal, 7 ft. in diameter, a proceeding demanding a maximum of care and precision, together with an expert knowledge of spinning as an art. The finished covers measured 5 ft. 6 in. in diameter, and were approximately 9 in. deep. Only a few works are equipped to carry out such spinning work as the above.

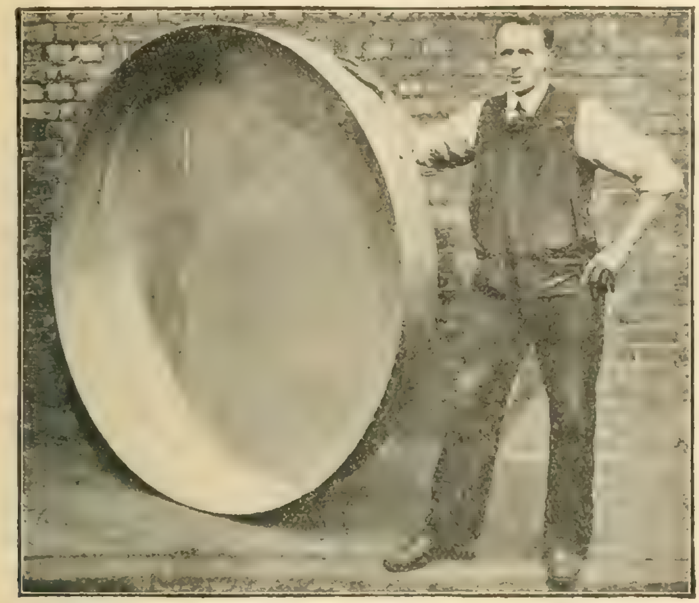


Fig. 3.—A Large Aluminium Spinning

"Witton" Main Regulator.

The accompanying illustration shows a main regulator, which has been made by the General Electric Co., Ltd., of 67, Queen Victoria Street, London, E.C., for a large firm of turbo-alternator manufacturers. The "Witton" standard rectangular face-plate construction is used, together with standard grid resistances mounted on a strong angle-iron framework. The strength and compactness of the unit can be readily appreciated from the illustration.

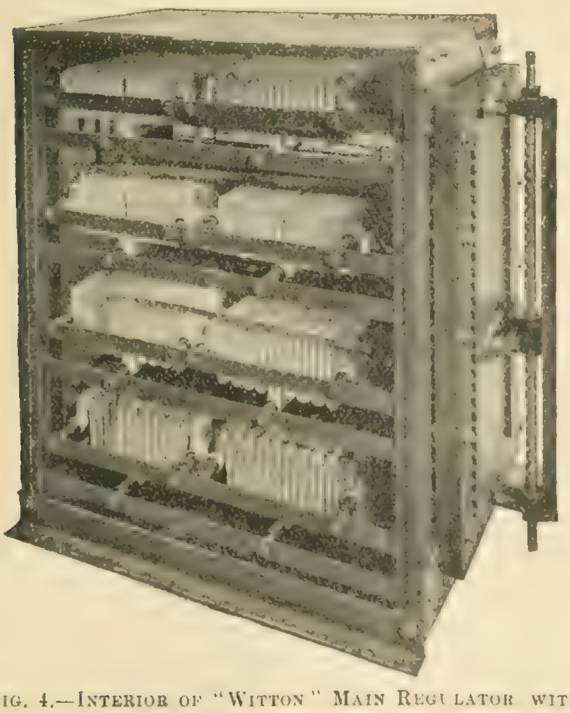


Fig. 4.—Interior of "Witton" Main Regulator with Grid Resistances.

WAR ITEMS.

Technical Institutions and Enemy Members.—The Iron and Steel Institute has struck the names of over 100 members of enemy nationality off its roll. Considerable numbers of enemy members are on the rolls of the Institutions of Civil and Electrical Engineers. It is reported that the German institutions are striking the names of members belonging to the Allied nations off their rolls, and German members of Allied institutions are renouncing their membership.

Writing editorially on this subject in its last issue, the *Engineer* says:—"The action taken by the Iron and Steel Institute at the annual meeting to close its ranks against enemy members raises a question of great interest at the present juncture. Under ordinary circumstances the war between Great Britain and other European nations need not have been waged within the confines of our technical institutions. It has always been one of the boasts of science that it did not recognise the boundaries created by geographers or politicians, and that even differences of race and language did not imply a divergence of interests when the claims of science were at issue. . . . . . It is a thousand pities that this great tradition has been broken, but it can be honestly said that it is not the fault of Great Britain or her Allies. The truth is that the way in which Germany has chosen to wage war, culminating in the wholesale murders which accompanied the sinking of the *Lusitania*, has put her people outside the pale of civilisation, and even sane-minded engineers and clear-thinking scientists have realised that it is no longer possible to allow the nationalities now at war with us to claim even the kinship implied by membership of the same technical society. . . . . .

"It is clear that the action taken by the Iron and Steel Institute, although founded on a righteous indignation for the methods of our chief enemy, has not been dictated by either passion or prejudice, but is the outcome of a jealous regard for its own honour. There are other scientific and technical societies which, if they have not already done so, will no doubt take steps to erase from their list those foreign members who are to be numbered among our enemies. The Society of Chemical Industry, the Royal Institution, the Royal Society, the Institution of Electrical Engineers and others have a certain percentage of foreign membership. It may be that in some instances there are technical difficulties and legal objections to be overcome. These, however, should not be allowed to stand in the way, and we may expect to hear that all our engineering and scientific bodies have eliminated from their roll of membership all subjects of the countries with which Great Britain is now at war, if for no other reason as a protest against the inhuman methods of warfare introduced by our enemies. This is not the time to shrink from the performance of a plain duty."

Lamps for Johannesburg.—We have received a cutting from the *Cape Times*, in which its Johannesburg correspondent states, under date April 28th:—"At the Johannesburg Town Council last night, the Finance Committee recommended the acceptance of Messrs. H. Davies & Co.'s tenders for the supply of electric lamps, at a cost of £1,142.

"Mr. Williamson pointed out that presumably the articles that were proposed to be accepted were made in Holland. The difference between these and the tender for British-made lamps was £500 against the latter, and they might reasonably assume that these lamps made in Holland were really made in Germany. In fact, he had evidence to that effect. They did not know what the position of Holland was in regard to the war, but in view of the latest information it might be that Germany had got Holland to come into line with her. It was, therefore, the duty of Britishers, no matter what the cost, to keep the British workman in employment. Was their money to be given to British workmen, or was it to go to Holland for the real benefit of Germany? Indeed, this tender of Davies & Co. could not be so low if it were not a real case of dumping. They had every ground to have suspicions of the low price—30 to 40 per cent. below the British price. He had nothing to say against Holland, but the sentiment of the Council should at once and always be in favour of Great Britain. He opposed the recommendation. Holland was merely a receiving house for Germany, and the money they sent to Holland would in this case be wages for German workers, either in whole or in part, for lamps such as these.

"Mr. O'Hara moved that the report be referred back, and supported the principal arguments advanced by Mr. Williamson. Mr. Murray seconded. Mr. Deys objected to slurs upon the attitude of a neutral country—Holland.

"The amendment was finally negatived, and the report adopted."

No Municipal Money for Pipes Band.—At last meeting of the Glasgow C.C., Councillor Taylor drew attention to a proposal by the Electricity Committee to present to the Division of Royal Engineers and Brigade of Artillery, which are being raised by the T.C., the necessary equipment and instruments for a pipe band. He contended that the Committee had no power under its Act to take any part of its revenue for this purpose, and he held that the expenditure was therefore illegal. The Town Clerk concurred in this view, and the Lord Provost declared the minute incompetent.

Oldham Tramways and War Bonuses.—The refusal of the T.C. to grant a war bonus to certain section of the employés has caused much dissatisfaction to the men concerned, and a demand is being made to have the question reopened. The T.C. has twice refused the application on the plea that it would mean an extra burden on the ratepayers.

Electric Sterilising of Wounds.—Amongst the hospital applications of electricity in the European war is reported the sterilising of wounds by zinc. A pad with zinc sulphide is placed on the wound, and being connected to the positive pole of a battery, is said to make the surrounding tissues antiseptic by the zinc salt forced into them. The method is pronounced efficient and speedy wherever available.

Board of Trade Inquiries.—In the list issued by the Board of Trade C.I. Branch for the week ended May 15th, the following inquiries for sources of supply of goods are recorded:—

- Electrical apparatus, &c. —
  - Brass sockets with vitrite case for electric metal-filament and carbon lamps.
  - Cables, porcelain insulators, and electric lampholders.
  - Electric lamps (wire drawn, economical).
  - Electric pocket lamps.
  - Wooden mounts for electric light fittings.
- Glass and glassware —
  - Mirrors and glasses.
  - Opal shades for electric light.
  - [illegible].

Names of firms abroad open to purchase the following articles have also been received and recorded:—

- Agate bearings for scales and electrical meters.
- Diesel engines.
- Electrical accessories, unspecified.
- Glass and glassware —
  - Chemical beakers and test tubes.

Westinghouse Staff and Munitions of War.—We learn that a movement was started a short time ago by the engineering and other office staff of the British Westinghouse Electric and Manufacturing Co., Ltd., to express in a practical form their patriotic feelings, and it was suggested by them to the management of the company that they should undertake in their spare time some manual work on munitions of war. This offer was accepted by the management, and operations were commenced almost immediately. For the present, each man will work a 5½ hours' shift one night per week, commencing at either 6.30 in the evening or 12 o'clock at night. We understand that approximately 300 staff men have already volunteered for work on this basis.

Technical Schools and Munitions.—The Industrial Reserve, of 227, Strand, W.C., is organising the technical schools throughout the country in connection with the production of munitions of war; the results already attained are very satisfactory. It is proposed to employ members of the Reserve in small engineering shops, supplying larger firms with standardised small parts.

Personal.—On the occasion of his departure to take up a lieutenancy in the Royal Marines (Submarine Miners), Mr. H. M. Taylor, borough electrical engineer of Middlesbrough, was presented by the staff of his department with a wristlet watch. Councillor Joseph Calvert, J.P. (chairman of the Electricity Committee) made the presentation. He stated that he could pay no greater compliment to Mr. Taylor than mention the fact that the majority of the staff had been with him during the whole of his 13 years' service, working harmoniously the whole time. He felt sure that Mr. Taylor's knowledge would be of great service to the Royal Marines. Mr. Taylor suitably responded. A few remarks by Mr. Telford and Mr. Scotson brought the ceremony to a close.

Mr. Thos. Edwin Scharffetter, of Hale and Manchester, electrical engineer, a natural-born British subject, has adopted the surname of Shorter.

Owing to unfounded rumours as to the nationality of Mr. C. A. Blascheck, city electrical engineer at Canterbury, the Mayor, on May 19th, deemed it necessary publicly to state that Mr. Blascheck was not a German, but an Englishman. His father was a German, who came to England 48 years ago, and three years later was naturalised. Mr. Blascheck's mother was an Englishwoman, and Mr. Blascheck was born in England, and had lived in the country all his life, except for a few years, during which he was sent to Germany to learn the technical work of his profession. The Council passed a vote of confidence in Mr. Blascheck.

Private T. Flynn who, before the war, was engaged at Darwen electricity works, states in a letter home:—"If there is a single man in England to-day physically fit for the Army or Navy and he has not joined he must be wholly ashamed of himself."

Roll of Honour.—Mr. Leslie Smith, of Blackburn, has been wounded in the Dardanelles. Four years ago he left Blackburn, where we was employed as an electrician, for Australia, and on the outbreak of war joined the Infantry Brigade. He sailed on the ss. *Duflinger*, a captured German ship, and Private Smith was made the ship's electrician. He had only been in the firing line an hour when hurt.

Private Chas. Walker, of the clerical staff of the Torquay Corporation electricity works, has been killed in action. On the outbreak of war he joined the 2nd Devon Regiment. Private Fred. Squires, of the same regiment, who was a conductor on the Paignton section of the Torquay tramways, has also been killed at the front.

Intelligence has been received at Chelmsford that Lieut.-Com. Hubert Dobell, Royal Naval Volunteer Reserve, is missing, and that it is believed that he was taken prisoner whilst making observations for aircraft. Prior to the war he was on the Marconi Experimental Staff, at Chelmsford.

Private John Chumley, who had been employed in the power house at the works of the St. Helens Cable Co., has been killed in action. He was 24 years of age. His father, Mr. Samuel Chumley, is also employed by the St. Helens Co.

We deeply regret to read in the *Times* advertisements that Lieut. Brian Crossley, 3rd Batn. Highland Light Infantry, attached 2nd Batn., youngest son of the late Sir Wm. Crossley, Bt., was killed in action in France on May 18th. Lieut. Crossley was known to many of our engineering readers by reason of the part he filled in the famous firm of Crossley Bros., Ltd., of Manchester. He was 29 years of age.

BUSINESS NOTES.

Catalogues and Lists.—Richmond Gas Stove and Meter Co., Ltd., Warrington.—Illustrated list, giving brief descriptive notes relating to natural draught gas-heated furnaces, &c., for expediting the production of shells and war requirements. The furnaces are in service in the principal ordnance factories and by motor and engineering firms.

Messrs. Turner Bros., Ltd., Rochdale.—Folders drawing attention to their hair and Balata belting.

Messrs. J. H. Heathman & Co., Parson's Green, Fulham, S.W. —Card giving prices and particulars of their patent fold-up step ladder with chair seat.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—A series of eight serviceable size blotters has been issued, the letterpress side of which keeps before the mind of the user one or other of the company's specialities—conduits, distribution boards, watertight accessories, electric light fittings, hand lamps, and shop window reflectors. Also a small eight-page booklet entitled: "Wiring for Electric Light and Power," and dealing generally with the merits of the Simplex conduit system. Copies of either the blotters or the booklet will be sent to any engineer on application.

Messrs. Mickelwright, Ltd., Alperton, Wembley.—Illustrated priced leaflets relating to their sliding contact resistances.

Worthington Pump Co., Ltd., India House, Kingsway, London, W.C.—Twelve-page illustrated pamphlet (No. 1,054) containing a description of a new type of motor-driven rotary dry-air pump, which they are putting on the market.

Book Notices.—We have received a copy of No. 2 of the "Records of Railway Interests in the War," published by the *Railway News* (one shilling). It is fully and interestingly illustrated, and contains a vast quantity of information concerning the many ways in which British railways and their staffs and employés are performing their part in connection with the war.

"Continuous Current Electrical Engineering." By W. Tolmé Maccall. London: University Tutorial Press, Ltd. Price 10s. 6d.

The May issue of *The Central* contains articles on the British Association visit to Australia, by G. W. O. Howe; the mercury arc, by T. M. Lowry; Diesel engine troubles, by A. C. Branch; the possibilities of domestic electricity, by H. W. Purle; and various other matters, as well as a Roll of Honour containing no fewer than 633 names—341 officers and 292 of other ranks. From the Imperial College as a whole the total number of men on active service is about 1,030. The annual report of the Old Centralians for 1914 shows a very satisfactory condition as regards both proceedings and finance.

Messrs. A. P. Lundberg & Sons have issued a third edition of their booklet, "The Teaching of Electric Light Switching," a subject which has now obtained a firm footing in technical colleges. Teachers of wiring classes will find this an excellent guide in arranging their lecture and demonstration courses.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV, No. 5. May, 1915. New York: The Institute. Price $1.

For Sale.—Kirkcaldy Corporation has for disposal 3,600 pairs of Conradty "C" carbons, particulars of which are given in our advertisement pages to-day.

South Africa.—A firm of agents in Cape Town, with a branch office in Johannesburg, a partner of which will shortly be in London, desires to secure the representation of United Kingdom manufacturers of high-class electrical and art metal fittings. Apply to the Board of Trade, C.I. Branch, London, for particulars.

Deed of Assignment.—Louisa Fellows (L. Fellows), electric light contractor, 72, Victoria Road, Surbiton.—Last day for claims for dividend, June 2nd. Trustee, Mr. G. C. Corfield, Balfour House, Finsbury Pavement, E.C.

Liquidations.—Oldham Boiler Works Co., Ltd.—Particulars of claims must be sent by July 3rd to the liquidator, Mr. H. Hague, Retiro Chambers, Yorkshire Street, Oldham.

Atlas Electrical Co., Ltd.—This company is winding up voluntarily, with Mr. P. F. Hedges, of 53, Cannon Street, E.C., as liquidator. A meeting of creditors is called for June 1st.

Trade Announcements.—The building occupied by Messrs. Tyler & Freeman, at 20, New Bridge Street, London, E.C., for the last 19 years is being pulled down and the firm are moving to larger premises at 40, Chancery Lane, W.C. New telephone Nos.: Holborn, 6490 and 6491. Telegraphic address: "Potential Holb., London." Firms are invited to forward copies of recent catalogues.

The Gath Electrical Engineering Co., with which is incorporated E. Sykes, is, after reconstruction, opening showrooms in Southgate, Halifax.

Fire.—On May 21st, a fire occurred at the premises of MESSRS CHARLES MACINTOSH & CO, LTD., india-rubber manufacturers, Chorlton-on-Medlock. The fire broke out in the spreading department, which was practically destroyed.

Bankruptcy Proceedings.—H. J. GODFREY, electrical engineer, late of 188, Balham High Road, S W.—A first and final dividend of 9½d. in the £ is payable on June 11th, at the Official Receiver's offices, 132, York Road, Westminster Bridge Road, S.E.

LIGHTING and POWER NOTES.

Accrington.—PRICE INCREASE.—It is stated there is to be an advance of 20 per cent. in the Corporation's charges for current to electricity users, and, in addition, the discount of 10 per cent. hitherto allowed may be reduced to 5 per cent., so that, if these proposals are carried through, the advance will be equal to about 27 per cent. on present charges.

Aldershot.—PLANT EXTENSIONS.—The L.G.B. has asked the Council to furnish a detailed statement of the works considered necessary on account of war requirements, and for which a loan of £8 500 has been applied for. The engineer and the chairman of the Lighting Committee are to wait on the L.G B. with reference to the matter. As it is deemed imperative that the new boiler plant should be at once installed, it was decided to take the money needed temporarily from reserve, and refund it if a loan is sanctioned.

Argentina.—By decree of the National Government, the clause in the new port of Buenos Aires construction contract providing for the erection of an electric power house and machinery by Messrs. C. H. Walker & Co., has been annulled.

Aylesbury.—The U.D.C. has approached the Bucks Education Committee as to proposals for electric lighting, and the Committee has replied that at present it cannot entertain the question.

Barnsley. — ELECTRIC COOKING. — The Borough Education Committee has decided to install an electric cooker in the kitchen for the new open air school.

Bitterne.—PROV. ORDER.—The B. of T. has informed the South Stoneham R.D.C. than an order has been granted to the Southampton T.C. to extend the E.L. mains to Bitterne, but that the order will not come into operation until after the war.

Blackpool.—The electricity returns continue to show a big increase in private lighting; the output during April was 16,770 units more than during the same month last year. Public lighting took 7,420 fewer units, and the Corporation tramways demand was 20,390 units down.

Bury (Lancs.).—PRICE INCREASE.—The Corporation Electricity Committee has decided to increase the price of electricity from July 1st. The charges for private lighting, public lighting and tramways will be increased by the addition of 10 per cent. to each account, and that for power and heating by the addition of 15 per cent.

Castletown-Berehaven.—L.G.B. INQUIRY. — An inquiry is about to be held into the powers required for the lighting of the town; the introduction of an electrical system has been suggested.

Continental.—SPAIN.—A concession has lately been granted for the establishment of a plant to utilise the water power of the river Mundo at Hellin for the generation of electrical energy for lighting and power purposes.

Crayford.—The West Kent Electric Co., which has secured the lighting of 200 houses to be erected on the Northumberland Heath Estate, has asked the P.C. to allow it to quote terms for the street lighting of the estate. The matter has been referred to the Lighting Committee, which is considering the lighting of the Barnes Cray Estate.

Cumberland.—POWER SCHEME.—The *Manchester Dispatch* states that great importance attaches to a scheme in progress, under the auspices of the Cumberland Waste Heat Owners' Co., Ltd., in which the Whitehaven Hematite Iron and Steel Co., Ltd., is largely interested, for the conversion of the waste gases from the furnaces at Cleator Moor into electrical power for the ore mines in the north-west hematite producing district. The plant, which will have a capacity of 2,200 KW., will be in operation by the end of June.

Darlington.—The L.G.B. has informed the T.C. that loans will not be advanced for the laying of mains and connections. The Electricity Committee is considering the desirability of increasing the charges for current.

Ely.—PROV. ORDER.—The Gas and Electricity Co. has decided not to proceed with the application for a prov. order for E.L. in the Urban Council's area. Objections had been lodged with the B. of T. by the Ratepayers' Association and others.

Grays.—LOAN REFUSED.—The L.G.B. has informed the U.D.C. that at the present time it cannot sanction the loan of £600 applied for, for electricity purposes.

Hants.—ASYLUM INSTALLATION.—The C.C. has decided to adopt electricity at the new Asylum at Park Prewett for pumping, laundry and baking machinery, cold storage and auxiliary cooking plant. The voltage will be 220 for the installation; on the grounds of cleanliness and convenience it has been decided to install the light in the cottages.

Harrogate.—EXTENDED SUPPLY AREA.—The B. of T. has granted the T.C. an order authorising it to supply current at Nidd, Plompton, Starbeck, Pannal, Haverah Park, Hampsthwaite, Killinghall, Ripley, Birstwith, Hartwith-cum-Winsley, and Clint.

Huddersfield.—RESTRICTED LIGHTING.—On account of the non-lighting of arc lamps, the Corporation Electricity Committee has allowed the T.C. a rebate of 50 per cent. off the public lighting account.

Kettering.—YEAR'S WORKING.—During the last financial year the Council's electricity undertaking sold 1.890,544 units, the maximum demand being 1,102 KW. The total revenue amounted to £15,107, and working expenditure to £7.448, leaving £7,659 as gross profit. Financial charges absorbed £3.953; £1,000 was placed to reserve fund, which now totals £3,200; and a balance of £4 387 was carried forward, as against a balance of £3,663 brought forward from the previous year.

Kingston-on-Thames.—The Sanitary and Drainage Committee has agreed to an increased charge of 10 per cent. for all current used for sewage works purposes.

Leek.—INCREASED PRICES.—The U D.C. has decided to advance from July 1st the present charges for current to all consumers by 10 per cent.

London.—HAMMERSMITH.—The Electricity Committee has decided to give supplies of electricity to the Notting Hill Electric Lighting Co., Ltd., and Fermans, Ltd., at a uniform rate of 1⅓d. per unit, less 33⅓ per cent. discount when the supply for power and lighting exceeds £100 per annum.

STEPNEY.—The L C.C has informed the B.C. that the borrowing of £15,000 for mains may be sanctioned, but that the order sanctioning the borrowing will not be issued until the B.C has agreed to limit expenditure on the provision of mains during the war to the laying of mains to supply electrical energy to consumers engaged on work for the War Office or Admiralty only. The Electricity Committee recommends the Council to agree to this.

The Electricity Committee reports that the plant necessary to enable the Council to furnish the Shoreditch Council with electrical energy in bulk has been installed and will be available on September 30th next. It is necessary under the terms of the supplemental agreement to give the Shoreditch B.C. notice by June 30th of the Council's ability to give this supply. The borough electrical engineer has been authorised to give such notice.

Manchester.—L.G.B. INQUIRY.—On the 21st inst. an inquiry was held into an application of the Corporation for sanction to borrow £543,000 for the provision of a new generating station at Barton. It was explained that the increased demands were entirely due to engineering and other firms in the city for the manufacture of war munitions, and, with one exception, Manchester was supplying more current than any other undertaking for the manufacture of munitions of war. Mr. S. L. Pearce, the chief electrical engineer to the Corporation, said if the application were not granted, the undertaking would have to refuse any further increase in supplies of current. The application now was for sanction to borrow £432,000. The Corporation would postpone the carrying out of the work involving the balance of the amount. The inspector announced that his instructions were to deal with the Manchester Corporation's application at the earliest possible moment.

Middleton (Lancs.).—The annual accounts state that public lighting will next year require £2,326, a reduction of £200 on the year previous, and foreshadow the postponement of the proposed extension of electric lamps.

Oldham.—YEAR'S WORKING.—The profit of the electricity department for the past year, subject to audit, is £3,550 (or £1.555 more than in the previous year), and this, added to the reserve fund, brought that to £12,979 The reserve will have to be spent on extensions which are now being made, in consequence of the bar on new loans. Units sold during the year amounted to 7,985,000, an increase of 929 000 units and a record. The cost of production was ·606d. per unit, compared with ·634d. last year.

Peterborough.—The T.C. has given Messrs. Aublet, Harry & Co., of Westwood, permission to lay an electric cable to their works from those of Messrs. Werner, Pfleiderer and Perkins, on condition that when the municipal mains are extended to the district the supply of current will be taken from the Council.

Plymouth.—Year's Working.—The annual report of the electricity department on the Newport Street electricity undertaking of the Corporation to March 31st, shows a sale of 2,520,420 units, producing estimated receipts of £21,790, compared with 2,277,223 units sold, and £19,981 received in the previous year, an increase of 243,197 units in the consumption of current, and £1,808 in the receipts.

Rawtenstall. — Street Lighting. — The T.C. has decided to light Booth Road, Waterfoot, by electricity, and the work is to be proceeded with at once.

Salford.—Year's Working.—For the past financial year the total revenue of the electricity department amounted to £117,584 as against £111,412 in 1913-14. The total working costs, inclusive of £6,414 for energy purchased, amounted to £65 776; this comparing with £67,232 in the previous year when £3,152 was paid for purchased energy. The generating costs at Salford fell from ·82d. to ·76d. per unit in 1914-15. The gross profit for the two years 1914-15 and 1913-14, was £51,808 and £44,180, and net profit, £8,406 and £3 629 respectively. Some 20 646 000 units were sold, being about a million in excess of the previous year.

Southend-on-Sea.—The T.C. has granted a supply of current at 1½d. per unit to a consumer for power purposes in connection with a medical apparatus used for three hours daily for the treatment of tuberculosis of the skin. The current is to be used only between 6 a.m. and 6 p.m.

Southport.—The Council has approved a recommendation of the Finance Committee to increase the rates by 3d. in the £, and to increase the gas and electricity charges by 10 per cent.

South Shields.—A formal inspection of the extensions recently carried out at the electricity works (and described and illustrated on page 693 of the Electrical Review) was made on the 19th inst., at the invitation of the chairman of the Electricity Committee. It was pointed out that two turbine plants of 3,500-kw. normal capacity had been put down in the space occupied by three reciprocating sets totalling 400-kw. capacity.

South Wales.—Wages Conference.—As the outcome of a conference between electrical contractors at Cardiff and Barry and the Electrical Trade Union, the following agreement has been arrived at:—Wages for electricians, cable jointers, and electrical fitters to be 9½d. per hour, with an increase to 10½d. in November: wages of armature winders to be 10d., with an increase to 11d. in November.

Stafford. — Year's Working. — The report of the electricity department for the past year shows an increase of 250.000 units sold, bringing the total for the year to over a million. The revenue from all sources amounted to £7,194, an increase of £814, while the total expenditure was £3,562, as against £3,934 in the previous year. The Committee recommends that £1,000 be transferred to the depreciation fund, and £100 as a contribution to the gas department, leaving a gross profit of £2,444, an increase of £87 on 1914. In pursuance of the arrangement as to profit sharing, the Committee recommends the payment of a bonus on the wages of the officials and workmen of the electricity department, of 14·6 per cent., as compared with 12·0, 10·0 and 11·7 per cent. in the three preceding years; it was decided that the maximum bonus in the electricity department should be 15 per cent.—*Staffordshire Advertiser.*

Wakefield.—Stanley Prov. Order.—The Corporation is petitioning Parliament against the Stanley (Yorkshire) Electric Lighting Prov. Order, asking to be heard when the confirming Bill comes before the Committee. The Wakefield Corporation's locus is objected to by the promoters of the order, and the Court of Referees is to decide the point on June 9th.

Watford.—The B. of G. has decided to install an electric motor for driving the water pump at the Workhouse.

Willesden.—The L.G.B. has sanctioned the borrowing by the U.D.C. of £1,112 for the purpose of laying a feeder cable from Acton Lane sub-station to Craven Park. It is proposed to substitute a feeder pillar for the disconnecting boxes now in use on the cables at Craven Park; also to interview the L.G.B. with a view to obtaining authority to raise part of the loans, amounting to £20,000, for prospective mains and services, sanctioned by the Board in August last year. The Committee is to hold a special meeting for the purpose of considering the report presented by the electrical engineer on new terms for electrical bulk supply and an estimate for a new generating station, &c.

Ystradgynlas.—Prov. Order.—The report dealing with the Council's negotiations for the taking over of the plant of the Glantawe Electric Supply Co., Ltd., states that the provisional order had been granted, but the B. of T. had included one or two additional clauses, which provided that the order should not come into operation until the termination of the war and at the time must be taken up within 15 months, the works to be transferred within the subsequent three years.

TRAMWAY and RAILWAY NOTES.

Accrington.—The Committee has empowered the tramway manager to engage women conductors if the necessity arises, as many of the conductors have joined the Colours. Women conductors will be paid at the same rate as the men.

Ashton-under-Lyne.—The tramway authorities have refused to concede an all round increase of 1d. per hour to tramway employés.

The tramwaymen held a mass meeting on Sunday, at which it was decided to invite the authorities to submit the application to arbitration.

Bolton.—Strike.—On Saturday last the whole of the employés of the Corporation tramways came out on strike. A certain number of cars, about 30, were run on the first journey, after which not a single car was run during the day. The service was also stopped on Sunday and Monday, and neither the Bury Corporation nor the South Lancashire Co., who run into Bolton, took cars within the borough boundaries.

The Tramways Committee passed a resolution instructing the general manager to arrange for certain services, and that in the event of any motormen or conductors refusing to carry out the orders to enable such cars to be run, their services in the tramways department be dispensed with. Motormen for extra time involved would receive about 3s. 8d. and the conductors 2s. 11d. to 3s. 4½d.; the men do not like the idea of working at night after starting about 4.30 in the morning. Since the outbreak of war 102 tramway employés have enlisted, while 51 left their employ to work in foundries, &c., making a total of 153 out of 450. The Tramways Committee has decided to make no payments to dependents of its employés who have not already enlisted. The Committee is at present paying £35 per week to dependents of employés who are with the Colours.

Burnley.—Female Labour.—A proposal to employ women as car conductors has been left in the hands of the chairman of the Tramways Committee and the tramway manager for investigation.

Continental.—Spain.—The Sociedad Hispano-Belge de Ferrocarriles, Mineria y Industria, is reported to be preparing plans in respect of a projected narrow-gauge electric railway between Fonsagrada and the Port of Ribadeo.

Darlington.—Female Labour.—The T.C. has arranged for eight female conductors to be employed, owing to the tramway staff having been depleted by enlistments. They will work eight hours daily, and receive between 19s. and 20s. per week.

Glasgow.—Female Labour.—There are now 150 fully trained women acting as conductors of Glasgow tramway cars, and on Tuesday another 50 women started training under the direction of male conductors, so that by Saturday 200 females will be engaged at the duties.

The Tramway Committee has, by a majority, recommended that all soldiers and sailors while in uniform be allowed to travel on the cars at half fare, the minimum half fare to be ½d.

Halifax.—Tramway Accident. — A serious tramway accident occurred on Saturday night to a car travelling from Ovenden to Halifax, which left the track, turned round and toppled over on to its side. Between 20 and 30 passengers were so injured that they had to be removed to the Halifax Infirmary. The accident occurred at a sharp turn in the roadway where there is a steep gradient. The car was considerably damaged. The cause of the accident is not known.

Huddersfield.—Year's Working.—The result of the past year's working of the tramway undertaking shows a surplus of £10,208, as compared with £8,800 in the previous year, after allowing £13,707 for depreciation. Out of this surplus £8,400 is to be put to relief of rates.

India.—The Karachi Electric Tramway Co. has received a franchise to extend its tramway lines. The new line has been needed for some time and promises to be profitable. Actual construction probably will be delayed a short time, but owing to the war, labour is now cheap, and work probably will be undertaken at no distant date.—*Far Eastern Review.*

Japan.—At a recent meeting of the Tokyo City Electric Enterprise Investigation Committee one of the municipal officials stated that the receipts from the enterprises were not sufficient to meet the repayment of the municipal loans. The municipal authorities propose raising tram fares in the immediate future by at least 1 sen per ticket, and this has caused indignation among some sections of the citizens, who are backed up by prominent members of the City Assembly.—*Far Eastern Review.*

London.—L.C.C.—Although the strike on the Council's tramways still continues, there are signs that a settlement will not long be delayed. During the week the Council issued a demand that all drivers and conductors of military age should return their uniforms, and the inspectors of all depôts have been instructed that no man is to be taken on again if he is eligible for military service. The department has had many applications from suitable candidates above military age for the vacant positions, and, in addition to the old training depôt, four new training schools have been opened at which the new men are receiving the necessary training as drivers. Efforts are being made by the men's unions to bring about a settlement through the B. of T.

One of the Union officials has stated that it is highly probable that within a week or so some form of National service may be decided on and that the Council has taken the opportunity of getting rid of men who would in any case probably have to go shortly.

The Woolwich Arsenal tramway service is now in satisfactory operation, and the general services are being improved daily.

Manchester.—Year's Working.—The annual report of the tramway undertaking states that the total revenue was £901,875, a decrease of £23,434 on the previous year. The balance, with bank interest, and after deducting working expenses and war allowances, amounted to £312,285, out of which £100,000 had been given to aid the rates. The aggregate length of single track open, including lines over which the Corporation had running powers, was 195 miles ; parcels carried numbered 1,236,500 ; and the total number of passengers was 202,768,420. Weekly allowances to employés who have enlisted amounted to £1,316, and the collections on the cars for war funds have realised £11,286.

Preston.—Female Labour.—The Tramways Committee's application for female conductors has brought an extraordinary response. It is intended in the first instance to put 14 or 15 women on the Ashton-on-Ribble section for probationary purposes, but it is probable that in due course the conductors on all cars will be women. As learners they will be paid half rates, but as qualified conductors they will start at the minimum rate for men, viz., 5d. per hour.

Salford.—War Bonus.—The tramway men have decided to accept the Corporation's offer of a war bonus similar to that recently awarded by arbitrators at Newcastle. Regarding the employment of women on the cars, the men have decided to ask the Corporation to withdraw female labour, and they will endeavour to find a suitable supply of male labour for the cars. Should this endeavour be unsuccessful the men have decided upon the conditions on which they will be prepared to work with women.

South Africa.—Electric Vehicles.—The South African General Electric Co., which is pushing the sale of electric vehicles in South Africa, has lately established a charging station and garage in Cape Town, where customers' cars can be charged and garaged.

South Staffordshire.—The Black Country tramwaymen have decided, by 72 votes to 62, to accept the bonus of 2s. a week offered by the companies. The men's demand was for an increase of ½d. per hour.

Whitworth.—The U.D.C. has decided that the Tramways and Electricity Committee be dispensed with for the present year, and that the work (if any) be done by the whole of the Council.

TELEGRAPH and TELEPHONE NOTES.

Jamaica.—To supply a need felt by the British Navy, a powerful wireless station is being built on the highlands of the Island of Jamaica, 3,000 ft. above the level of the sea.

A force of about 300 men has been working on the plant for two months. The new station is being constructed by the British Government, and no details as to its equipment or range have been permitted to become public, except that the plant will be a very powerful one with a long radius of action.

Nottingham.—As the result of experiments which they have been conducting, Messrs. Farse & Co., electrical engineers, have received a large Government contract for the supply of telephone mechanism, which, it is said, will ultimately amount to over £250,000. Hitherto these telephone parts have been a German monopoly, so that the contract may mean the establishment of a new industry in Nottingham.

Time Signals.—It is stated that arrangements are in working order for the daily transmission of a wireless time signal for the use of shipping in South African waters, through the medium of the Union Government wireless station at Slangkop.

Wireless Signalling on Railways.—Experiments are being conducted this week on a section of the London and South-Western Railway Co.'s system with five engines equipped with wireless signalling apparatus.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—June 15th. City Council. Four mechanically-fired boilers, one turbine-driven boiler-feed pump, two fuel economisers, circulating water pumps. City Electrical Engineer. Specifications from Messrs. McIlwraith, McEacharn & Co., Ltd., London, E.C.

June 30th. Victorian Railway Commissioners. One 13-in. centre lathe for turning or grinding commutators for traction armatures ; one 9-kw. motor-generator and battery-charging accessories ; four electric motors.*

July 14th. Victorian Railway Commissioners. Supply of 60,000 flame arc carbons for use in Ganz flame arc lamps (Contract 28,811) ; aluminium feeder, insulators, feeder taps, and terminal anchoring and joint clamps, for St. Kilda-Brighton electric street railway (Contract 28,817).—*Australian Mining Standard.*

Sydney.—July 12th. Metropolitan Board of Water Supply and Sewerage. Two steam turbines and condensers at Ryde pumping station, for the Chatswood pumping plant. Secretary, 341, Pitt Street, Sydney.

July 19th. Council. Maximum-demand indicators. Specification (10s. 6d.) from Electric Light Department.

July 19th. Municipal Council. One or two 12,000-kw. turbo-alternators (Contract No. 363).* A copy of the specification can be obtained from the City Electrical Engineer, Sydney.

July 19th. Steel towers for 33,000-volt transmission line. Specification (10s 6d.) at E.L. Department, Town Hall.

July 21st. N.S.W. Government Railways and Tramways Department. One 250-k.v.a. turbo-generator.*

Adelaide.—June 30th.*—Deputy P.M.G. 120 miles of outside distributing wire ; 123 miles of insulated copper wire

July 7th.*—27,000 jointing sleeves and 55 000 copper binders.

Perth.—July 7th. Deputy P.M.G. 31,000 porcelain or alternatively stoneware insulators (Schedule 432 W.A.).*

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Dublin.—June 7th. Electric passenger lift for Irish United Assurance Society. See "Official Notices" to-day.

Dundee.—June 4th. Corporation Electricity Department. Reinforced-concrete floors and jointless flooring, required for the extension to Carolina Port generating station.

Eccles.—June 9th. Corporation. Installation of the electric light at the Anson Street Council Schools, Winton. Forms of tender (10s.) from Mr. E. Parkes, Town Clerk, Town Hall.

Edinburgh.—June 21st. Two 5,000-kw. turbo-alternators and condensing plant, for Portobello supply station. See "Official Notices" May 21st.

Edmonton.—June 1st. Maintenance of the intercommunication fire alarms at the various elementary schools in Edmonton for 12 months for the Education Committee. Architect, Town Hall, Lower Edmonton.

Finchley.—May 31st. U.D.C. Wiring, for light, 100 workmen's dwellings. See "Official Notices" May 7th.

Kirkcaldy.—June 14th. Corporation. 100 half-watt 1,000-c.p. lamps and lanterns for street lighting. See "Official Notices" to-day.

London.—L.C.C.—June 4th. Installation, 260 wiring points, 345 lights, also electric bells, at the County Secondary School, South Hackney. See "Official Notices" May 21st.

St. Pancras.—June 14th. Corporation. Twelve months' supply of Welsh and steam coal for the electricity stations and baths.

West Ham.—June 14th. Installation of lighting and water-heating apparatus at Knox Road Special School, for Education Committee. See "Official Notices" to-day.

Manchester.—June 2nd. Corporation. Coal-unloading crane, conveying plants, &c. See "Official Notices" May 7th.

New Zealand.—Christchurch.—July 3rd. House service meters for the City Council. Specifications from the City Electrical Engineer's office.—*New Zealand Shipping and Commerce.*

Portsmouth.—June 1st. Corporation. 100 tons of steel girder tram rails, five tons of steel fishplates, one ton of fishplates, three tons of 5-ft. wrought-iron tie-bars. See "Official Notices" May 14th.

Rangoon.—August 11th. Installation of a system of fire-alarms, for the municipality. Specification (10s.) from Messrs. Ogilvy, Gillanders & Co., 67, Cornhill, E.C.

Redditch.—June 14th. H.T. three-phase switchboard. See "Official Notices" to-day.

Rhondda.—June 4th. U.D.C. Water-storage tank (30,000 gallons), for Porth Electricity Works. See "Official Notices" to-day.

Tasmania.—Launceston.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c. ; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Hobart.—July 5th. Lead-covered telephone cables ; glassware and other material for batteries ; telephone instruments and parts, including switchboards; iron work; various insulators; iron, steel, copper and bronze wire; india-rubber, gutta-percha, cotton, silk or wool-covered wire; sleeves, paper jointing, &c., for P.M.G.'s Department. See "Official Notices" to-day.

Wigan.—May 29th. Corporation. H.T., three-core, paper and lead-covered, armoured feeder cable, transformer and switchgear. See "Official Notices" May 14th.

CLOSED.

Australia.—The following tenders have been accepted :—

P.M.G.'s Department, N.S.W.

240 miles twisted pair, rubber insulated wire, £14 10s. per mile.—British Insulated & Helsby Cables, Ltd.

P.M.G.'s Department, Victoria.

Accumulator battery, Tudor type, for Perth radio-telegraph station, £322.—J. R. W Gardam.
3 miles paper insulated, lead-covered cable, 104 pairs, £392 per mile; 3 miles ditto, 39 pairs, £223 per mile.—British Insulated & Helsby Cables, Ltd.

Victorian Railways Department.
(Electrical equipment of Melbourne suburban system.)

Track and line relays, £3,061.—British Pneumatic Railway Signal Co., Ltd.
Track resistance, £1,547.—McKenzie, Holland & Westinghouse Power Signal Co., Ltd.
Volt feeder cables, volt track cables and accessories, schedules rates.—British Insulated & Helsby Cables, Ltd.
Overhead equipment of permanent way and overhead transmission mains, schedule rates.—British Insulated & Helsby Cables, Ltd.
Hard-drawn copper wire, at £86 17s. per ton.—British Insulated & Helsby Cables, Ltd.

Melbourne, Brunswick and Coburg Tramways Trust.

3-core H.T. cable, £1,182.—W. T. Henley's Telegraph Works, Ltd.
Overhead material, £4 554.—G. H Bishop, British Insulated & Helsby Cables, Ltd.; Lascelles, Parrington, Australian General Electric Co.
Car equipment, £6 549.—Australian General Electric Co.
Sub-station equipment, £3,510.—Australian General Electric Co.—*Tenders.*

Bexhill-on-Sea.—The T.C. has accepted the tender of Messrs. Myers, Rose & Co. for 500 tons of Shipley Peas coal, for the electricity works, at £1 7s. 6d. per ton.

Bradford.—The Guardians have accepted the offer of Mr. Charles Bell, at £33, for installing electric light at the Westbrook Lodge relief station.

Dover.—The T.C. received the following tenders for six electrical vehicles for scavenging :—

Edison Accumulators, Ltd.	(accepted)	£6,760
General Vehicle Co., Ltd.		5,850
Wolseley's Motors, Ltd.		6,490

Glasgow.—The Tramways, Works and Stores Committee recommends acceptance of the following :—

Scrap copper cable, scrap motor field coils, scrap zinc.—P. and W. MacLellan, Ltd.
Scrap copper wire and bonds, scrap armature coils, scrap brass, brass dust, scrap lead, scrap rubber cable, scrap dry cells.—R. M. Easdale & Co.
Scrap lead-covered cable.—Trainer & Allison.
Brass turnings and borings, copper and mica turnings.—Pegler Bros. & Co., Ltd.
Cast-iron stopping-place sign posts.—D. King & Son; J. and A Law, Ltd.
Two 500-KW. rotary converters.—British Westinghouse Co., Ltd.

The Corporation has placed a 12 months' contract for direct current house service meters with the British Thomson-Houston Co., Ltd.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

War Office.

Telegraph pole arms.—Bullers, Ltd.; Siemens Bros. & Co.
Insulator bolts.—T. W. Lench, Ltd.; Chas. Richards & Sons.
Battery boxes.—Accumulator Industries, Ltd.; Houghton-Butcher Mfg. Co., Ltd.; Walters Electrical Mfg. Co., Ltd.
Insulator brackets, clips, pole, &c.—Bullers, Ltd.; T. W. Lench, Ltd.; Siemens Bros. & Co., Ltd.
Electric cable and wire.—T. Bolton & Sons, Ltd.; B I & Helsby Cables, Ltd; Callender's Cable and Construction Co., Ltd.; Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; R. Johnson, Clapham & Morris, Ltd.; Johnson, Matthey & Co., Ltd.; R. Johnson & Nephew, Ltd.; London Electric Wire Co. & Smiths, Ltd.; Shropshire Iron Co., Ltd.; Siemens Bros. & Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. & Smiths, Ltd; Ward and Goldstone.
Electric cells.—Siemens Bros. & Co., Ltd.
Resistance coils.—Gambrell Bros., Ltd; Muirhead & Co., Ltd.; Nalder Bros. & Thompson, Ltd.; R. W. Paul; W. G. Pye & Co.; Reid Bros. Engineers, Ltd.
Telegraph commutators and vibrators.—Edison & Swan United Electric Light Co.; Gell Telegraph Appliances Syndicate, Ltd.
Electric cranes.—Babcock & Wilcox, Ltd.
Insulator cups.—Bullers, Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Electric sets, &c.—Austin Motor Co.
Galvanometers.—Edison & Swan United Electric Light Co., Ltd.; India-Rubber, Gutta-Percha and Telegraphs Works Co., Ltd.
Insulators.—Litholite, Ltd.
Electric lamps.—Brimsdown Lamp Works, Ltd.; Cryselco. Ltd.; Efandem Co., Ltd.; General Electric Co., Ltd.; India-Rubber, Gutta-Percha, and Telegraph Works, Ltd.; Omega Electric Lamp Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.
Telegraph poles, steel.—Bayliss, Jones & Bayliss; Siemens Bros. & Co., Ltd.
Ditto, wood.—W. H. Beal; W. E. Chivers & Sons; Cuttians Steam Joinery Works; John Jaques & Sons, Ltd.; Maple & Co. Ltd.; H. H. Martyn and Co., Ltd.; T. and S. E. Merredew, Ltd.; Venesta, Ltd.; D. Wishart & Co.
Electric light switches.—General Electric Co., Ltd.
Telephones, sets and parts.—London Electric Wire Co. and Smiths; Siemens Bros. & Co., Ltd.; Walters Electrical Mfg. Co., Ltd.; Western Electric Co., Ltd.; West London Scientific Apparatus Co., Ltd.
Works services, electrical wiring, Codford, Sutton Veney and Warminster.—Edmundsons Electricity Corporation, Ltd.
Electrical wiring, Codford.—Tredegar, Ltd.
Electrical wiring, Sutton Veney.—Girdlestone & Co.
Electric light installation, Cannock Chase, Mansfield, Oswestry and Rhyl.—Ellis & Ward, Ltd.
Electric light installation, Richmond.—Cox-Walkers.

India Office. Store Department.

Wireless apparatus.—Marconi Wireless Telegraph Co.
Cable.—Siemens Bros. & Co.
Searchlights.—Chance Bros. & Co.
Telephone parts.—Peel-Conner Telephone Works.
Wire.—B.I. & Helsby Cables, Ltd.; T. Bolton & Sons, Ltd.; White Cross Co.

Post Office.

Telegraphic apparatus.—Creed, Bille & Co.
Telephonic apparatus.—Automatic Telephone Mfg. Co., Ltd.; Brit. L. M. Ericsson Mfg. Co., Ltd.; Phoenix Telephone and Electric Works, Ltd.; Western Electric Co., Ltd.
Telephonic cable.—Johnson & Phillips; Pirelli-General Cable Works, Ltd.; St. Helens Cable and Rubber Co., Ltd.; Western Electric Co., Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.; Doulton & Co., Ltd.; Oates and Green, Ltd.
Insulator spindles.—T. W. Lench, Ltd.
Insulating strips.—Millars Timber and Trading Co., Ltd.
Laying ducts, Stockport.—W. H. Worthington, Ltd.
Laying ducts and pipes, Belvedere to Hop Exchange, S.E.—F. G. Brummell.
Telephone Exchange equipment, Huddersfield.—Peel-Conner Telephone Works, Ltd.
Telephone Exchange equipment extensions, East (London).—Western Electric Co., Ltd. Salisbury.—Peel-Conner Telephone Works, Ltd.

Kingston-on-Thames.—The T.C. has accepted the tender of the Anglo-American Oil Co., Ltd., for 1,400 tons of fuel oil for Diesel engines for two years, at £3 5s. per ton.

London.—Stepney.—The Electricity Committee reports the purchase of 6 270 tons of coal for the electricity undertaking at prices ranging from 21s. 6d. to 24s. a ton, and has accepted the offer of Messrs. E. Foster & Co. for 3,000 tons of Bestwood Washed Peas, at 21s. 6d. per ton, in weekly quantities of about 60 tons.

Hackney.—The Electricity Committee recommends the B.C. to enter into a sole-use contract with the Electrical Apparatus Co., Ltd., for the supply of direct-current house type meters, as may be required, up to and including 25 amperes capacity, for one year.

Spain.—The Spanish Ministry of Marine has recently placed a contract with the Sociedad Espanola de Construccion Naval for the establishment of an electricity generating plant at the State Artillery and Projectile Works at La Carraca for lighting and power purposes.

Tasmania.—The Mount Lyell M. and R. Co., Ltd., has entered into a contract with the British Insulated and Helsby Cables, Ltd., for the sale to them of 250 tons of electrolytic copper (E.S.A. brand) monthly.—*Tenders.*

FORTHCOMING EVENTS.

Physical Society of London.—Friday, May 28th. At 8 p.m. At King's College, Strand. Papers on "Numerical Relations Between Electronic and Atomic Constants," by Dr. H. S. Allen; "A Method of Calculating the Absorption Coefficients of Homogeneous X-Radiation," by Mr. H. Moore; "Two Experiments Illustrating Novel Properties of the Electron Currents from Hot Metals," by Prof. O. W. Richardson, F.R.S.; "High Permeability in Iron," by Prof. E. Wilson.

Royal Institution of Great Britain.—Friday, May 28th. At 9 p.m. At Albemarle Street, W. Paper on "Engineering Problems of Mesopotamia and Euphrates Valley," by Sir J. Jackson.

Friday, June 4th. At 9 p.m. Paper on "Radiation from Exploding Atoms" by Prof. E. Rutherford, F.R.S.

Rontgen Society. Tuesday, June 1st. At 8.15 p.m. At Cancer Hospital, Fulham Road, S.W. Annual general meeting.

Thermal Insulation Tests of Electric Ovens.—A recent issue of the *Electrical World* contained some particulars of an investigation into the resistance to heat offered by five different kinds of oven wall, the oven in question being one used for electrical work at Harvard University, rectangular in shape with walls composed of asbestos board. A summary of results from the various tests is given below :—

Series	Nature of wall.	Deg. C. rise per watt input.	Thermal resistance ratios.	
1	Single shell	0·0254	1	
2	Double shell and simple air space	0·0410	1·62	
3	Double shell and cellular air space	0·0410	1·62	1
4	Double shell packed with cotton waste	0·0605	2·38	1·47
	Double shell packed with metallic wool	0·0779	3·07	1·9

The oven measured externally 63 in. × 41½ in. × 44 in., and internally, 56 in. × 34½ in × 35 in. (approximately). It was found that after seven or eight hours from the commencement of heating, the rate of rise of internal temperature was sufficiently small to enable heat input to be taken as heat leakage without serious error.

The ovens provided with double walls, containing a simple air space between them, showed about 60 per cent. more thermal resistance to the escape of heat than a single wall, after a steady input for from seven to eight hours. Inserting a few horizontal wooden strips into the walls to break up the air space into compartments had no appreciable effect. Packing the hollow walls with loose dry cotton waste increased the double-wall thermal resistance nearly 50 per cent., and packing with a loose flocculent mineral substance nearly 90 per cent. The latter substance is procured in Indiana, and is fused and blown out with compressed air.

MAIN-MOTOR-STARTING SWITCHGEAR USED ON MODERN GERMAN SUBMARINES.

By NORMAN H. WOOD.

Owing to the exigencies of service to which a modern ocean-going submarine boat is exposed, and the fact that the machinery used to submerge the boat and propel it when submerged must be absolutely reliable, every effort is made to install apparatus which is effective and yet extremely simple.

On the surface a submarine is propelled by means of internal-combustion engines using crude oil, but when diving and running submerged the boat is driven by powerful electric motors and maintained at the desired depth by means of diving rudders or hydroplanes. Should, however, the main motors or their starting switchgear break down when the boat is running submerged, the diving action of the hydroplanes becomes nil, and the submarine, due to its reserve buoyancy, will immediately rise to the surface, thereby becoming a helpless target for the guns or ram of an enemy warship having a greater surface speed than itself.

These motors receive their current from a large storage battery usually placed amidships, and on modern German submarines the starting gear is of a very special type, the peculiarity being that the starting rheostat has been entirely eliminated. Experience has shown that these rheostats, even when immersed in oil, are very unreliable. Further, they occupy a large space and are very heavy.

The starting switchgear adopted by the German Navy is shown on the accompanying diagram.

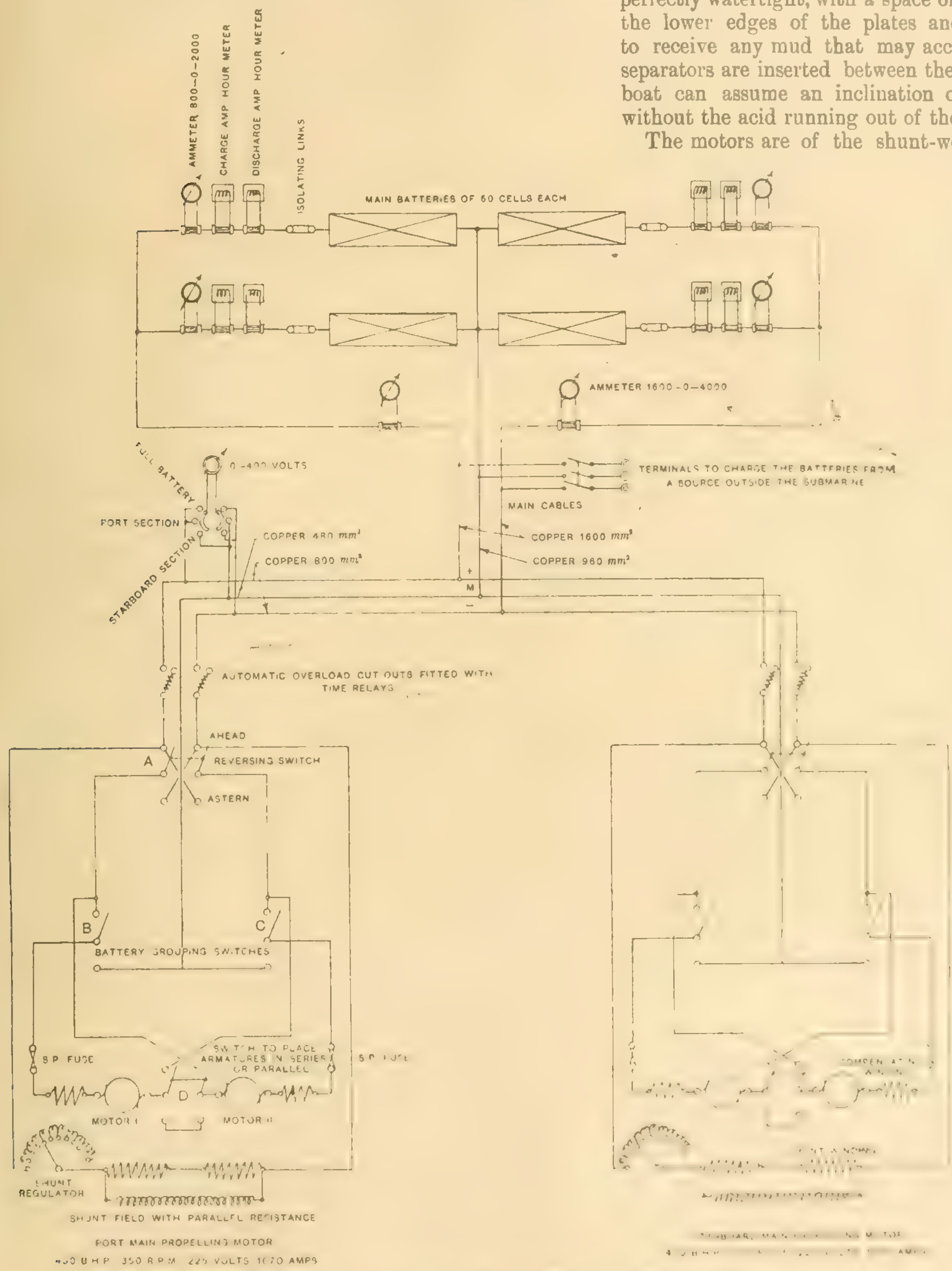

AMMETER 800–0–2000
CHARGE AMP HOUR METER
DISCHARGE AMP HOUR METER
ISOLATING LINKS
MAIN BATTERIES OF 60 CELLS EACH
AMMETER 1600–0–4000
FULL BATTERY
0–400 VOLTS
PORT SECTION
STARBOARD SECTION
COPPER 480 mm²
COPPER 800 mm²
TERMINALS TO CHARGE THE BATTERIES FROM A SOURCE OUTSIDE THE SUBMARINE
MAIN CABLES
COPPER 1600 mm²
COPPER 960 mm²
M
AUTOMATIC OVERLOAD CUT OUTS FITTED WITH TIME RELAYS
AHEAD
A
REVERSING SWITCH
ASTERN
B
C
BATTERY GROUPING SWITCHES
SWITCH TO PLACE ARMATURES IN SERIES OR PARALLEL
S P FUSE
D
MOTOR I
MOTOR II
SHUNT REGULATOR
SHUNT FIELD WITH PARALLEL RESISTANCE
PORT MAIN PROPELLING MOTOR
450 B H P 350 R P M 225 VOLTS 1070 AMPS

Diagram of Connections of Motor Starting Switchgear.

The battery consists of 4 units of 60 cells each, arranged in series-parallel, and any one unit can be cut out by means of the isolating links. The cells are of a special type designed to withstand repeated momentary shorts without appreciable damage. The individual plates are of lead, the positives being of the high surface type whilst the negatives are pasted. The containers are of special vulcanite and are perfectly watertight, with a space of 60 mm. allowed between the lower edges of the plates and the container-bottoms to receive any mud that may accumulate. Grooved wood separators are inserted between the individual plates. The boat can assume an inclination of 25° in any direction without the acid running out of the containers.

The motors are of the shunt-wound double-motor type, fitted with interpoles and compensating windings. Each main motor has two armatures mounted on the same shaft, with two distinct but equally proportioned fields of eight poles each, whereby each armature at full load exerts half the total output, viz., 225 B.H.P.

The shunt fields are arranged in series, with a non-inductive resistance in parallel to provide a shunt discharge path when the current in the fields is switched off. The whole is mounted together to form one complete unit.

The starting switchgear is of the open type, and consists of quick-breaking change-over knife switches with auxiliary breaking-contacts, the whole being mounted on slate base-plates secured to angle-iron frames, with the connections taken off at the back.

The cables are lead-covered and armoured with interwoven flexible galvanised-steel wires.

Starting for the "Ahead" position is effected as follows:—

1. Switch A is moved up, switch D down, and the automatic overload cut-outs are inserted, when a current is immediately sent through the shunt windings. It is thus impossible to start up the motors on an open field.

2. Switch B is placed up and switch C down, when a very heavy impulse current, about 1,000 amperes, is sent through the two armatures in series, which at once commence to revolve. As this heavy current is only momentary, the time limits, which are set for about 3 seconds, prevent the cut-outs from operating.

3. By means of the shunt regulator the speed is increased to the utmost, when the shunt resistance is quickly cut out

and switch C placed up, whereby the armatures are in series across the full battery pressure.

4. By means of the shunt regulator the speed is again increased to the utmost, the shunt resistance quickly cut out and switch D moved up, thus placing the armatures in parallel across the full battery pressure.

The speed can now be adjusted at will by means of the shunt regulator. With this arrangement continuous regulation from 80 up to 350 R.P.M. is possible.

To reverse, switches A, B, C and D are opened, A is placed down and the other switchings are carried out as above.

As the time limits are set to operate at about 3 seconds the cut-outs are fully effective on a prolonged overload, but as an additional safeguard single-pole fuses are placed in the armature circuits.

This switchgear is usually placed in the boat as near the main motors as possible, and is provided with the necessary number of ammeters and ampere-hour meters of the mercury-motor type, to enable the officer in charge to read off the condition of the battery-units and, incidentally, to check their efficiencies.

The battery can only be charged when the boat is on the surface, the motors being driven as dynamos by the oil engines, but special terminals are provided to enable the battery to be charged with its sections in series or parallel from a source outside of the submarine, such as the parent boat or dockyard plant.

The capacity of the battery is so rated as to enable the main motors to give their full outputs for 1½ hours, thereby imparting to the boat a submerged speed of about 10 knots.

NOTES.

The Engineering Institutions' Volunteer Training Corps.—A meeting was held at the Institution of Electrical Engineers, on Thursday last week, to inaugurate the Engineering Institutions' Volunteer Training Corps, the formation of which was foreshadowed in these columns recently. Sir John Snell, President I.E.E., occupied the chair, and there was a good attendance.

The President announced that the Corps had been formed at the request of General Sir O'Moore Creagh, V.C., military adviser to the Central Association of Volunteer Training Corps, who had nominated Col. C. B. Clay, V.D., as Commandant, and he referred to the presence at the table of Mr. H. C. Gunton, Power Engineer to the Post Office and Commandant of the Post Office Engineering Volunteer Training Corps, and engineering adviser to the Central Association, whose experience in Territorial and Volunteer organisation would be valuable to them. He hoped the I.E E. would form a nucleus which members of other Engineering Institutions would join: when the London unit had been organised, it was hoped that the Local Sections would form similar units in their respective areas. The Corps would have the cordial sympathy and support of the Council of the Institution, and it might be possible to contribute to its equipment from the Institution funds, should that be found necessary.

Col. Clay proposed that Sir John Snell, who had already done a great deal for the Corps, should be invited to become its Hon. Commandant, and this proposal having been heartily endorsed by the meeting, Sir John said he had great pleasure in accepting the appointment. He then vacated the chair, and Col. Clay read a letter from General Sir O'Moore Creagh, who, after expressing his pleasure on the acceptance by Col. Clay of the position of Commandant of the Corps, said:—

"The formation of engineering units is of the greatest importance if the Volunteer organisation is to be satisfactorily completed, and the members of your unit should be eminently suitable for carrying out work corresponding to the several branches of the work of the Royal Engineers. I understand that in addition to Telegraph, Telephone and Searchlight Detachments, you propose to furnish detachments that can manipulate emergency lighting sets, and also detachments that would be prepared to undertake emergency work in power stations in case of damage by bombs or other causes. I consider that the number of engineers who could be usefully employed on work of this nature is practically unlimited, and would be of the greatest service." Col. Clay proceeded to express his indebtedness to the assistance of Mr. Gunton, and read a letter received by the latter from Birmingham, describing the work that was being done by the Birmingham Electrical Volunteer Force, of which particulars were given in our issue of March 5th, 1915, p. 341. He stated that it was not proposed to limit membership to the engineering societies. Mr. Gunton had offered them the use of the Inns of Court Hotel for drill purposes, and, with his adjutant, Mr. G. F. Preston, would provide them with instructors from the Post Office Corps. Other places where they might drill were mentioned, including the Headquarters of the London Electrical Engineers (Territorials), where Col. Le Rossignol had kindly offered to afford them facilities.

Members of other volunteer corps could join by arrangement with their commandants for transfer, and it was thought that special constables might be able to join the corps. He regretted that as no form of attestation was permitted by the War Office, they could not share the work of the Regulars at present. An entrance fee of 5s. and a subscription of 5s. a quarter were suggested; the uniform would cost about 30s. They must begin with squad drill and company drill, and flag signalling; their technical work would embrace telegraphs and telephones, searchlights, trench work, wire entanglements, mining, temporary lighting, and, perhaps, wireless telegraphy. They might also be employed in semi-military functions, such as lighting camps, &c.

Mr. Gunton pointed out that in the early days the assistance of the Post Office Corps might be very useful to the new body, the former having obtained the loan of telegraphic apparatus and tools. It was important that eligible men who were not permitted to enlist should nevertheless be trained, ready to enter the Royal Engineers in a semi-trained condition in case of need. In his opinion the Volunteer movement encouraged recruiting for the Army, and there was plenty of scope for the corps.

Many questions were asked and answered, and it was agreed to commence drill on Wednesday next week, at 6.30 p.m. Saturday afternoons will also be taken, and other days will be arranged for as required. The meeting concluded with a hearty vote of thanks to Sir John Snell, Col. Clay, and Mr. Gunton for their work in forming the corps.

It was suggested during the meeting that many engineering firms would be glad of the opportunity to assist in equipping the corps with apparatus, and arrangements will be made to this end.

We are informed that drills will be held on Mondays, Wednesdays and Fridays at the Headquarters of the London Electrical Engineers, 46, Regency Street, S.W., starting on Wednesday, June 2nd.

Australia and Preference.—At a meeting held in April at Melbourne by the Victorian Chamber of Manufactures a communication was received from the Western Australian chamber asking for the views of the Victorian Chamber regarding the following recommendation from the New South Wales Chamber:—"That this Council heartily approves of the extended preference to the Mother Country given in the latest tariff, and urges upon the Federal Government the desirability of the Commonwealth also comprising trade reciprocity with the Dominions, and a fixed minimum surcharge of 25 per cent. for ten years upon all goods made in Germany. That the foregoing resolution be forwarded to the Associated Chamber of Manufactures of Australia for submission to the Federal Government."

According to the *Melbourne Age* the executive of the associated chambers was to consider the question contained in the New South Wales recommendations a few days later. The executive of the Victorian Chamber, together with the executive of the New South Wales Chamber, took steps at the beginning of this year to urge action somewhat in the direction indicated.

We are indebted for the foregoing information to an esteemed electrical correspondent in Victoria who is anxious that we should be kept informed in this country respecting the growing feeling in the different Australian States regarding the need for a prohibitive duty against German manufactures.

Heavy Mechanical Road Traffic.—The Departmental Committee recently appointed by the President of the Local Government Board to consider the law and regulations relating to the construction and use of road locomotives and heavy motor-cars in Great Britain has commenced to take evidence. Communications should be addressed to the Secretary of the Committee, Mr. R. J. Simpson, Local Government Board, Whitehall.

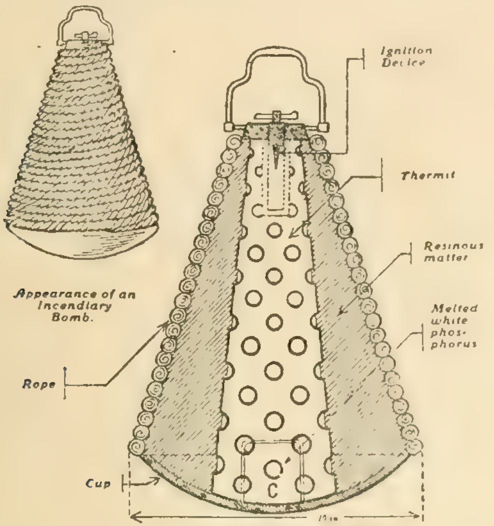
Industrial Electric Heating.—An Industrial Electric Heating Association has been formed at Toledo, U.S.A. Our American namesake quotes the following preamble to the constitution, showing the aims of the organisation:—"Recognising the opening of a new and heretofore undeveloped field in the electrical industry, the importance of which, and the possibilities for the development of which, are so great, and the present knowledge so small, it seems imperative that an organisation should be perfected to study and gather together all the available information on this great subject for the benefit of its members and of the industry at large and for the exchange of ideas and data."

Electric Light and Fans in German Trenches.—The *Times* special correspondent in Northern France states that the trenches taken from the enemy east of La Quinque Rue and Rue d'Ouvert were fitted with electric light and fans, and with mechanism worked by electric power for draining them. "The necessary power was obtained from electric plant at the coal-mines in the La Bassée area. In one trench our men profited for several hours by the electric light, but eventually the enemy severed the wires and so cut off the current."

Removal of Rust.—In a paper read before the Iron and Steel Institute at the recent annual meeting, Messrs. J. N. Friend and C. W. Marshall described experiments on the quantitative removal of rust from iron by chemical reagents. Various solutions were tried, but none was found that would remove rust without also dissolving some of the iron. One of the best reagents, acting quickly on the rust but very slowly on the iron, was boric acid; a saturated solution cleaned rusty plates in a day or two, after which very little loss in weight of iron occurred. A 10 per cent. solution of aluminium sulphate cleaned the iron in 24 hours and yielded an excellent metallic surface. Sodium citrate, which had often been recommended, acted very slowly, a 20 per cent. solution taking four days to clean the iron; it gave a beautiful surface, but the iron continued to dissolve during the whole period of immersion.

Air Raids and Fire Prevention. — An excellent "Warning" leaflet, No. 17A, has been issued to the public by the British Fire Prevention Committee, containing a description of the bombs used by enemy aircraft, and the best steps to take to deal with fires resulting from their use. Copies can be obtained from the Committee at 8, Waterloo Place, Pall Mall, S.W., on application. By kind permission of the Committee, we are enabled to reproduce a sectional drawing of the incendiary bombs, which, it will be seen, are exceedingly well calculated to ignite anything of an inflammable nature within their range.

The bomb, as a rule, is conical, corded round; the base is a flat cup, on which a pierced metal funnel is fitted, having the ignition device and handle attached at the top.



SECTION OF INCENDIARY BOMB.

The funnel is generally filled with thermit, which upon ignition generates intense heat, and by the time of the concussion, has taken the form of molten metal at a temperature of over 5,000° F. The molten metal is spread by the concussion.

Outside the funnel is a padding of a highly inflammable or resinous material, bound on with an inflammable form of rope. The resinous material creates a pungent smoke.

There is generally some melted white phosphorus in the bottom of the cup, which develops nauseous fumes, and in some cases celluloid chippings are added, and occasionally a small quantity of petrol.

The best means of combating the flames produced by these infernal devices is to apply a stream of water from a series of buckets or a hose—single buckets of water are of little use, and sand has not the necessary cooling effect. Damped respirators should be worn to prevent breathing the pungent fumes. Gas and electricity supplies should be cut off at once.

Explosive bombs seldom cause fires.

Institution and Lecture Notes. — Diesel Engine Users' Association.—At the May meeting of the Association, it was agreed that a member unable to attend a meeting on any particular occasion should be entitled to nominate a deputy to attend in his place. The question of a suitable allowance to be made for depreciation of Diesel engine plant in connection with income-tax assessment was discussed, and its further consideration was adjourned. The subject of lubrication of Diesel engines was further dealt with. Information on several interesting points had been received from many of the members of the Association, and it was decided to extend the time for sending in returns from other undertakings and to ask for further information in certain cases. These returns will then be tabulated and circulated among the members only. The next meeting of the Association is to be held on Wednesday, June 16th, when the question of cracked pistons will also come up for discussion.

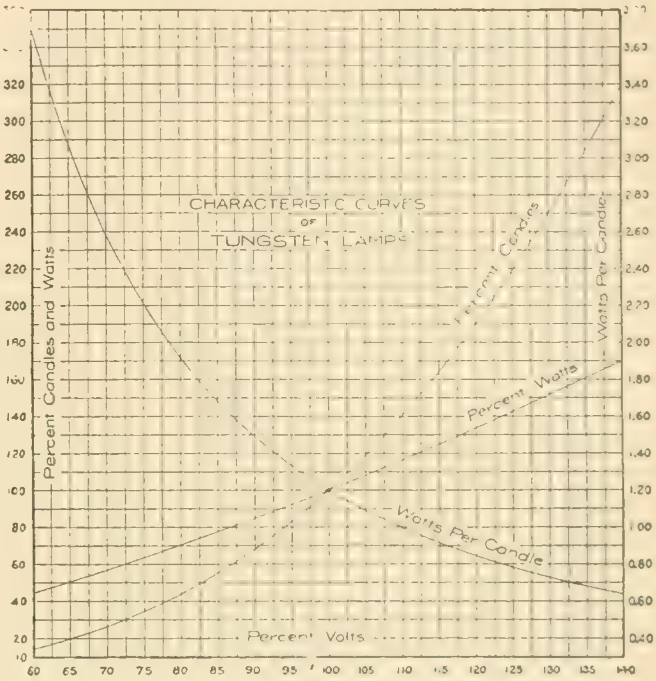
Institution of Electrical Engineers.—The annual general meeting of the YORKSHIRE LOCAL SECTION was held at Leeds, on May 12th; Mr. T. Roles occupied the chair. The annual balance-sheet and report were presented and adopted. The following officers and members of the Committee were elected for the ensuing year:—Chairman, Mr. H. Hodgson Wright (Halifax); Vice-Chairmen, Mr. H. A. Neville (Wakefield), and Mr. W. Lang (Leeds); Hon. Sec., Mr. Jno D. Bailie (Leeds); Committee, Messrs. R. H. Campion (Dewsbury), W. M. Selvey (Sheffield), C. J. Jewell (Wakefield), P. J. Pybus (Bradford), J. E. Storr (Leeds), and E. C. Wallis (Leeds).

The annual general meeting of the contributors to the I.E.E. Benevolent Fund was to be held yesterday to receive the report and statement of accounts for 1914.

Association of Mining Electrical Engineers.—At a meeting in Dunfermline of the East of Scotland branch, office-bearers were appointed as follows:—President, Mr. W. A. Wilkie, Cardenden; Vice-President, Mr. D. Beveridge, Kelty; Secretary and Treasurer, Mr. Robert W. Peters, Lochgelly. A discussion took place on the "Use and Abuse of Oils on Mining Plant and Bearings of Electrical Machinery."

Electrically-Driven U.S. Warship.—The *Journal of Commerce* (Liverpool) states that the General Electric Co., of New York, will, according to an official announcement, supply the electric propelling machinery for the new U.S. battleship *California* for £86,200. The *California* is under construction at New York Navy Yard, which submitted an estimate of £126,200 for a steam equipment.

Tungsten-Filament Lamp Characteristics.—One of the greatest difficulties in photometry arises from the differences in the colour of light from different sources, which cause the personal element to assume excessive importance, as no two observers agree exactly in their judgment as to when two colours viewed in the photometer are of equal intensity. Hence in accurate work it is necessary to average a large number of observations made by different persons in order to arrive at a reliable result. By varying the temperature of the filament of a standard tungsten lamp, it is possible to obtain a wide range of colours which can be matched with the colours of the lamps under test, and when the candle-power of the filament corresponding with each temperature has been determined, the process of comparison is greatly simplified.



CHARACTERISTIC CURVES OF TUNGSTEN LAMPS.

This subject has been investigated by Messrs. G. W. Middlekauff and J. F. Skogland, whose results are given in the Scientific Papers of the U.S. Bureau of Standards. The authors find that all vacuum tungsten lamps (100 to 130 volts), over a wide range of wattage, have the same voltage-current-candle-power characteristics, independently of the method of manufacture, and the relations between these three factors can all be accurately expressed by one general equation of the form $y = Ax^2 + Bx + C$, where x = log voltage, y = log candle-power, log wattage, log current, or log watts per candle, and A, B, C are constants, the values of which depend upon the significance of y. The equation expresses the voltage-candle-power and the voltage-watts per candle relations to well within 0·3 per cent., and the voltage-wattage relation to well within 0·05 per cent. of the observed values over the range from 0·7 to 3·3 watts per candle, the latter limit extending beyond the watts per candle corresponding to colour match with 4-watt carbon lamps. It is therefore possible, after carefully standardising a tungsten lamp at colour match with 4-watt carbon primary standards, to calculate with a high degree of precision its candle-power, voltage and current at any desired watts per candle or colour within the range above-mentioned. Thus all measurements can be made at colour match without the use of colour screens.

To avoid the necessity of making tedious calculations, the authors give tables which enable the change to be made from one efficiency to another with an ordinary slide rule. The characteristic curves of lamps of sizes 25 to 100 watts at 100-130 volts, taking normally 1·2 watts per candle, are shown in the accompanying figure.

Coal Supplies Conference. — As a result of the National Conference on Coal Supplies to Gas and Electricity Undertakings, a deputation attended before the Coal Exports Control Committee, on the 20th inst., and laid the views of the Conference before it. The deputation consisted of Sir Corbet Woodall, Past President of the Institution of Gas Engineers and Governor of the Gas Light and Coke Co., Sir John Snell, President of the Institution of Electrical Engineers, Alderman Phillips, chairman of the Salford Corporation Gas Committee, Alderman Kay, chairman of the Manchester Corporation Gas Committee, Mr. Frank Bailey, chief engineer of the City of London Electric Lighting Co., Ltd., Dr. Charles Carpenter, chairman of the South Metropolitan Gas Co., Bailie Smith, chairman of the Glasgow Corporation Electricity Committee, Mr. Reginald Neville, M.P., chairman of the Brentford Gas Co., Mr. Hanbury Thomas, managing director of the Sheffield Gas Co., Mr. J. S. Highfield, chief engineer of the Metropolitan Electric Supply Co., and Mr. D. Milne Watson, general manager of the Gas Light and Coke Co.

Educational Notes.—University of London.—The Senate last week resolved that the science department of Goldsmiths' College should be closed as from the end of the present session. It was also resolved that the East London College, previously admitted as a School of the University for limited periods, should be continued as a School of the University in the faculties of Arts, Science, and Engineering without further limitation of time.

Bristol University.—The Council has decided to commence the erection of new buildings, for which a total sum of £220,000 has been presented by Messrs. G. A. and H. H. Wills.

Manchester School of Technology.—Ten research scholarships in technology, value £80 to £50, with fees remitted, tenable during the session 1915-16, will be awarded on July 5th, 1915. Applications must be received by June 21st. Particulars can be obtained from the Registrar. The scholarships are open to graduates of any University in the British Empire, and to other persons possessing special qualifications for research.

Appointments Vacant.—Borough electrical engineer (£400) for West Hartlepool; charge engineer (30s.) for St. Albans Electricity Works. Particulars are given in our advertisement pages.

Fatality.—Sergt.-Major Thompson, 11th Welsh, at the Seaford camp, aged 35 years, who was, before he joined the Colours, in the clerical department of the Swansea electricity station, was returning to camp just before midnight recently when he was accidentally run over by a motor-car, receiving internal injuries from which he succumbed shortly afterwards.

Domestic Electric Service at Hendon.—In connection with their efforts to extend the domestic uses of electricity, the Hendon Electric Supply Co., Ltd. have arranged with Mrs. Maud Lancaster to give a series of demonstrations of various domestic electric appliances. The first of these demonstrations will take place on Tuesday next at St. Alban's Hall, Golder's Green. At 3.30 o'clock a lesson in cooking economical French dishes will be given by Mrs. E. Lewie, and it is after tea that Mrs. Lancaster will begin her explanations to ladies and their cooks.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Luton Electricity Committee proposes to raise the salary of Mr. R. Harding, chief clerk, from £120 to £130 per annum.

The Bexhill-on-Sea T.C. has appointed Mr. S. R. Burton, senior shift engineer, to succeed Mr. R. N. Smith (who has enlisted) as consumers' assistant, at £2 per week.

Tramway Officials.—Mr. F. Freshwater, manager of the Imperial Tramways Co., Ltd., Stockton-on-Tees, and his wife, have been presented by the staff with an inscribed solid silver tea and coffee service on the occasion of their silver wedding.

Mr. John Cameron, Jun., a son of Mr. John Cameron, manager and secretary of Blackpool and Fleetwood Tramroad Co., has been appointed manager of Northampton tramways at a commencing salary of £350 a year. For some years Mr. J. Cameron, jun., has been borough electrical engineer of Northampton.

General.—The *Times* states that the Trustees of Columbia University, in the City of New York, have awarded the Barnard Gold Medal to Prof. W. H. Bragg, F.R.S., Cavendish Professor of Physics in the University of Leeds, and his son, Mr. W. L. Bragg, Fellow of Trinity College, Cambridge, and a member of the College staff, at present holding a commission in the Leicestershire R.H.A. (T.F.), for their works on X-rays and crystals.

The Albert Medal of the Royal Society of Arts for the current year has been awarded to Prof. Sir J. J. Thomson, O.M., D.Sc., LL.D., F.R.S., for his researches in physics and chemistry, and their application to the advancement of Arts, Manufactures, and Commerce.

Mr. H. R. P. Gibbs, late chief electrical engineer in Mysore, and now the scientific head of the Tata hydro-electric scheme, has been appointed consulting electrical engineer to the Government of Mysore, the position of chief engineer being still in the hands of Mr. S. G. Forbes.—*Indian Engineering.*

Mr. Alexander Mackenzie has been appointed president of the Brazilian Traction, Light and Power Co., and its allied companies, to fill the vacancy caused by the death of Dr. F. S. Pearson through the *Lusitania* disaster. Mr. Mackenzie has been closely associated with the Rio de Janeiro Tramway, Light and Power Co. and the Sao Paulo Tramway, Light and Power Co. from their inception, and for many years acted as general and legal representative of the companies in Brazil.

The Prime Minister has written to Sir Edgar Speyer, informing him that the King is not prepared to accept his resignation of the marks of distinction received in recognition of public services and philanthropic munificence. Mr. Asquith says he has known Sir Edgar long and well enough to estimate at their true value the "baseless and malignant imputations" upon his loyalty to the British Crown. Sir Edgar left Liverpool on Wednesday to spend a brief holiday in the States.

The *Electrical Review and Western Electrician* states that Mr. Thomas A. Edison has been voted the American who has done the most to benefit mankind, and is to receive the Civic Forum Medal of Honour for distinguished public service. The medal, which was established to give recognition upon the part of the rank and file of the American people to that one of their countrymen who in ways of peace performed some signal public service, was first awarded last year, Colonel George W. Goethals being the recipient.

Obituary.—Reuter's Paris correspondent announces the death of M. Pierre Martin, the inventor of the Siemens-Martin process of manufacturing steel. The Iron and Steel Institute conferred the Bessemer Gold Medal upon M. Martin last May.

M. Georges Dary.—We regret to record the death of M. Georges Dary, who was for many years associated with our contemporary *L'Electricien*, of Paris, which has not yet been able to resume publication owing to the absence of M. Montpellier, the proprietors, and all the staff on military service. M. Dary, who has been an occasional, but valued, contributor of the Electrical Review in recent years, underwent an operation a short time ago at Toulouse. It was his intention, immediately after recovery, to place before our readers his views regarding the future prospects for electrical industry in France, but, unfortunately, it has been willed otherwise. He had two sons serving with the French Forces, one of whom was, we believe, taken prisoner some months ago. M. Dary's sentiments were always most cordial towards this country, and he believed most completely in the ultimate crushing of the enemy by the Allies. We tender to the family our sincere sympathy in the great loss that they have sustained.

NEW COMPANIES REGISTERED.

Highfield Syndicate, Ltd. (140,408).—This company was registered on May 20th, with a capital of £5,000 in 4,875 cumulative preferred ordinary shares of £1 each and 5,000 deferred ordinary shares of 6d. each, to adopt an agreement with F. W. Highfield, to develop and turn to account the patents referred to therein, to carry on the business of precipitating or condensing dust, metallic or other particles, fume vapours, and volatilisation products, electric and general smelting and refining, etc. The subscribers (with one preferred ordinary share each) are: F. H. Haviland, Thurnham, Lowther Road, Bournemouth, solicitor; W. A. Maslom, 15, Old Christchurch Road, Bournemouth, solicitor. Private company. The number of directors is not to be less than two or more than seven; the first are F. H. Haviland and F. W. Highfield. Qualification, £100 preferred ordinary or £2 10s. deferred ordinary shares. Solicitor: W. A. Maslom, 15, Old Christchurch Road, Bournemouth.

Ecco Battery, Co., Ltd. (140,389).—This company was registered on May 19th, with a capital of £12,000 in £1 shares, to adopt an agreement with T. Hill Jones for the acquisition of the property referred to therein, to carry on the business of electrical engineers, agents, factors, warehousemen, manufacturers, dealers, importers and exporters, etc. The subscribers (with one share each) are: M. Wolff, 19 & 21, Fore Street Avenue, E.C., merchant; A. J. Mardlen, 84, Milton Street, E.C., merchant. Private company. The number of directors is not to be less than three or more than six; the first are M. Wolff, A. J. Mardlen, M. H. Goldstone, T. H. Jones, T. M. Jones, and T. A. Tayler (all permanent). Qualification, 500 shares. Remuneration, £50 each per annum. Registered office: Invicta Works, Bow Common Lane, E.

General Cable Manufacturing Co., Ltd. (140,379).—This company was registered on May 18th, with a capital of £6,000 in £1 shares, to carry on the business of cable manufacturers' merchants, factors, dealers, agents, purchasers and vendors, in England and elsewhere, etc. The subscribers (with one share each) are: Hans Ochsenbein, 15, Garlick Hill, E.C., cable merchant; J. Wright, 2, Wood's Villas, Swanley, Kent, engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. Wright and G. E. Pullen. Qualification, £5. Remuneration of chairman, £10 per annum; of others, £5 each per annum. Solicitors: Sparks, Whitehouse, Russell & Co., 32, Walbrook, E.C.

Anglo-Chinese Engineers' Association, Ltd. (140,361).—Registered May 17th, by Stileman & Co., 110, Leadenhall Street, E.C. Capital £53,750 in 5,000 six per cent. cumulative preference shares of £10 and 75,000 deferred shares of 1s. each. Objects: to carry on in China or elsewhere the business of ironfounders, mechanical engineers, manufacturers of agricultural instruments and other machinery, tool makers, metal workers, boiler makers, millwrights, machinists, iron and steel converters, smiths, builders, metallurgists, electrical and water supply engineers, gas makers, agents, merchants, shipowners, carriers, manufacturers of and dealers in machinery, implements, rolling stock, and hardware of all kinds, etc., and to adopt agreements with A. J. Moore-Bennett. The signatories (with one deferred share each) are: S. Denison, Hunslet Foundry, Leeds, engineer; A. J. Moore-Bennett, St. Winifred's, Lordship Lane, S.E., consulting engineer. Private company. The first directors (to number not less than two or more than 12) are A. J. Moore-Bennett, J. Davis (Rose, Downs & Thompson, Ltd.), Hull; S. Denison, H. J. Ward, 10, St. Swithin's Lane, E.C., and W. W. Gibbs (Gwynnes, Ltd.), Hammersmith Iron Works, Hammersmith, W. No qualification necessary. Remuneration (except managing director) as fixed by the company. Registered office: 9 & 10, Pancras Lane, E.C.

Holme Electric Co., Ltd. (140,393).—This company was registered on May 19th, with a capital of £1,000 in £1 shares, to carry on at Holme and elsewhere in the West Riding of Yorkshire the business of an electric light company in all its branches. No share shall be allotted or transferred to a person who is not either (1) a ratepayer of the Urban District of Holme, or (2) a resident within the said district, or (3) an owner of property within such district. The subscribers (with one share each) are: C. Tinker, Lane Head, Holme, near Holmfirth, manufacturer; H. Howard, Lane Head, Holme, near Holmfirth, farmer; A. Howard, Lane Head, Holme, near Holmfirth, surveyor; H. Batty, Lane Head, Holme, near Holmfirth, teamer; J. Batty, Lane Head, Holme, near Holmfirth, farmer; P. Haigh, Lane Head, Holme, near Holmfirth, warper; Hubert Hadfield, Lane Head, Holme, near Holmfirth, farmer. Minimum cash subscription, £800. The first directors are: C. Tinker, H. Howard, C. Beardsell, Harry Hatfield, and R. Calvert. Registered office: Council Offices, Holme, near Huddersfield.

Halliwell and Co., Ltd. (140,421).—This company was registered on May 21st, with a capital of £2,000 in £1 shares, to carry on the [illegible], [illegible] workers of [illegible]. The subscribers (with one share each) are: H. Halliwell, Hill Crest, Singleton Road, Kersal, Manchester, engineer; J. R. Halliwell, 3, Moss Bank Road, Crumpsall, near Manchester, electrical engineer. Private company. H. Halliwell is permanent [illegible]. Qualification, £100. Registered office: 43, Thomas Street, [illegible].

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Foster and Pullen, Ltd.—First mortgage debenture, dated May 8th, 1915, to secure £500, charged on company's undertaking and property, present and future, including uncalled capital, registered. Holder: G. Grange, 12, Guy's Cliffe, Undercliffe Lane, Bradford. A memorandum of satisfaction in full on May 4th, 1915, of first mortgage debenture dated May 4th, 1910, securing £500, has also been notified.

Coast Development Corporation, Ltd.—Second mortgage, dated May 3rd, 1915, to secure £3,000, charged on the electric lighting station, Walton-on-the-Naze, and goodwill of business carried on there. Holders: Sir Thomas S. Cave, K.C.B., Kilworth, Woking, and others.

Wycombe Borough Electric Light and Power Co., Ltd. (53,133).—Capital, £50,000 in £5 shares. Return dated March 24th, 1915. 8,000 shares taken up; £40,000 paid. Mortgages and charges, £40,000.

Brilliant Sign Co. (1907), Ltd.—Charge on certain book debts due from debtors in Belgium, dated May 6th, 1915, to secure £1,000. Holders: Capital & Counties Bank, Ltd., 39, Threadneedle Street, E.C.

Universal Cheap Cables, Ltd.—Mortgage, dated May 10th, 1915, to secure £50, charged on certain freehold land at Norman's Bay, Sussex. Holder: O. N. Lake, 219, Tufnell Park Road, N.

British Battery Co., Ltd. (137,905).—Debenture, dated May 17th, 1915, to secure £700, charged on the company's undertaking and property, present and future. Holders: A. H. Rose and T. A. Rose, 39, Beech Street, Barbican, E.C.

CITY NOTES.

Callender's Cable and Construction Co., Ltd.

Mr. T. O. Callender (managing director) presided at the annual meeting, held on May 20th, at Hamilton House. He first apologised for the absence of Sir Fortescue Flannery (Chairman) through illness. The capital expenditure was £14,624, against £16,119 last year. It had not been necessary to spend so much as in 1913, but still they had to make some fairly considerable extensions at the factory. On the other hand, they had slightly raised the depreciation, which now stood at £9,967, as against £8,900 in the previous year. Cable drums, contract plant, etc., stood at £40,443. They had found it necessary to modify in some respects the arrangement of their accounts, owing to the large amount of contract plant which they had to purchase in connection with the important telephone contract which they secured from the Government. Last year the item stood at £21,097. Goodwill and patents were nil, as the item had been entirely written off. The stocks of raw material were £44,811, or £22,000 down as compared with the previous year. They had been able to dispose in the ordinary course of their business of some of the stocks they had, although they would gladly, if possible, have increased certain of the items which, owing to the war, they could not get, and this during the early part of the present year caused them some inconvenience. It was common knowledge that owing to transport and other difficulties and the requirements of the Government metals, and especially copper, had been exceedingly difficult to obtain, and practically all of the reduction in the stock of raw materials was due to the inability to get the materials as promptly as they wished. That position was now improved, although railway and sea transport was still being carried on with the greatest possible difficulty. On the other hand, manufactured stock had considerably increased, and now stood at £101,145, against £68,307 in the previous year, or an increase of £32,000. That was due, again, considerably to the difficulty of transport, for it happened that at the moment the balance was struck they had a lot of stuff awaiting shipment, and the increase had long since been fully disposed of. If they put the two items or raw materials and manufactured goods together, which was a fair way of looking at it, the total was £145,956, against £135,834 in the previous year, or a difference of only £10,000. The expenditure on contracts in course of execution, etc., was £72,325, as against £137,146 last year, but this was no more than they expected, for at the end of last year, when their books closed, no new contracts were being placed, and they were simply working out the large contracts they had then in hand. So far as contract business was concerned, it was quite evident that owing to the war and the restrictions imposed on municipalities by the Treasury that there could not be the same amount of contract business for electric mains in 1915 or in the latter part of 1914 as there was in previous years. Therefore, the reduction in their contracts, although they were sorry to see it, was no more than they could have expected, and was, indeed, much less than might have been anticipated. Their debtors were £265,572, as against £219,000, an increase of £45,000. That probably might fairly be set against the decrease in the contract work, because the amount of business they did in 1914 compared most favourably with that of the previous year, both in volume and profit, in spite of the war. In fact the profit figures were conclusive evidence that they must have done a much larger business than in the past, which really was the case. Their retention money, which was always a large item in the balance sheet, was £105,940, against £80,190, but as nearly the whole of the increase was owing by the Government they need have no misgivings. During the latter part of the year, when they had the greatest possible anxieties as to the way their business might be carried on, they found a surprising amount of assistance from the municipalities and Government in the prompt way in which accounts were settled. In August they were in great anxiety as to what the outcome of the situation would be, but they had surmounted these difficulties, and, like other people in the country, had come wonderfully well out of it. It was only right, however, that he should testify to the loyal assistance they had had from customers on their books, many of whom had been their friends and had stood by them ever since the company started in business. On the other side of the balance sheet, many of the figures were practically identical with those of last year. Bills payable, however, were £96,360, against £150,405; but on the other hand their creditors were £214,694, against £166,519. Taking the two figures together, they were much the same as in 1913. Turning to the profit and loss account, they had to deal with the handsome sum of £162,254, which, considering the state of affairs, was a very reasonable profit for the company to have made. It compared with £159,234, or an increase of £3,020. The Chairman went on to explain that the item was arrived at in rather a different way to that of previous years, and the sum shown as profit would have been a good deal more had they followed the usual custom. The £162,254 was profit after certain commission had been deducted for 1914, which was not the case in 1913. The item of £867 for allowances to staff on active service by no means represented what would be their contribution in the current year, and they still had men leaving the company's service to join the Forces. None of them would, however, grudge for one moment such contributions. No fewer than 300 of the staff and of the permanent men had joined the Colours, and, in addition, a large number of men who were in the company's service at the outbreak of war, but who were not in permanent service, had also joined. In all, between 600 and 700 men who were with Callender's on August 4th had gone. That drain had, of course, been serious and caused them inconvenience, but they could hardly object to it under the circumstances. They had always considered it their duty to employ as many Naval Reserve men as possible, and they required handy and reliable men who knew what discipline was; and, of course, when war broke out they melted away like snow. Repairs and maintenance of plant and buildings amounted to £14,204. A considerable part of that upkeep was really in the way of depreciation, because when any of their plant became old-fashioned they simply dealt with it straight away. The net profit was £98,692, as against £91,861. They saw no reason for altering their policy of carrying forward substantial sums, especially in these times of serious trouble. The result had only been arrived at after a good deal of trouble and worry. At first none of them knew where they would be, and they had to grope along for some months, and they were only now getting their business into proper order. The amount of business generally in the company decreased in 1915, but not to the extent that they might reasonably have expected. The large telephone contract on which they had been engaged had been suspended, but they hoped on the conclusion of war it would be renewed with much new work in addition. The re-arrangements necessary owing to the war had been done with all possible expedition, but it was not easy to take a factory designed for economically manufacturing cables and turning it into use for something else. They had a large engineering business in addition, and they had been able to take work offered to them by the Army and Navy, and especially by the Navy, with whom they had always been in close touch. They had done considerable work for the Admiralty, and it was a great satisfaction for them to know that in several of the serious operations which had taken place their work had been reported on, and they had every reason to be satisfied with the outcome of it. The Chairman proceeded to speak in eulogistic terms of the work of the British Navy, and remarked that the work they were now carrying out necessarily could not be so profitable as that which they dealt with in the ordinary course of business. Still, they would look after the interests of the shareholders to every extent which was proper and right, and he hoped they would not be unduly depressed when they came before them with the [illegible] year's accounts.

Mr. J. [illegible] seconded the motion, and the report was adopted without discussion.

On the motion of Mr. J. Stewart [illegible] a hearty vote of thanks was passed to the board and staff.

Mexico Tramways and Electric Companies.

Circulars have been issued to the bondholders and shareholders of the Mexico Tramways Co., the Mexican Light and Power Co., Ltd., the Mexican Electric Light Co., Ltd., and the Pachuca Light and Power Co. by the president explaining the position of [illegible]. As [illegible] the circulars state that since the date of the issue of the last annual reports of the companies the financial and political conditions in Mexico have [illegible]. At the present time the [illegible] of the country [illegible] and practically all business is at a standstill. The directors and [illegible] tion and used every possible endeavour to protect the shareholders' interests. As the affairs have reached a climax and the control of the tramways has been taken out of their har is, they desire to lay the position fully before them. The existing situation does not arise from a financial weakness on the part of any of the companies. They have all had a prosperous existence from their inception, and, but for the political interference, there is no reason to believe that they would not still be earning not only the interest on their bonds, but satisfactory dividends for the shareholders. The credit of Mexico has steadily fallen. Power has been held now by one faction, now by another, and each new authority has issued large amounts of paper money, with the result that the value of the currency has depreciated, so that at the present time the rate of exchange is not more than 5d. to the peso, instead of 25d., the normal rate. As millions of paper pesos are already in circulation—and the amount is likely to increase rapidly—a still further drop in exchange may be expected. The Tramways Co., however, was obliged to accept this paper currency for fares, with the result that a large proportion of the gross receipts was useless for buying exchange on London and Toronto for the purpose of paying coupons or purchasing materials for maintenance and current operation. It is now practically impossible to communicate (except with great delay) with the officials of the company in Mexico, but the latest information received states that when Carranza's representative was recently driven from the City of Mexico by Zapata he took with him the "controllers" off the cars, thereby rendering them unfit for service. As a result, all traffic has ceased. The board have made numerous protests to the authorities in Mexico, and have repeatedly filed protests against the actions of the Mexican leaders through the representatives of the British Government in Mexico, the Department of the Secretary of State in Washington, and the Foreign Office in London. The authorities have not up to the present taken over the control of the businesses of the Mexican Light and Power Co., Ltd., the Mexican Electric Light Co., Ltd., or the Pachuca Light and Power Co., and the physical condition of the properties of these companies has been very little injured. It has been necessary, however, to grant a large increase in wages, with a consequent decrease in net revenue, and as the income of the businesses is largely received in paper, there is practically no available surplus after providing for the maintenance which is absolutely necessary to keep the businesses in operation. The board at the present time are conferring with the trustees for the bondholders as to what further steps, if any, should be taken to protect the bondholders' interests. The board feel, however, that the future of the enterprises must necessarily depend upon the development of the political conditions in Mexico and the future attitude of the United States Government towards that country.

Kalgoorlie Electric Power & Lighting Corporation, Ltd.

Mr. E. Pope, presiding at the annual meeting, held on Tuesday, said that the general business of the company had been maintained throughout the year, and the result was well up to the average of previous years. There was some alteration in the items of the balance sheet—the reserve established for depreciation and renewals having been written off. This fund had been used chiefly for purchasing new up-to-date plant to take the place of the original plant. The old plant had been, and was being, maintained in efficient running order, and formed a valuable stand-by plant; but owing to the progress in engineering practice it was somewhat out of date and could not be operated at a cost low enough to yield a satisfactory profit on the price at which they now had to sell current. It had, therefore, depreciated in value, and it had become advisable to write off the fund for depreciation and renewals, the cost of the plant. Out of the profit for the year £7,000 had been set aside for the redemption of debentures. As some holders might have been compelled to realise, and possibly, owing to the war, there might not have been much market, they decided to protect the holders as far as possible by buying for the company if debentures were offered. With part of the money reserved for the redemption of debentures they had subscribed for £5,000 of the war loan. There would be some increase of their operating costs during the current year, but they had reason to think that in the final result they would nearly, if not quite, maintain their average moderate profit. So far as the year had gone, they had done a little better than in the corresponding period of last year. Some of their contracts had been recently renewed, and the aggregate of current sold showed but little variation. As they knew, a great deal of the engineering capacity of the country was engaged on Government work, and whilst the war lasted they might at any time, if they had a breakdown, find it impossible to get a supply of new plant, or even of material. Fortunately, they had a fairly large stock of spare parts and supplies. Still, any breakdown, even on a moderate scale, might necessitate running their stand-by plant for a considerable time, and this would seriously reduce their profit. This was a risk they could not altogether avoid. They could congratulate themselves that the scene of their operations was outside the area of actual conflict, and that their loss was not likely to be great. At their last meeting they discussed the project of conserving all cash possible for the purpose of paying off the existing debentures, and that for this purpose they should pay the preference shareholders their full dividend in second debenture bonds, bearing 6 per cent. interest. They had come to the conclusion that it was better to go on as they were for the present. They were of opinion that the debentures would be handled and dealt with fairly equitably and to the satisfaction of the holders when the time came. No debenture holder need fear for either his interest or his capital. The Kalgoorlie goldfield, upon the life of which they depended, would be operated at a profit long after the last of their existing debentures were paid off. In conclusion, the Chairman expressed the satisfaction of the board at the services of Mr. Crocker, their general manager, and the staff he controlled; of Mr. Batley, who represented Messrs. J. G. White & Co., their consulting engineers; and of the secretary, Mr. H. J. Dixon.

Mr. G. C. Howard seconded the motion, and the report was adopted.

Companies Struck Off the Register.—The following companies have been struck off the Register and are accordingly dissolved:—

Alkaline Accumulators (Paul Gouin).
Anglo-Brazilian Power and Shipping Corporation.
Beam Co. (British Electrical and Mechanical Co.).
Blast-Furnace Power Syndicate.
Coal Substitute.
County Electric Traction Co.
Electric Batteries and Carbons.
Leeds Electric Co.
Schoenfeld Universal Oil Filter Co.
Southwold Electricity Works.
Witney Electric Supply Co.

Cuban Telephone Co.—The gross income from rentals and miscellaneous sources aggregated over $1,200,000 during 1914, and after deducting all costs of operation, taxes and general expenses, and providing ample depreciation reserves, the net balance of operating income amounted to over $559,000. The company paid during the year two quarterly dividends on preferred stock, totalling $60,000, and one quarterly dividend on common stock, amounting to $62,500. Nearly $700,000 of the accumulated net cash surplus has been used for the purpose of carrying on construction work. The general financial stringency has made impracticable the further placing of securities, hence the action of the directors in not declaring the dividends which have been earned.—*Financial Times.*

Anderston Foundry Co., Ltd.—The accounts for the year to March 31st show that £5,321 was brought in, and the profit, after providing for depreciation and income-tax, was £30,707 (against £40,984). It is now recommended that there should be paid a final dividend of 15s. 6d. per share (making 20s. per share for the year), less tax, the same as for the previous year. £2,500 is placed to reserve.—*Times.*

Stratford-on-Avon Electricity Co., Ltd.—Mr. G. M. Bird presided at the annual meeting held on the 14th inst. He regretted that it had been necessary to pass the dividend on this occasion. They had hoped to steadily progress until 5 or 6 per cent. was paid, but the year had brought a set-back. There were advances in fuel and wages, and several breakdowns on the mains which occasioned considerable expenditure for repairs, though other repairs and maintenance charges were reduced. He did not think there would be a big advance in anthracite coal. Unfortunately they could not increase the price of electricity, as their agreement with the Corporation bound them not to exceed 5d. per unit for lighting. The Corporation had increased the price of gas by 4d per 1,000, and they might be disposed to allow the company to advance their rate per unit, and if it was found that the present price could not be made to pay they might approach the Corporation. Mr. Priest seconded the adoption of the report.

Doulton & Co., Ltd.—A financial daily states that after paying 5 per cent. on the preference shares for the year ended December, 1912, £31,626 is to be carried forward.

Veritys, Ltd.—The directors, according to the *Financial Times*, recommend a dividend at the rate of 6 per cent. per annum on the ordinary shares for the half-year, making 6 per cent. for the year, carrying £1,001 forward.

Havana Electric Railway, Light and Power Co.—The accounts show the business for 1914 in comparison with 1913 was as follows:—Gross earnings, $5,396,713, against $5,417 054; operating expenses and taxes, $2,595,321, against $2,612 952; net income, $2,801,392, against $2,804,101. Dividends paid during the year, 6 per cent. on preferred and 5 per cent. on common stock.

Lima Light, Power and Tramways Co.—The report states that the net profit for 1914 was £p120,259. There is to be put to reserve and redemption fund, £p28,867; to reserve for bad and doubtful debts, £p10,000; to extraordinary repairs, £p16 814; to provision for losses in exchange, £p7,000; and the dividend 1 per cent. (in respect of the first quarter of 1914, since when no dividend has been paid), £p13,498; leaving £p50,077 to carry forward.

United River Plate Telephone Co., Ltd.—The gross earnings for 1914 were £630,652, less maintenance and other charges in Argentina and London, £468,846. After paying the preference dividend and the interim dividend on the ordinary shares, there remains £103,206, plus £6 357 brought forward; £2,000 is to be put to staff provident fund, £20,000 to reserve, and a final dividend of 5 per cent. on the ordinary shares, making 8 per cent. for the year, is recommended, leaving £6,563 to be carried forward. The directors refer with regret to the death of Mr. D. Smith, for many years secretary and latterly managing director. Annual meeting held yesterday.

Anglo-Argentine Tramways Co., Ltd.

For the year 1914 the gross receipts were £2,850,995, less working expenses £1,880,996, leaving £969,999. After adding interest on investments at £13,421 brought forward, and deducting debenture, loan, and preference interest and charges, £917,388, there remains £96,409, which is to be carried forward as, having regard to the decrease in the traffic receipts for the current year as compared with those of 1914, and the uncertainty of the outlook for the remainder of 1915, the directors have decided not to recommend any dividend on the ordinary shares. The average number of miles of surface line open for traffic working throughout the year has been 361, against 348 in 1913. The extension to Caballito of the first subway line from Plaza Mayo to Plaza Once was opened in April as far as Rio de Janeiro Station, and the entire line on July 1st, the whole length of the subway open, with extensions, being 4¼ miles. The construction of the second subway line between Retiro and Plaza Constitución, which under the company's municipal concession was to be completed by December 31st, 1914, has been postponed under the authorisation of the Municipality.

Mr. G. Pedriali, the general manager, as usual makes a detailed report on the position of affairs. Business was bad from the commencement of the year 1914. The local crisis of the previous year continued, failures being frequent, and many large and important firms involved. Land speculation and the restriction of credit by the banks were the causes. The war came as the last straw, and absolutely paralysed everything for the rest of the year. The effects are still felt, in spite of the excellent harvest prospects. Excess of emigration over immigration amounted to 61,103 for 1914. The tramways were, of course, affected, as the following returns show, and the traffic receipts were diminished, notwithstanding the additional facilities offered by the subway:—

	Surface.	Subway.	Total.
Passengers carried 1913	340,014,573	2,125,849	342,140,422
" " 1914	303,500,792	28,514,462	332,015,254
Decrease per cent., 1913	10 7	—	2 9
Car kilometres run 1913	81,740,322	165,104	81,905,426
" " " 1914	78,072,894	3,556,177	81,629,071
Decrease per cent., 1913	4.5	—	0.3

The total rolling stock increased from 2,603 to 2,676. The rolling stock was maintained at a considerably reduced cost, but 1914 was not a year for records, as heavy and continuous rains caused floods, with consequent detrimental effects upon the car equipments. Approximately, 21 km. of new track were brought into service, and reconstruction of permanent-way track has been completed or taken in hand in several directions. The severe drop in receipts on all lines renders comparisons of value impossible, otherwise it would have been interesting to draw conclusions in regard to the effect of the opening of the subway. Many lines have already been favourably affected, and have become valuable feeders to the subway. Energy consumption per car km. has been further decreased, the average decrease being 17 watt-hours per car km. run. This is a result of the improved condition of the rolling stock and of the careful attention given to the manner of driving. The gross receipts were £2,847,471, a decrease of £115,673, but they were still in excess of the 1912 figures by £94,399. The report gives figures showing the continuous fall that took place in receipts for the subway during each of the months from July to December, and on the surface lines during the whole year. Import and export trade was seriously affected by the war; freights on coal had oscillated from 11s. to 25s. per ton to Buenos Aires; and Cardiff coal of best quality was extremely difficult to purchase.

The average consumption of current per car km. on the surface lines was 613 watt-hours in comparison with 630 watt-hours in 1913.

On the subway in 1914 the average consumption was 1,810 watt-hours per car km.

The 12 per cent. additional municipal tax for 1914 amounts to $82,131.

Passengers per car km. (surface lines) have decreased from 4.16 in 1913 to 3.89 in 1914.

Expenditure per car km. (surface lines) have been reduced from 24.87 cents to 23.06 cents. This is due partly to the reduced 12 per cent. tax for 1914, working out at over half a cent less per car km., and partly due to economy in maintenance of cars, track, overhead line and buildings, equal .87 cents.

Expenditure for the surface lines was £1,572,079, a decrease of £202,867; and for the subway £129,887, an increase of £121,849. The net receipts decreased by £148,901 for the surface lines and increased by £111,246 for the subway. The gross receipts, therefore, show a decrease of £115,673, or 3.90 per cent. The expenditure decreased by £81,018, or 1.51 per cent., and the net receipts by £34,655, or 2.94 per cent. The percentage of expenditure on receipts has been 59.77 per cent., compared with 60.17 per cent. in 1913. Expenditure has been kept at a minimum, and important economies have been effected in all sections. From the labour point of view, the year in Buenos Aires has been the quietest ever experienced, owing to the abundance of labour offering. Mr. Pedriali, referring to the subject of prospects, says:—

> The forecast contained in my report for 1913 was, of course, completely upset; in the first place owing to the fact that the local crisis, which had been threatening for a whole year, became suddenly worse about the month of April, 1914, and then matters were thrown all out of gear by the outbreak of the European war. The past year has been a great lesson to everybody in this city. Whereas formerly money was plentiful and the tendency was to spend generously, now everybody is economising, and even though business may have slightly improved since the new year, there is no doubt that the spirit of economy is still in the ascendency, so that our receipts are, if not still dropping, at any rate at a complete standstill. Under these circumstances, it is extremely difficult to even make a guess at what our receipts should be during 1915. Unfortunately, however, there is no doubt that we cannot expect any increase whatever on the year 1914, and in all probability there will be some decrease.

The annual meeting was held yesterday.

West London and Provincial Electric Supply Co., Ltd.

Mr. Harry Kahn presided over the annual meeting, at 14, Ironmonger Lane, E.C., on May 19th. He said that the success of the Chiswick Electricity Supply Corporation spelt the prosperity of the company. Out of the available balance, £5,337, they were paying 6 per cent. on the preference shares, carrying forward £393, as compared with £26 brought in. The balance sheet was now a perfectly clean one, the item preliminary expenses £483, having been written off in the previous year. In regard to the Chiswick Electricity Supply Corporation, which supplied Chiswick and Aberystwyth, in view of war conditions there was every reason to be satisfied with the results submitted. During the year the number of consumers had increased by 111 to 2,717, but owing to the lighting restrictions the increase in consumers had only partly made up for the reduced consumption for shop-front and similar lighting, the total revenue being down from £19,440 to £19,369. Nevertheless, owing to the saving in the cost of fuel resulting from the Diesel engine installed in 1913 coming into full use during the year, and in spite of the increased cost of coal and the increase in local rates, the balance carried to net revenue account was £249 higher than for 1913, namely, £8,813. The net revenue account, after payment of debenture interest, trustees' fees, and premium on sinking fund policy, showed a balance of £4,787, which represented the net profit, as against £4,643 for 1913. This amount the corporation had utilised by paying a dividend of 6 per cent. on its ordinary shares, and by transferring the balance of £1,019 to depreciation reserve fund account. It was difficult to give any accurate forecast for 1915. Up to the present the revenue from the Chiswick undertaking continued to show a considerable falling off, owing to the lighting restrictions now in force. This falling off, however, would naturally be proportionately less during the summer months. To make up to a certain extent for the loss of revenue, the advance in the price of coal and other increases in the cost of production, the directors of the corporation, in common with other Metropolitan supply companies, were reluctantly compelled to increase the charge for current by 10 per cent. from April 1st. As regarded Aberystwyth, conditions were looking better, as the revenue had increased owing to the town being full of soldiers who were billeted at the various boarding-houses, etc., which had consequently used more current than usual at the non-season period. The corporation were installing a second Diesel engine at Aberystwyth in place of the old steam set, and estimated that a considerable saving in the cost of production would be effected by this expenditure.

Mr. W. B. Esson seconded the motion.

In reply to Mr. Charrington, Mr. Esson said the extra Diesel engine to be installed at Aberystwyth would bring the capacity up to 350 kw. They were replacing a steam set, and it did not increase the capacity, but the economy.

Delhi Electric Tramways and Lighting Co., Ltd.

Mr. A. W. Tait presided at the annual meeting, held on May 19th, at Basildon House, E.C. He said that the combined undertakings showed a net revenue of £8,163, as compared with £6,252 in 1913, and £2,990 in 1912. The progress was satisfactory. The increase in the gross revenue had been 10 per cent. for the tramways and 19 per cent. for the electricity supply. The tramway traffic receipts had been adversely affected by the monetary conditions created by the war, and, in addition to the usual accident claims, they had to meet a judgment for a somewhat costly accident claim. But for these incidents, the tramway undertaking would probably have paid its way during the year, and this after charging current from the supply undertaking at the rate of 1½d. per unit. The unsuitable type of car was responsible for heavy [illegible] maintenance charges and abnormal current consumption, but they were unable to deal with that matter until capital could be provided to install new cars with double motor equipment. Permanent-way maintenance was still heavy, but contract arrangements made during the year had resulted in a small saving. The passengers carried numbered [illegible], an increase of 16½ per cent. Over 57 per cent. of the passengers only travelled half-a-mile or under, and the first-class traffic still remained very small, being under 6 per cent. of the total. The total number of car miles run was [illegible], an increase of 3 per cent., while the receipts per car mile were 5.4d., as against 5.2d. in the previous year, and they carried the total available population 23¼ times during the year, as against 20¼ times in 1913. During the year they had some difficulty with the staff, and in May they had a serious strike, in which they lost nearly half of the drivers. With a view to encouraging a better class of employé they had had under consideration provident and bonus schemes. A bonus scheme had been put into operation, the effect of which would be closely watched, and if the results justified it, a provident scheme might also be instituted. With regard to the electricity supply undertaking, he was pleased to say that there had been no serious failure of any kind in the power station during the year. In order to cope with peak loads, and to supply further stand-by in case of breakdown on either of the oil engines or of the steam plant, satisfactory arrangements had been made whereby their power station was to be linked up with the Government station, which would enable them when desired to draw alternating current from them, and, should it be necessary, to give them a supply when the same might be available. The units generated showed an increase of 26 per cent., and the average cost was .92d., as compared with 1.08d. The units sold for lighting and power were 931,219, an increase of 26 per cent., and the units used by the tramway system were 572,393, an increase of 16 per cent. The units sold for lighting and power in 1909 were 188,072, as against the 931,219 last year—an increase of 395 per cent. in the five years; while the traction units during the same period showed an increase of 55 per cent. During the first six months of last year they connected 193 new consumers, which was the highest rate the company had reached, but during the second six months they only connected 138 new consumers. The growth of the power supply had been quite satisfactory, but they could not expect any great developments in this connection, as Delhi was not a large industrial centre. There might be some falling off in the rate of progress during the present year owing to the causes he had referred to, and to a certain amount of competition which had sprung up. With regard to the current year, he could only say that, provided they had no breakdowns in the power station, or serious diminution in revenue due to the conditions created by the war, it was reasonable to suppose that the results would show some improvement over those for 1914. With regard to the new city of Delhi and the concession for electric lighting and tramways, nothing would be done in regard to this until the shareholders had had an opportunity of expressing their opinion on the whole matter. The directors would shortly have an opportunity of discussing the situation with the general manager, who proposed to come to London. His (the Chairman's) impression was that the Government would not take any definite steps towards asking for tenders for some little time. There was, however, considerable field for expansion of the company's existing system of supply, and during the next twelve months they would have to incur capital expenditure to approximately £25,000 in order to cope with the demand. Before the war the directors had under consideration an issue of second debentures, to which the consent of the Indian Government had been obtained. If conditions improved, he hoped before very long they might be able to do something in the way of raising the necessary capital, but that, of course, was dependent upon the sanction of the Treasury during the period of the war, and application was being made to ascertain whether permission would be granted. Although it was unfortunate that the surplus profits must be applied in the manner he had indicated, there was at least some satisfaction to the shareholders in knowing that steady progress was being made, and that the balance of profits which would otherwise be available for dividend on the preference shares continued to grow, and he hoped that at some time in the not very distant future they might be able to declare a preference dividend.

Mr. T. W. Stratford-Andrews seconded the motion, which was adopted.

River Plate Electricity Co., Ltd.

The annual general meeting was held on Friday last, at Capel House, New Broad Street, E.C. Mr. M. W. Mattinson, K.C., who presided, said that the accounts showed a substantial reduction in the available profits compared with 1913. The company had been in existence 12 years, and at the end of every year up to the present he had been able to report an improvement in its position. On this occasion they had to submit to some set-back in their progress, but when all the circumstances of the times were taken into account the result was only what they might reasonably have expected. The net profits were about £10,400 less, and half of that deficiency was solely and directly attributable to the war, as during the past year the company had only received three months' instead of a full twelve months' interest upon its investment in the German Trans-Oceanic Electric Co., of Berlin. The acquisition of that investment went back to the inception of the company, when they disposed of the old and decayed electric station at Buenos Ayres to the German company, which then, as now, was the principal electric company in that city. In return, in addition to some cash, they received £150,000 in 5 per cent. obligations of the company, which had always paid large dividends on its ordinary shares, which came behind their obligations. The annual amortisation of the obligations and the interest had been met up till last year, when the outbreak of war suspended all commercial relations between this company and Germany. They assumed that at the conclusion of hostilities the German company would resume payment of its obligations. The shortage of income last year from that default was a little over £5,000, but as they received one quarter's interest on the bonds, the shortage in the current year would be some £1,700 more. The balance of the lessened profit was due to less favourable working results in the Argentine, due largely, though not wholly, to the war. While the number of their consumers at La Plata had increased substantially, the average consumption of current had gone down. Since the war broke out they had had to contend with a rise in the price of materials, and the profit they made out of the public lighting had been cut into by the rise in the price of carbons. The question of fuel had given, and still continued to give, the board considerable concern, and but for the care and thrift exercised by the manager (Mr. Lindop) the diminution in profits would have been much greater than it was. They were carrying out their engagements with the Government both in the letter and the spirit by putting the lines underground in most of the important thoroughfares. They had also agreed to substitute half-watt lamps for the public lighting in place of the present arc lamps. The plant which had thus become obsolete had been scrapped, the loss being charged against revenue. Taking all those considerations into account, he thought it was cause for satisfaction that the profits were as large as they were. The sale of the company's Tucuman station was completed last June, and the board were satisfied that they had acted wisely in disposing of it upon the terms which they obtained. The whole district had been in a most depressed condition throughout the year, and if they had continued to operate the station under the competitive conditions which had prevailed they must have had a large loss, which would have helped to materially reduce their profits at La Plata. After careful consideration the board had decided to recommend the payment of a dividend of 8 per cent. for the year upon the ordinary stock. That was less than they had paid during the previous four years, but it was in excess of the average dividend paid since the incorporation of the company. In determining the dividend they had to have regard to the future outlook, and he estimated that by carefully husbanding their resources they would be able to complete their programme without having to raise any fresh capital or creating any floating debt. They felt that they could easily pay the 8 per cent. ordinary dividend without unduly straining their resources, and the reason they were able to do that was because they had kept the ordinary capital down to a very low figure. They had built up the business out of the savings of former years and out of profits made in other directions, and by the issue of ordinary shares at a premium. In the first four years of their existence they paid no ordinary dividend; in the fifth year they paid 2½ per cent.; the next year 6 per cent., while during the four years preceding 1914 they paid 10 per cent. This year they had had to drop to 8 per cent., which gave an average of 6 per cent. over the whole period. He might say that although they were not putting anything this year to general reserve, they were strengthening the future position by carrying forward £20,000 instead of £13,000 as last year.

Mr. R. Miller seconded the motion, which was carried unanimously.

Willans & Robinson, Ltd.

The annual meeting was held recently at the Victoria Engineering Works, Rugby. Mr. J. C. Peache, who presided, said that the accounts showed a substantial improvement in revenue, notwithstanding the abnormal times. After paying the dividend as recommended, the reserve fund would amount to more than sufficient to cover a year's dividend on the preference shares and stock. For the first six months of the year 1914 conditions were normal, and they obtained a fair share of turbine business at prices somewhat better, owing to the excessive competition of recent years, than had previously prevailed. In consequence, the profit from this, which was the main portion of their business, had been the principal factor in the improved results shown. The Diesel engine, too, had continued to provide a satisfactory volume of trade, and the repeat orders which were being regularly placed by customers bore practical testimony to the reliability and excellence of the Willans-Diesel engine. With the outbreak of war the whole conditions of business were disturbed. From November onwards their standard lines of output had to take a second place, and the volume of production, too, was gravely affected, for the directors considered it right not only to give absolute preference to Government work, but also to encourage enlistment among the employés. Over 20 per cent. of the male employés of the company were now serving in His Majesty's Forces—that was some 50 per cent. of the male employés who were eligible. Since November the works had been largely engaged on the supply of munitions of war, and the ordinary business had suffered not only by being to a considerable extent put on one side to make way for Government work, but also by increased cost of production due to the general rises in wages and materials which had taken place and to the difficulty in temporarily replacing the men who had gone to the Front. Liberal provision was being made by the company for dependents of these men while away on service, and it was intended to reinstate them on their return. The heavy increase of work that had been thrown on the remainder of the staff by the absence of a large proportion at the Front had been cheerfully and willingly borne; and the workpeople (which included a large contingent from Belgium) in all branches of the business had been keeping good time and maintaining a high standard of quick and efficient production. The company's managing director had recently been appointed chairman of the British Electrical and Allied Manufacturers' Association, an important institution that had a far-reaching influence on the interests of both employers and employed in the particular branches of industry in which the company was chiefly concerned. The appointment was, too, a well-deserved recognition of the merits of the managing director.

Mr. Davenport seconded the resolution, which was carried.

Brisbane Electric Tramways Investment Co., Ltd.

The annual meeting was held on Wednesday at Winchester House, E.C. Mr. H. R. Beeton, in proposing the adoption of the report, said that the total receipts of the tramways for the past year amounted to £348,406, as compared with £316,244 for 1913, and the expenditure, including costs in connection with the Arbitration Court award, amounted to £194,960, as against £191,936. The profit, therefore, amounted to £153,446, as against £124,308, and that, with £3,436 brought forward, gave an available balance of £156,882. This is to be dealt with as shown in our last issue. There had been an increase of £150,000 in the ordinary share capital, due to the issue of 30,000 new shares, which were all taken up by the shareholders. The capital expenditure on the tramways during the year had amounted to £103,751 for the construction of extensions, the purchase of equipment and plant, the building of new car sheds, and the acquisition of a new power house site. The site of their present power house station was held on a lease from the Queensland Railway Commissioners which expired in 1926, but which might be required by the Government before that date. They had therefore thought it prudent to avail themselves of an excellent site which was available not far from the present station, so that the alteration to the feeder system would be reduced to a minimum. £47,500 of available cash not immediately required had been invested in the purchase of £50,000 of the War Loan, a course which he felt sure the shareholders would approve. The most important event during the year had been the High Court's decision in the tramway case which, as they anticipated, annulled the decision of the Commonwealth Conciliation and Arbitration Board. A number of men had joined the Australian Expeditionary Force, and their employés were contributing to the patriotic fund at the rate of £100 per month. The company would, of course, keep open the places of the men who were serving with the Colours. The Tramway Company had already subscribed to the British war funds, and they proposed to extend their support to the Queensland war funds.

Mr. J. B. Concanon seconded the resolution.

Replying to a shareholder, the Chairman said that the power station and the road equipment were maintained in the highest state of efficiency. They were undoubtedly approaching the time when they would have to face a certain limited expenditure on the renewal of the permanent way, for which their present renewals fund was altogether adequate. The reserve fund was available for the general purposes of the company, either for the equalisation of dividends or for periodical distribution by way of bonuses should the board consider it prudent.

The report was adopted.

STOCKS AND SHARES.

Tuesday Evening.

Italy's long-delayed intervention in the war has had a cheering effect upon Stock Exchange sentiment, but, so far, has been without influence on quotations. The idea is prevalent that, with the help of our latest ally, the war should be shortened by at least six months; and her entry into the theatre of hostilities—as the newspapers put it—has been hailed with satisfaction in the Stock Exchange, as elsewhere. The most dramatic event of the week just past was the denunciation of "a certain section of the English Press" which attacked Lord Kitchener on the day before the Stock Exchange separated for its Whitsun holiday, and which culminated in a vote of confidence in the War Minister, followed by the burning of the *Daily Mail*. Lord Kitchener replied in a cordial telegram of thanks.

Home Railway securities remain dull, and the terrible tragedy of the troop train lies like a pall over the market. Where prices have moved at all, they have gone back a little, the Undergrounds easing off with the rest. The succession of Lord George Hamilton to the chairmanship of the Underground Electric Railways of London, in place of Sir Edgar Speyer, Bart., P.C., caused no alteration in prices. Central Londons are still wanted, but Metropolitans and Districts have both gone back ¼. Other stocks are dullish.

Electricity Supply issues show one alteration—a fall of ⅛ in County of London Preference being the solitary instance of a change in this market for a fortnight. It is by no means easy to pick up shares. There are buyers about for several of the best-known issues, which, however, are not offered at anything like the market prices. It might be supposed from the quietude of the market that the tone was depressed, but, in point of fact, the difficulty is to get shares, not to sell them. This, of course, is the season of the year in which the public investor as a rule declines to have anything to do with what may be called illumination issues. In these disjointed times, however, there seems to be nothing surprising in the demand for electric lighting shares, with an accompanying absence of supply.

Most of the markets connected with Mexican securities have been further depressed, the reason being lurid illumination cast upon the affairs of that country by a circular issued to the proprietors of the Mexico Tramways Company and its three associated concerns. In this it is pointed out that affairs are in a state of chaos, and practically all business is at a standstill. Matters have reached a climax, and the control of the tramways has been taken out of the hands of the directors and officials. The rate of exchange is 5d. to the peso, instead of the normal 25d., and a further drop may be expected. The Mexico Tramways employés asked last October for 25 per cent. increase of wages, recognition of the Union, and other conditions, to agree to which would have ruined the Company. A strike was proclaimed, and the tramways ceased running. Then the authorities took over the operation of the lines, doubled the salaries of part of the staff, and gave a 25 per cent. rise to the rest. The tramways receipts were paid into the company's bankers for a short time, but later on were diverted into the Government Treasury. When Carranza's representative was driven from the City of Mexico by Zapata, he took with him the "controllers" off the cars, with the result that all traffic has ceased.

The Mexican Light and Power Company has suffered little physical damage, but although electric light is still freely used, it has not been possible to obtain payment for the same. Over two million pesos is owing for street lighting or power furnished to the Government. Repeated protests have been filed by the board through different diplomatic representatives, but apparently without any success. The board feel that the future of the enterprises must necessarily depend upon the development of the political situation in Mexico, and the future attitude of the United States Government towards that country.

Other foreign securities are none too good. Brazil Tractions have fallen a further 2 points to 52, the Rio rate of exchange being erratic and unstable. Dr. F. S. Pearson (the president of the company), who went down with the ill-fated *Lusitania*, has been succeeded by Mr. Alexander Mackenzie, of the Rio Tramways and San Paulo Light and Power Companies. Anglo-Argentine Trams have weakened on the passing of the dividend on the Ordinary shares. For the past half-decade, 1909-13, the annual dividends have been 6, 7¾, 7¾, 8¼ and 6¾ per cent. respectively. The net revenue fell off by only £26,000, but the interest charges were largely increased; and instead of paying a dividend on the Ordinary shares, the directors have elected to carry forward £96,400, an increase of £83,000 as compared with the previous year. In view of the very large amount of British capital invested in the Anglo-Argentine Tramways, it may be of interest to set out the principal items in the balance-sheet for the past seven years; the figures compare as follows:—

Liabilities.

	Debentures.	Pref. capital.	Ordinary.	Sinking fund.	Reserve	Paving fund.	Renewal fund.
1908 ..	£831,600	£4,400,005	£1,500,000	£24,325	£63,777	£25,692	£212,900
1909 ..	6,305,540	5,700,000	2,500,000	51,706	66,014	25,701	187,611
1910 ..	7,785,484	5,700,000	2,500,000	79,820	66,014	41,675	179,546
1911 ..	8,785,154	5,700,000	2,500,000	33,637	66,014	44,315	177,338
1912 ..	10,005,732	5,700,000	2,500,000	42,432	66,014	43,876	169,371
1913 ..	10,715,961	5,700,000	3,005,760	46,380	75,145	44,189	171,457
1014 ..	12,191,836	5,700,000	3,250,000	52,144	75,145	43,232	183,887

Assets.

	Concessions and property.	Discounts on debs.	Stores.	D'btors.	Investments at cost.	Cash and bills.	Total assets.
1908 ..	£6,458,739	£74,862	£83,593	£26,106	£305,786	£48,092	[illegible]
1909 ..	13,911,493	661,769	161,268	36,156	317,991	84,522	15,216,805
1910 ..	14,634,036	773,312	185,303	113,581	817,901	667,766	16,761,100
1911 ..	15,757,347	778,879	401,885	144,462	816,594	756,207	[illegible]
1912 ..	17,081,646	814,174	405,272	144,213	816,279	495,639	19,281,203
1913 ..	18,554,215	784,397	430,636	120,033	829,005	244,593	20,474,132
1914 ..	19,510,500	869,018	801,468	66,989	536,107	742,300	22,094,660

The Bombay Electric Supply and Tramways Company has just announced a dividend on the ordinary shares at the rate of 6 per cent., which is the same as that for a year ago; a bargain was done on Tuesday at 7 9/16, being the first transaction recorded in the shares since the Stock Exchange re-opened, at the beginning of January. The Shanghai Electric Construction Company has announced a dividend of 6 per cent. for the year, a decrease of 1 per cent. as compared with 1913; the falling-away is explained entirely by the loss of exchange on subsidiary coinage, which came to no less than £28,000, equal to 8¾ per cent. on the capital of the Company.

The Telegraph market is irregular. Eastern Ordinary and Preference are both better, but Globes of each sort have given way a little. Anglo-American Preferred fell a point, and New York Telephone 4½ per cent. bonds are 1¼ lower. The United River Plate Telephone report is a good one, showing a net profit of £161,800, allowing payment of the regular 8 per cent. for the year, free of income-tax. The report of the Cuban Telephone Company explains that the general financial stringency has made impracticable the further placing of securities; hence the action of the directors in not declaring the dividends which have been earned. For the year, the Preferred stock received six months' dividend, and there was one distribution for three months made on the Common. The company's 5 per cent. first mortgage bonds stand about 79, but the Preferred has not changed hands this year.

In the manufacturing group, Callenders gained the fraction at 12½, though, on the other hand, Henleys eased off to 14 and India-Rubber shares to 11, while British Insulated at 11¼ are ¼ down on the week. British Aluminiums have hardened, and manufacturing shares on the whole are very steady, commanding a fair amount of attention. The rubber market keeps firm, owing to the produce holding its price of 2s. 5d. per lb.; while nearly every report which appears shows substantial reduction in working costs. The Armament issues have a slightly sagging tendency, for which absence of business is held responsible. The strong measures taken by the L.C.C. in connection with the strike of tramwaymen had no effect upon prices in the market, but they have been discussed with considerable satisfaction. In the Stock Exchange, at all events, there is extremely scant sympathy for the employés who chose a time like the present to disregard the counsels of their leaders and to do their best to add discomfort and loss to the community at large.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price May 25, 1915.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.				
Brompton Ordinary	10	8¼	—	£6 1 8
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4½	—	5 11 1
do. do. do. 4½ Pref. ..	4½	4⅛	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	14¼	—	6 6 4
do. do. 6 per cent. Pref. ..	6	12¼	—	4 18 0
do. do. 5 Deb.	5	112	—	4 9 3
do. do. 4½ Deb.	4½	98	—	4 11 10
County of London	7	11½	—	6 1 9
do. do. 6 per cent. Pref. ..	6	11½	— ⅛	5 4 4
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	95 xd	—	4 14 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1¾	—	6 18 0
do. do. 6 per cent. Pref. ..	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	3½	3⅛	—	5 12 5
do. 4½ per cent. Pref. ..	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	75	—	4 13 4
St. James' and Pall Mall	10	8	—	6 5 0
do. do. do. 7 per cent. Pref.	7	6⅜	—	5 9 10
do. do. do. 3½ Deb.	3½	75	—	4 13 4
South London	5	8	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7½	—	6 0 0
do. 4½ Pref.	4½	4⅞	—	4 12 4
TELEGRAPHS AND TELEPHONES.				
Anglo-Am. Tel. Pref.	6	105¼	−1	5 13 8
do. Def.	1½	22⅝	—	6 12 10
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8½	—	5 17 8
do. Pref.	10	15	— ½	6 13 4
Eastern Extension	7	13⅛	—	*5 17 6
do. 4 Deb.	4	92	—	4 7 0
Eastern Tel. Ord...	7	134	+2	*6 0 0
do. 3½ Pref.	3½	74	+ ½	4 15 3
do. 4 Deb.	4	92	−1	4 7 0
Globe Tel. and T. Ord.	6	11	— ¼	*6 [illegible] 9
do. Pref.	6	11⅞	— ⅛	5 1 0
Gt. Northern Tel.	22	30	—	7 6 8
Indo-European	65/-	54	—	6 0 4
Marconi	20	$1\frac{11}{16}$	—	11 17 0
New York Tel. 4½..	4½	96¾	− 1¼	4 13 0
Oriental Telephone Ord.	10	2	—	5 0 0
do. Pref.	6	$1\frac{3}{16}$	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 3
United R. Plate Tel.	8	6⅜	—	*7 0 8
do. Pref.	5	5	—	5 0 0
West India and Pan.	1	$1\frac{5}{16}$	—	7 11 0
Western Telegraph	7	13¾	—	*5 16 5
do. 4 Deb.	4	91	—	4 6 6
HOME RAILS.				
Central London, Ord. Assented ..	4	80	+1	5 0 0
Metropolitan	1¼	28¾	— ½	4 7 2
do. District	Nil	16⅞	— ¼	Nil
Underground Electric Ordinary ..	Nil	1⅜	—	Nil
do. do. "A"	Nil	5/6	—	Nil
do. do. Income ..	6	78¾	— ¼	*8 15 0
FOREIGN TRAMS, &c.				
Anglo-Arg. Trams, First Pref. ..	5½	4¼	—$\frac{3}{16}$	6 9 5
do. 2nd Pref.	5½	3¾	— ⅛	7 6 8
do. 4 Deb.	4	81½	+ ½	4 19 3
do. 4½ Deb.	4½	88	—	5 2 3
do. 5 Deb.	5	90	—	5 11 1
Brazil Tractions	6	52	−2	11 10 10
Bombay Electric Pref.	6	10⅜	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	35	−5	Nil
do. 5 per cent. Bonds ..	—	58	−3	Nil
do. 6 per cent. Bonds ..	—	85	−2	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	39	−2	Nil
do. 1st Bonds	—	49	−2	—
Adelaide Sup. 6 per cent. Pref. ..	6	$5\frac{5}{16}$	—	5 13 0
do. 5 Deb.	5	103	—	4 17 1
MANUFACTURING COMPANIES.				
Babcock & Wilcox	14	51/-	—	5 9 8
British Aluminium Ord.	5	21/-	+6d.	4 15 3
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	11¼	— ¼	6 13 4
do. Pref.	6	6	—	5 0 0
British Westinghouse Pref.	7½	$1\frac{15}{16}$	—	7 15 0
do. 4 Deb...	4	72	—	5 11 1
do. 6 p. lien	6	101	+2	5 19 0
Callenders	15	12½	+ ½	6 0 0
do. 5 Pref...	5	5	—	5 0 0
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	8½	—	4 12 6
Edison & Swan, £3 pd.	Nil	12/9	—	Nil
do. do. fully paid	Nil	1⅞	—	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	14/-	—	8 11 6
do. do. Pref.	7	$1\frac{1}{16}$	—	6 11 9
Gen. Elec. Pref.	6	$10\frac{3}{16}$	—	5 17 8
Henleys	20	14¼	— ¼	*8 0 4
do. 4½ Pref.	4½	4⅞	—	4 12 4
do. 4½ Deb.	4½	97	—	4 12 9
India-Rubber	5	9	— ⅛	5 11 1
Telegraph Con.	20	87	—	6 9 10

* Allowance made for dividends being paid free of income-tax.

Swedish Electrical Exports.—The exports of electrical machinery and apparatus from Sweden during the three months ending with March last attained a value of £66,140, as compared with only £55,402 in the corresponding quarter of 1914. On the other hand, there was a marked decline in the exports of telephone material and apparatus—from £102,781 to £61,977.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 26th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a „ Nitric	„	19/-	..
a „ Oxalic	per lb.	..	..
a „ Sulphuric	per cwt.	..	..
a Ammoniac Sal	„	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	„	£9	..
a Bisulphide of Carbon	„	£21	..
a Borax	„	£22	..
a Copper Sulphate	„	£29	..
a Lead, Nitrate	„	£35	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
c Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	7d.	..
a Potash, Caustic (88/90 %) ..	per ton	..	..
a „ Chlorate	per lb.	1/6	..
a „ Perchlorate	„	1/6	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers ..	„	£11 10	..
a „ Recovered	„	£8	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %) ..	„	£10 2 6	..
a „ Chlorate	per lb.	10½d.	..
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks ..	per lb.	3½d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£95	£5 inc.
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£125	£5 inc.
b „ Sheet, in ton lots ..	„	£125	£5 inc.
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/- to 1/0¼	
c „ „ (solid drawn) ..	„	1/0½ to 1/0¾	..
c „ Wire, basis	„	1/0¼ to 1/0½	..
c Copper Tubes (solid drawn) ..	„	1/1½ to 1/1¾	..
g „ Bars (best selected) ..	per ton	£100	..
g „ Sheet	„	£100	..
g „ Rod	„	£100	..
d „ (Electrolytic) Bars ..	„	£89	..
d „ „ Sheets ..	„	£107	..
d „ „ Rods ..	„	£95	..
d „ „ H.C. Wire	per lb.	11½d.	..
f Ebonite Rod	„	3/-	..
f „ Sheet	„	2/6	..
d German Silver Wire	„	1/9	..
h Gutta-percha, fine	„	6/10	½d. inc.
h India-rubber, Para fine	„	2/7½	11d. inc.
j Iron Pig (Cleveland warrants) ..	per ton	65/6	..
l „ Wire, galv. No. 8, P.O. qual.	„	£20	5/- dec.
g Lead, English Pig	„	£20 15	..
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£11 15 to £12	..
e Mica (in original cases) small ..	per lb.	4d. to 2/6	..
e „ „ „ medium	„	3/- to 5/-	..
e „ „ „ large ..	„	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/2 to 1/3½	..
p „ „ rolled strip & sheet	„	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	1/1	..
r Steel, Magnet, in bars	per ton	£80	£10 inc.
g Tin, Block (English)	„	£164	£2 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals ..	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

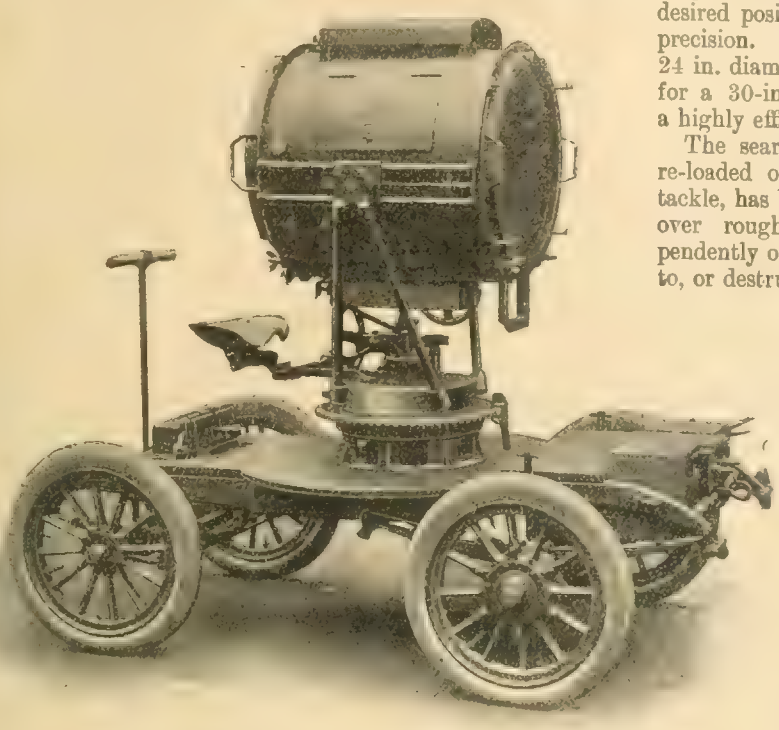
Quotations supplied by—

a G. Boor & Co.	*j* Bolling & Lowe.
b The British Aluminium Co., Ltd.	*k* Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	*l* Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	*m* W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	*n* P. Ormiston & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*o* Johnson, Matthey & Co., Ltd.
g James & Shakspeare.	*p*
h Edward Till & Co.	*r* W. F. Dennis & Co.

The Chief Technical Assistants' Association.—An inaugural dinner in connection with this Association was held at Pinoli's Restaurant, Wardour Street, W., on Thursday evening, May 20th, with Mr. J. T. Baron (resident engineer of St. Pancras) in the chair, supported by Mr. T. K. Richardson (generating engineer of St. Marylebone) in the vice-chair. This Association, which was originally formed by the chief assistants of London, embodies generally the chief technical assistants of the large undertakings. As a consequence of the war, it was not thought expedient that any musical programme should be arranged, and the proceedings consequently partook largely of a speech-making character; amongst the gentlemen who spoke in support of the Association and its objects were the following:—The chairman and vice-chairman; Mr. J. R. J. Bowden (deputy engineer of Hackney); Mr. J. Leadbeater (assistant engineer at Hampstead); Mr. J. H. Parker (chief assistant engineer at Croydon); Mr. H. F. J. Thompson (chief assistant engineer at Battersea); and Mr. W. Young (resident engineer at Stepney). On the whole, a very enjoyable evening was spent, and the chief object for which the dinner was held, namely, that the more recent members might have an opportunity of making the personal acquaintance of, and becoming better known to, the older ones, was thoroughly realised.

A MOTOR SEARCHLIGHT PLANT.

One of the features of the great war that will stand out prominently when its full history comes to be written will be the many new uses it has found for the motor vehicle. Among these, from an electrical point of view, are the motor X-ray machines for use in conjunction with the medical service, automobile wireless telegraph stations, and travelling searchlight plants. Shortly after the outbreak of hostilities, we published some particulars and illustrations of the motor searchlight plants which had been constructed by Messrs. De Dion, Bouton & Co. for the French War Office, and we are now able to do the same as regards a motor searchlight plant which has recently been completed by the Austin Motor Co., Ltd., of Northfield, Birmingham.



Searchlight Mounted on Special Trolley.

The motor lorry, on which the searchlight outfit is carried, consists of a standard Austin 2-3-ton chassis, the bodywork having been specially designed and constructed for the purpose for which the vehicle is being used. The electricity-generating plant, which has also been designed and manufactured by the Austin Co., is located in the forward part of the body, behind the driver's seat, and is entirely distinct from the engine employed to propel the vehicle; it comprises an Austin 12-h.p. 2-cylinder petrol engine provided with a specially-designed cooling system and exhaust-silencing chamber. The engine is coupled direct to a dynamo having an output of 120 amperes at 80 volts, and at a speed of 1,000 r.p.m.; the generator is connected up to a drum carrying a long length of cable, the contact being so arranged as to avoid the possibility of a fault developing from it whilst the drum is in motion.

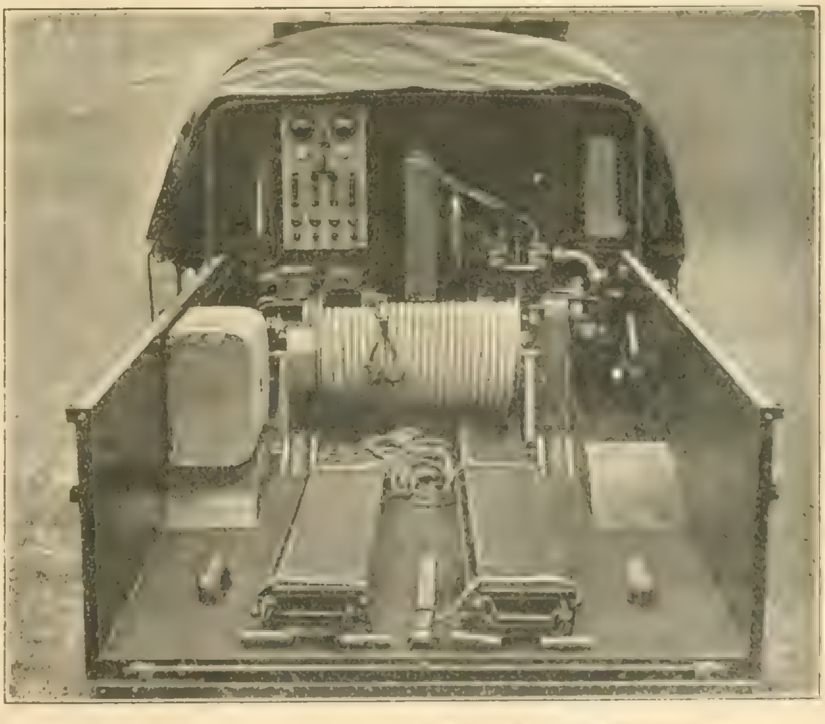
In order to allow the searchlight to be used some distance away from its current-generating plant, the projector, as will be seen, is carried on its own special trolley, which runs on four pneumatic-tired wheels.

In order to provide a safeguard against the danger when on inclines of the trolley over-running the men, the rear wheels are provided with brakes operated by a hand lever at the back of the trolley chassis. The projector itself was constructed by Messrs. Crompton & Co., Ltd., of Chelmsford, and is mounted on a swivelling base, and also swings in horizontal trunnions. It will also be noted that a seat which revolves with the projector is provided for the operator.

Both the horizontal and vertical movements are controlled by means of worm gearing; the latter can be thrown out of gear, enabling the light to be quickly swung into the desired position, and the beam adjusted with the necessary precision. Although the projector illustrated is only of 24 in. diameter, the plant is adequate to furnish the current for a 30-in. one, but by the use of the smaller diameter a highly efficient result is assured.

The searchlight trolley, which is unloaded from, and re-loaded on to, the motor lorry by means of ramps and tackle, has been specially constructed to enable it to be used over rough ground—possibly for long distances—independently of the motor-lorry, in the event of capture, damage to, or destruction of that unit.

The electricity generating plant, when not required to run the searchlight, can be used to furnish current for the temporary lighting of officers' quarters, field hospitals, or any other purpose for which a good light is desirable, a switchboard being included in the equipment.



Searchlight Generator, Cable Drum, &c., on Motor Lorry.

SINGLE AND MULTIPLE GROUND-WIRE ANTENNÆ.

The capital cost and various working risks associated with the use of ordinary aerials offer sufficient incentive to investigate thoroughly the possibilities of low horizontal aerials. If found reasonably effective, the latter should be useful in many commercial stations, and offer obvious advantages for special temporary Press installations and for military purposes, where easy erection and inconspicuousness are important considerations. For some time there has been no doubt that bare wires laid along dry soil are capable of receiving radio-signals more or less effectively, but only recently have the results of important American experiments been published, showing that such a conductor remains effective even on damp ground, and can easily be modified to secure efficiency of reception *commensurable with that of an elevated aerial over commercial distances.* The tests in question have been in progress at Beloit (Illinois) for some 18 months past, and have led to certain definite conclusions, although further quantitative data are required before the design of horizontal aerials can be reduced to an exact basis.

Since orientation affects considerably the working of horizontal antennæ, it is necessary to bear in mind the relative positions of the stations mentioned below; these are shown in fig. 1.* Most of the tests were carried out between Beloit and a field station at Freeport, the receiving circuit there being as shown in fig. 2, and using crystal detectors. Signals of uniform intensity were emitted from Beloit of 900-m. wave length, and of the bare No. 18 copper wire (274 m. long) at Freeport, half C D rested on the earth while A B, at first, was hung by linen thread 7 ft. above ground. As a result of preliminary tests it was found best to shorten the wire A B (towards Beloit) and lay the whole wire C X on the ground, the best lengths of wire to receive the 900-m. waves over a distance of 34 miles being C D = 138 m. and A X = 61 m. During most of the tests the grass-covered thin soil, with limestone subsoil, was dry, but with the wires lying in wet grass the Beloit clock signals could still be heard, and no difference could be detected between the efficiency of the system when C D rested on wet soil in a field of stubble and when it was insulated on stakes 1 ft. high. No appreciable improvement in tuning or loudness was secured by substituting for C D a connection to the water of a creek.

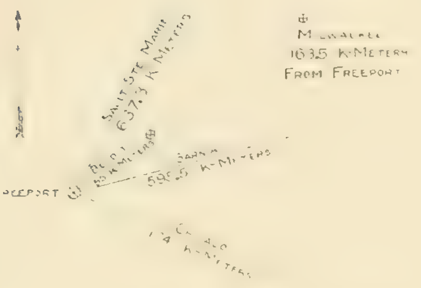


FIG. 1—RELATIVE POSITIONS OF STATIONS

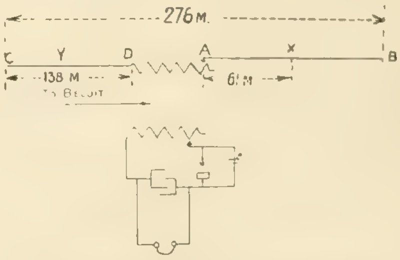


FIG. 2—RECEIVING SYSTEM AT FIELD STATION.

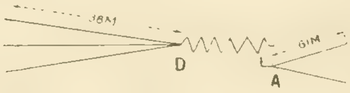


FIG. 3.—MULTIPLE-WIRE ARRANGEMENTS

With the wire A X due north and the longer wire C D in various positions, best reception was obtained with the long wire extending directly away from Beloit. Commercially readable signals could be obtained using only ¼ KW. input to the Beloit aerial (four 90-m. horizontal wires, two 30-m. slanting wires; horizontal section at 45° to the meridian, free end extending S.E.; logarithmic decrement 0·16 with 900-m. wave.)

By using a "fan" of three wires in parallel to the left of D (fig. 3) and of two wires to the right of A, the intensity of signals was greatly increased, and the received intensity of Milwaukee and Chicago signals seemed to be as great as when the large elevated aerial at Beloit was used. By adding a third 61-m. wire (to form a 3-wire fan) at A, still better results were obtained, Sault Ste. Marie and Sarnia signals being easily read. A further important advantage of the multiple over the single-wire arrangement is that tuning is as sharp as with commercial aerials of the elevated type.

If these results can be quantitatively confirmed and established for all ordinary conditions of soil and atmosphere, their importance can hardly be exaggerated, for it means that a symmetrical multiple earth-wire system having pronounced directive effect can be used for receiving in practical radio-communication *without using greater sending power than for elevated aerials*. Further tests appear to be desirable on very wet soil, for notwithstanding the fact that bare wires were used in these tests, the soil surface was mostly dry, and when the outer ends of the wires were deliberately connected to earth, the system would not respond to incident radiation. From the work already done, it seems that an earth-wire system operates best when its electrical length (including transformer primary) is about one-fourth the incident wave length. The receiving instruments should be inserted about one-third the distance from the end nearest the transmitting station, and to operate at the same efficiency, the total length of the ground-wire system should be about twice that of an elevated aerial.

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[*] C. A. Culver and J. A. Riner. *Electrical World*, 1915, p. 723.

ELECTRIC POWER IN INDIA.*

By H. R. SPEYER, A.M.I.E.E.

In the two great Indian industrial centres alone there are at work at least 95 cotton and 45 jute mills. Excluding the miscellaneous industries, these aggregate no less than 200,000 I.H.P., of which total at the present time not even 10 per cent. is driven by electricity. It must therefore be clear to all that an excellent field is open to manufacturers for the installation of up-to-date electrical plant in India.

It would appear, however, that with few exceptions, British manufacturers of electrical machinery have in the past been reluctant to consider seriously the development of an Indian business, apparently not wishing to incur the initial expense essential for systematically canvassing the country. Half-measures have only too frequently been adopted by British firms by reason of their allocating their selling agency to established commercial firms in India on a commission basis, and almost without exception this method has proved unsatisfactory.

Electrical machinery quite unsuited to the working conditions prevalent in India has been sent to that country, and proving unsatisfactory has led mill-owners and their engineers to regard with keen disfavour electric plant for mill or factory working.

It is absolutely necessary for an engineer to be on the spot to nurse carefully any new electric power installation during the first 18 months or two years, or until the mill-owner or his engineers have gained complete confidence in the working of the plant. Only recently two important electrification schemes carried out by one of the leading British manufacturing firms were superseded by steam plant, owing solely to the lack of qualified supervision on the part of the manufacturer's engineer during the erection and probational period.

There is no doubt whatever that the time has now come for British electrical manufacturers to realise that if they wish for a fair percentage of the Indian electrical trade, they must be prepared to send out to the country their very best power men and not merely one commercial engineer. They must further be prepared to establish themselves on their own account in at least the two largest industrial centres of India, and be prepared to undertake the electrification of mills and factories from A to Z and not against c.i.f. or f.o.b. prices. This method would ensure the confidence of mill-owners and their engineers, and such British firms as were established in India in this way would be able in a very short time to build up a lucrative business.

The pioneering work may now be regarded as having been accomplished, and the field for electrical power for industrial purposes in India to-day, is one which if handled to advantage by engineers of experience should yield a handsome return to the manufacturers.

Since 1907 electrical imports have increased from £155,000 to £198,000, while steam plant imports have fallen from £800,000 to £310 000 in 1912.

During the last few years a very great proportion of the electrical plant installed in India, together with hydraulic and steam turbines, has been supplied from the Continent. Table I embodies the chief data of the five most important public electric supply undertakings in India; of 66,900 KW. of plant installed in these stations Switzerland has supplied 54,000 KW., England only 7,500 KW., and the United States 5,400 KW. of the prime-movers, whilst Germany has supplied no less than 32,000 KW., the United States 17,000 KW., Switzerland 10,000 KW., and England only 7,500 KW. of the electrical generating plant. In the author's opinion this is due chiefly to the greater standardisation covering a large range of voltages, in many cases from 220 to 6,000 volts, which allows foreign manufacturers many opportunities of putting forward standard plant where British manufacturers are obliged to quote higher prices to cover special construction; and in addition the time required for delivery of the plant in the case of the British firms will in the majority of cases be considerably in excess of that of the Continental firms. It must also be borne in mind that Continental makers are fully alive to the conditions under which electrical plant has to work in India, and have spent both time and money in experiments before deciding on the standardisation of plant intended for export to a tropical country. Except in some isolated cases, however, the same cannot be said of the majority of British electrical manufacturers, or else the author's experience has been unfortunate. The reason for this deplorable lack of enterprise appears in the majority of cases to be due simply to the lack of experience on the part of British electrical firms of the unfavourable conditions prevalent in India; and as soon as greater experience has been gained with the working conditions, it is to be hoped that British firms will bring their manufactures into line to meet the requirements of the Indian market.

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[*] From the *Journal* of the INSTITUTION OF ELECTRICAL ENGINEERS (Abstract).

TABLE I.—Public Electric Supply Companies in India.

Company.	Inaugurated.	Power.	System. Voltage and frequency.	Station capacity in KW.	Connections. Lighting and fans in KW.	Horse-power of motors.	Tariffs.		Country of origin.	
							Lighting and fans.	Power.	Prime movers.	Electrical plant.
Tata Hydro-electric Power Co.	1911	hydraulic	6,600; 100,000; 2,200. Three-phase, 50 cycles.	32,000	400	50,000 (including extension)	1·25d.	0·5d.	Switzerland	Germany U.S.A.
Mysore Government Cauvery Falls Co.	1900	,,	2,300; 35,000; 2,300. Three-phase, 25 cycles.	12,000 (including extensions)	400	9,000 (excluding extension)	3d.-2·5d.	0·5d.-0·25d.	,,	U.S.A.
Calcutta Electric Supply Corporation	1898	steam	6,000. Three-phase, 50 cycles. 440/225 c.c.	10,000	18,862	6,200	6d.-3d.	1d.-0·6d.	,,	(generators) Switzerland (switchboard) England
Bombay Electric Supply and Tramway Co.	1905	,,	5,500. Three-phase, 50 cycles. 500/225 c.c.	7,000	7,025	2,850	4·5d.	1·5d.-0·8d.	England	England
Rangoon Electric Tramway and Supply Co.	—	,,	—	5,900	—	—	—		U.S.A. England	U.S.A. England

Total station capacity 66,900 kw., of which Switzerland supplied 54,000 kw., England 7,500 kw., and U.S.A. 5,400 kw. of prime-movers; Germany 32,000 kw., U.S.A. 17,400 kw., Switzerland 10,000 kw., England 7,500 kw. of electric generating plant.

It must be remembered that during the Indian "rainy" season, which lasts each year from June to October, the humidity reaches a figure of 95 per cent., with a temperature often of 98° F., and in the mills, factories, and engine room a temperature of 115-120° F. is often recorded. The temperature of water available for condensing purposes during the hot months, even when taken direct from the river or other sources of supply, often reaches 95° F., with the result that in the case of turbine plant, the economical steam consumption of which depends so largely on a good vacuum, it is essential to install condensing plant of a much larger capacity than is usual at home.

The effect of these adverse climatic conditions on the insulation of electrical apparatus for high-tension plant recently led to a controversy as to whether it was advisable to install 6,000-volt motors, at which pressure a supply of electricity for power purposes is available at cheap rates in two of the largest industrial centres in India, or whether it was preferable to interpose transforming plant, reducing the pressure to 500 volts for the supply to the motors. A large percentage of "burn-outs" on low-pressure motors (220-500 volts) has been directly traceable to the humidity, and it was thought by a number of engineers that the installation of high-pressure motors would be coupled with the risk of a still greater number of breakdowns due to this cause. It seems, however, to the author that the insulation on the average low-tension motor to prevent internal short-circuiting between successive turns due to the difference of potential between them, is insufficient to prevent the percolation of moisture from an external source, whereas the insulation necessary on 6,000-volt mains to prevent internal short-circuiting due to the potential difference between successive layers, is more than sufficient to prevent the percolation of moisture from an outside source. The author has in many cases supervised the installation of motors to run at 6,000 volts, and, with one exception, excellent results have been obtained.

Another factor which has hampered the development of electricity for industrial purposes in India during recent years has been the lack of English capital for projected industrial enterprises for utilising either water power or coal near the pit's mouth for the generation of electric power for transmission at a cheap rate for mill and factory use.

In the collieries of Bengal, which raise no less than 12,000,000 tons of coal per annum, a sound practical scheme was projected a few years ago for the centralisation of a power house for supplying electric power to the collieries in general, but owing to the lack of both capital and co-operation between colliery owners, the scheme fell through, with the result that there are now scattered over the coalfields a number of small electric power houses working with both unfavourable power and diversity factors, so that the economy it was hoped to achieve by the use of electric power, has to a great extent not been realised. The coal consumption at the collieries indicates that at least 85,000 b.h.p. is awaiting electrification.

Another favourable project which fell through owing to lack of capital was the Mourbhunj water-power scheme, which contemplates harnessing the water power available at Mourbhunj for providing a cheap source of electric supply to the mills and factories in and about Calcutta. Taking into consideration the fact that the 85 mills at work in the vicinity of Calcutta utilise altogether approximately 100,000 i.h.p., the success of this scheme would have been assured, as it is quite possible that had capital been forthcoming, substantial guarantees would have been obtained from the mills and factories for the supply of current to replace existing steam plant. It is an encouraging fact that the Tata hydro-electric scheme has been realised in Bombay, but it is to be regretted that the whole of the capital had to be found in India after an opportunity had been given to English capitalists.

Had the money been found in England there is little doubt that arrangements could have been made for the installation of English plant, whereas with the exception of the motors and transformers for the mills, the whole of the 60,000 h.p. of generating and transmitting plant has been purchased from the Continent and from America (see Table I).

There is, however, no doubt that the visit of His Majesty King George to India in 1911 served in a large measure to focus the attention of the British public on the country, and from the glowing reports which appeared at the time on the prosperity of the country and its development, it is to be hoped that financiers will have at last realised that the resources of India offer a reliable and safe investment for capital.

(To be continued.)

LOAD FACTOR, OUTPUT AND COST.

By C. ASHMORE BAKER, A.M.I.E.E.

In the field of electricity supply, when one attempts to compare the economic results of one undertaking with another, one finds the most astonishing discordance between concerns working under substantially similar conditions as regards matters of primary importance such as size, load factor, locality, &c.

Take, for instance, two towns, A and B. Both inland provincial towns, outside the coal areas, both municipal undertakings, both giving three-wire direct-current supplies at approximately the same voltage, both having maximum loads equal within 10 per cent., and almost exactly equal load factors, and yet the working expenses per unit sold are in one case over 50 per cent. higher than they are in the other.

Again, compare A and C, whose load factors are not very different, 17·6 and 16·7 respectively, and yet although their maximum loads vary as 1 : 22, their respective total working costs vary only as 1 : 1·13 (13 per cent.).

I mention these facts for the purpose of drawing attention to the danger of comparing one undertaking with another, or with a relatively small group of others selected according to some particular plan.

In order to obtain a knowledge of the relative economy of any undertaking, it should be compared with a very large number of other undertakings, so that the influences of purely local or psychological conditions may become negligible

It is the object of this article to suggest means for such comparisons, to illustrate methods of applying them, and to draw attention to some of the more interesting results thus obtained.

Influence of the Size of Undertaking on its Working Costs.—The data I have made use of in preparing this article are those comprised in the annual tables of the *Electrical Times* for the year 1911-12.

If we take two columns of these tables, such, for instance, as maximum load and total working costs per unit, and if we plot them on squared paper, it will be obvious at first glance that although the variation from the mean may be considerable in the case of any one undertaking, there is, nevertheless, a tendency for the two co-ordinates to be related in a definite way, which might be represented by a mean curve drawn through the points plotted.

We can obtain a closer approximation to what this mean curve should be like, if, instead of plotting each undertaking separately, we plot the averages of similar groups. Taking the returns already alluded to relating to local authorities, and omitting all such undertakings as purchase a supply in bulk, we have a list of some 200 concerns. Arranging these in the order of their maximum loads, and subdividing them into groups of 10 consecutive towns each, we can plot the mean load of each group of 10 towns against the mean of their total working costs; this will give us the points plotted in fig. 1.

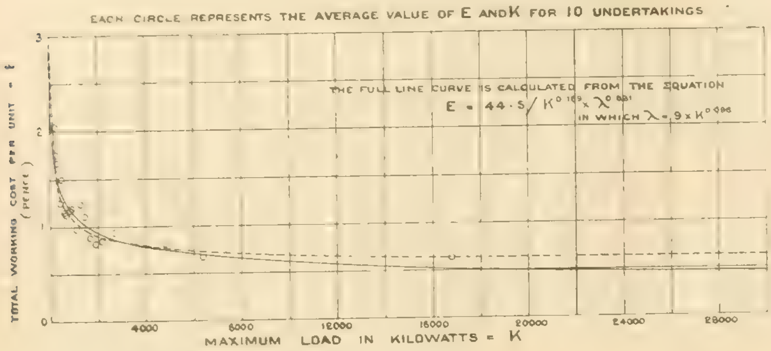

Fig. 1.

In this diagram, although the values plotted are still somewhat irregular, they indicate that a mean curve drawn through them would show a close family resemblance to an hyperbola. If instead of plotting our co-ordinates directly we plot their logarithms as is done in fig. 2, it at once becomes obvious that the relation between the co-ordinates is so nearly a straight-line law that any departure therefrom is not of great importance. Now it is a simple matter to find the mean of a number of co-ordinates following a straight-line law. All we have to do in this case is to divide our undertakings into two groups, one containing the 100 larger concerns, and the other the 100 smaller ones. For each of these two groups we add together the logs of all the maximum loads and likewise the logs of all the working costs; we then divide each of these four totals by 100, and we have as the result two pairs of co-ordinates which we can plot on our squared paper (A and B, fig. 2). A straight line ruled through these two points represents the mean of our separately plotted co-ordinates. The empirical law connecting maximum load and cost per unit sold (neglecting for the moment the influence of load factor) for municipal electric supply undertakings is found by projecting the straight line back until it intersects the vertical ordinate representing zero on the horizontal scale, and calling E the cost per unit sold and K the maximum load in kilowatts, we have—

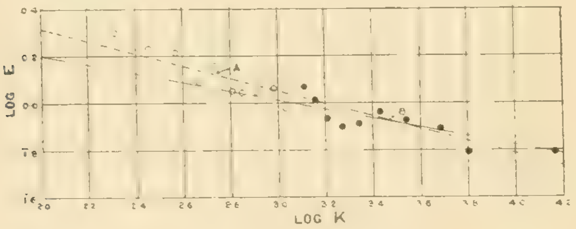

Fig. 2.

$$\text{Log } E = 0{\cdot}84 - (\log K\ 0{\cdot}265),$$

or

$$E = 7/K^{0{\cdot}265} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

But here a digression is necessary. The cost of production is influenced by the load factor of any given undertaking, as well as by its output—so much so, that it is useless to attempt to establish any standard of comparison which does not take this influence into account.

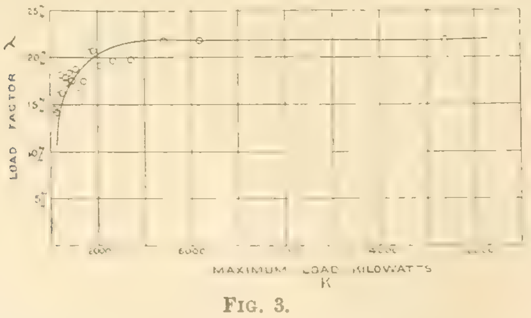

Fig. 3.

We may ascertain approximately the influence of load factor on the cost of production in a manner similar to that employed for ascertaining the influence of maximum output, namely, by setting down our list of towns in the order of their respective load factors, instead of in that of their respective loads. But there is a distinct relation between "maximum output" and "load factor," as will be seen from an examination of fig. 3, in which are plotted as co-ordinates the mean maximum loads of our 20 groups of towns and their corresponding load factors (indicated by the symbol λ). In order to discover the influence of λ on the cost of production, we must be able to eliminate the influence of K and *vice versâ.*

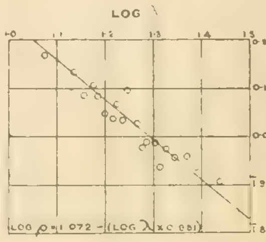

Fig. 4.

Now, it will be seen on examining fig. 3 that for plants above a certain size, the load factor does not vary much as a function of output, thus for the first three groups of towns its average is constant at 21·7 per cent., while the whole of the first 10 groups comprising 100 undertakings give an average load factor of over 20 per cent. If, therefore, we calculate our K E formula afresh from the results obtained by these 100 undertakings, we shall obtain an equation connecting E and K, in which the disturbing element λ enters to a negligible extent.

This equation is $\log E = 0{\cdot}577 - (\log K \times 0{\cdot}189)$,

or

$$E = 3{\cdot}78/K^{0{\cdot}189} \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

and the logarithmic graph is represented in fig. 2. Here it will be seen that the full line which represents this equation passes through the mean of the first 10 points, represented by dots; the remaining 10 points represented by open circles, and composed of groups of towns having generally somewhat smaller load factors, fall above the full line.

We are now in a position to study separately the influence of load factor on the working costs, and for this purpose we can employ, as has been said, the same method as that adopted for studying the influence of maximum load.

Thus, if we re-arrange our towns in groups of 10 in the order of *load factor*, commencing with the highest load factors, we again obtain 20 groups of undertakings, each of which will give us a pair of co-ordinates, but in these co-ordinates the disturbing influence of maximum load comes in, because the average value of the load is not the same for each group. If, however, we calculate from equation (2) what the cost should be with the average load factor of the 100 largest undertakings, and divide the actual average cost by this calculated figure, we shall obtain ratios varying from group to group according to the mean load factor of each group, which ratios can be plotted as co-ordinates of their corresponding load factors. The logs of these co-ordinates are plotted in fig. 4.

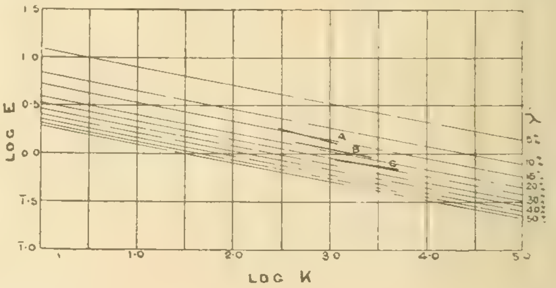

Fig. 5.

The equation corresponding with this diagram, calling ρ the ratio of the actual to the calculated value of E, is

$$\text{Log } \rho = 1{\cdot}072 - (\log \lambda \times 0{\cdot}83), \text{ or}$$
$$\rho = 11{\cdot}8/\lambda^{0{\cdot}831} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

The quantity ρ is obviously a coefficient by which we must multiply a result obtained from equation (2), in order to make due allowance for the influence of load factor.

These two equations combine into the expression

$$E = \beta/(K^{n} \times \lambda^{\eta}).$$

in which E is the total cost of production per unit sold, β is a constant representing the value of E when K and λ are unity, and n and η are powers of K and λ respectively. Giving β, n and η their numerical values, we obtain the equation

$$E = 44{\cdot}5/(K^{0{\cdot}189} \times \lambda^{0{\cdot}83}) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

From this equation a diagram (fig. 5) has been prepared, showing the logarithms of E for various values of K and λ. It will be seen from this diagram that for each value of λ a straight line slopes downward from left to right. The height of its intersection with the ordinate representing 0 is obviously the calculated value of E when K = 1, viz., $\beta/\lambda^{0\cdot831}$, while the slope of the line (that is, the vertical distance of any point on it below the point of origin divided by the horizontal distance of the same point from zero) is 0·189.

Component Items in the Cost of Production.—The method we have employed for discovering an equation correlating the total cost of production per unit sold with K the maximum load for the year, and with λ the load factor, may be employed in an exactly similar manner in order to obtain analogous equations, correlating K and λ with the separate heads of expenditure of which E is made up.

It is not necessary to enter into the details of these calculations. It will be sufficient for the purposes of this article if the results are available. These are given in Table I, in which the constant β and the exponents n and η of K and λ respectively are given for each item. These data are calculated from the averages of 200 municipal undertakings.

Symbol.	Description of item.	Log β	β	n	η
F	Coal and other fuel	0·694	4·95	0·193	0·418
O	Oil, waste water and stores...	0·314	2·06	0·351	0·584
W	Wages of workmen	1·394	24·8	0 332	0·951
R	Repairs and maintenance ...	0·716	5·19	0·125	0·894
T	Rent, rates and taxes ...	0·267	1·85	0 092	0 821
M	Management, salaries, office and legal expenses, insurance, &c.	1·470	29·5	0·251	1 174
E	Total working costs... ...	1·649	44·5	0·189	0·831
P	Average price received (total supply) ...	1·949	88·9	0·112	1·027

As an illustration of the use of this table, suppose we wish to find out if the cost per unit for, say, fuel, in a concern in which we are interested is above or below the municipal average.

The maximum load and the load factor we will assume to be 3,000 KW. and 16 per cent. respectively, while the actual cost for fuel is, let us say, 0·3d. per unit sold.

Now the average municipal cost is—

$$F = 4\cdot95/(3{,}000^{0\cdot193} \times 16^{0\cdot418}),\ \text{whence}\ F = 0\cdot331.$$

The fuel costs for the undertaking in question are thus (0·3/0 331) × 100 = 91 per cent., or 9 per cent. below the general average.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Cab Signalling.

In view of the large number of mistakes that have been made by the Board of Trade and the railways respecting electrical signalling equipment, Mr. Ogden's exceedingly informing letter is very opportune.

Since Mr. Ogden's criticisms appeared, one technical journal has named the British railways that have adopted or tested cab signalling systems of various sorts. But judging from well-known facts, one is tempted to marvel at the unscientific and unbusinesslike way in which the railways and the Board of Trade have handled this matter.

If a real and satisfactory preventive of a certain numerous class of wrecks still remained undiscovered, one could understand why British railways in some instances had adopted, and in other cases were still experimenting with, very faulty kinds of cab signals. But inasmuch as a genuine preventive has been known to railway officials for at least four years, and to thousands of other persons for about half that time, two things are, to put it mildly, quite strange. One is that no railway has even tested the only satisfactory cab signal extant; the other is that no Board of Trade Inspecting Officer has ever taken the trouble to recommend a trial of this signal.

Some time ago, one technical editor published, as his own opinion, the statement that Mr. Dammond had "the sanest ideas" as to cab signals that he (the editor) had ever seen presented. Those who, like myself, saw Mr. Dammond's full-size tests, and have no interest in any signalling system, are strongly of the same opinion.

I think Mr. Acfield knows very well that Mr. Dammond has "made an advance" on the Great Western cab signal. Why, then, has the Great Western been allowed, and the Dammond refused, a test on the Midland Railway?

Along with other visitors, I was invited by Mr. Dammond to produce as many earths as we wanted in his full-size equipment. We did so, and every resulting error was a safe one. We were also invited to produce any number and any combination of earths and open circuits we wanted; and we did not get a dangerous error any time we tried. Has not Mr. Acfield had the same opportunities as we to test the Dammond system?

Will the "railophone" or the Great Western equipment on the Midland Railway pass these important tests?

May 24th, 1915. **Traveller.**

Cable Shortage.

I happened to visit a job the other day (a three-phase one) and found two men about to pull in six 7/14 cable into two pipes. The total length of the pipes was 54 ft. 2 in., and allowing very sparingly for tails at main switch, motor and starter, I decided to cut each length 55 ft. — 6 × 55 ft., being a complete 110-yard coil. A coil of cable by a well-known maker was unwrapped, measured out and cut, but to my, I may say disgust, the last length only measured 42 ft. 7 in., making a total of 317 ft. 7 in., or a shortage of 12 ft. 5 in.

Out of curiosity I measured two coils of a smaller size and found one to be 1½ yards short, while the other one was actually 5 yards over. I should very much like to know how the cable makers arrive at the length before labelling the coils 110 yards. Is it weighed or measured? During these times of keen competition and dear material, every contractor requires his full pound of flesh, and 1,760 yards to the mile.

Coils of cable, such as the one I have described, may mean the difference between profit and loss, and I would be interested to find out other contractors' experiences in this direction.

If one item on the label is incorrect, namely, the length, what satisfaction is there in insisting on seeing the label for insulation resistance, &c.?

I trust that a few observations like this may lead to closer attention on the part of our manufacturers to ensure weights and measures, as well as their well-known quality, thus combining quantity and quality.

Contractor.

Automatic-Lift Accidents.

I am glad that such an authority as Mr. Frank Broadbent has brought up the subject of electric-lift accidents.

Lift accidents seem generally to fall under two headings, namely, those in which injuries are caused to persons by the opening of doors when the lift is away, and those in which injury is caused to the person in the cage or car. My experience goes to show that the latter are the more common.

As Mr. Broadbent has dealt with the first, I will confine myself to the second class.

First case. Car switch lift, serving four floors of offices. On one occasion, when the lift was ascending, the foot of a lady passenger projected beyond the edge of the car, and became trapped at the next landing. As a result the toes had to be amputated.

Second case. Full automatic push-button lift with gate contacts. A visitor accompanied by a boy ascended, the boy being told to wait in the lift. For some reason the gate was closed; it could never be ascertained whether the lift was called, or the boy pushed one of the buttons, but it was clear that he attempted to get out while the lift was moving, with fatal results.

Third case. This only occurred a few months ago, and may be described rather more fully. The lift in question was situated in a warehouse, and was chiefly used for packages about 2 ft. cube, averaging ¾ cwt. Its travel was about 100 ft. per minute, was controlled by a handrope, and worked by a regular attendant, a man rather past middle age, but quite able bodied. There were the usual double-pole switch and fuses in the basement, and an additional double-pole switch and fuses on the top floor, where the motor, gear, &c., were also situated.

On hearing a cry one day a man, working on the top floor, rushed over and opened the double-pole switch. The unfortunate lift operator was found so badly crushed between the floor of the cage and the landing that the flooring had to be cut away in order to release him. As life was extinct and there were no eyewitnesses, what actually occurred could only be conjectured, but what apparently happened was this: The cage was well loaded, the packages being placed on top of one another, leaving very little room for the operator. One of the packages appeared to have toppled over and knocked the attendant forward, possibly pinning him down or jamming the handrope, with fatal results. A fatality having somewhat similar features is recorded in the ELECTRICAL REVIEW, of May 21st, on page 728. Other instances could be given, but the two points I wish to raise are:—

First, that every lift should be fitted with gates to the cage or car, preferably with gate contacts.

Secondly, that the time is more than ripe for a clause to be embodied in the Home Office Regulations to cover electric lifts. Apparently as long as the motor is earthed and the fuses are not on the live side of the switch nothing else matters.

It is, perhaps, hardly necessary to mention that every lift should be periodically inspected by someone competent to do so.

London, W.C., *May 24th*, 1915. **Ernest F. Butler.**

P.S.—I should be glad to know if any reader has succeeded in maintaining an arc on a door or gate contact when opened. I often tried to do so, but have only been successful on one occasion.

In connection with Mr. Broadbent's excellent article under the above heading, which appeared in your issue of May 14th, we notice that he draws attention to two points in the design of electro-mechanical locking gear, which are capable of improvement:—

The first point is one which is easily overcome by placing the lever which actually locks the gates either at the "far" side or at the back of the car. This lever should rotate a shaft which is enclosed in a tube screwed into the lock, so that it is quite impossible to tamper even wilfully with the locking mechanism; such an arrangement is shown in fig. 1. The lock is fixed in the centre of the gate, as this is the point at which most force is applied; this is important, as with some locks fixed at the top of the gate it is often possible, by pulling at the lower end of the leading spigot of the gate, to bend it in such a manner as to release the catch.

The second point is the most important, as it is here that a real danger exists. In the majority of cases, and unless some special device, such as we illustrate in fig. 2, is fitted, it is possible for anyone to open a landing gate or door as the lift cage passes. To obviate this possibility, we have designed a "pilot" or "car switch," which, when rotated into the "up" or "down" positions, operates a movable "ramp" through the medium of Bowden wire mechanism, in such a manner that the "ramp" is raised, and the gate actually locked, before the lift moves away from the floor, also the gates on the floors which the lift passes are not unlocked, and it is thus quite impossible for an accident such as Mr. Broadbent has described to take place. The only gate which is unlocked is that on the floor at which the lift stops, and even this gate is not released until the lift has come to rest by the car switch handle being moved to the "off" position.

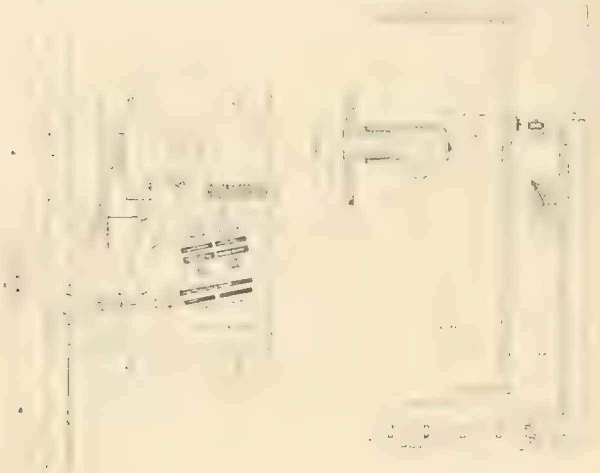

Fig. 1.

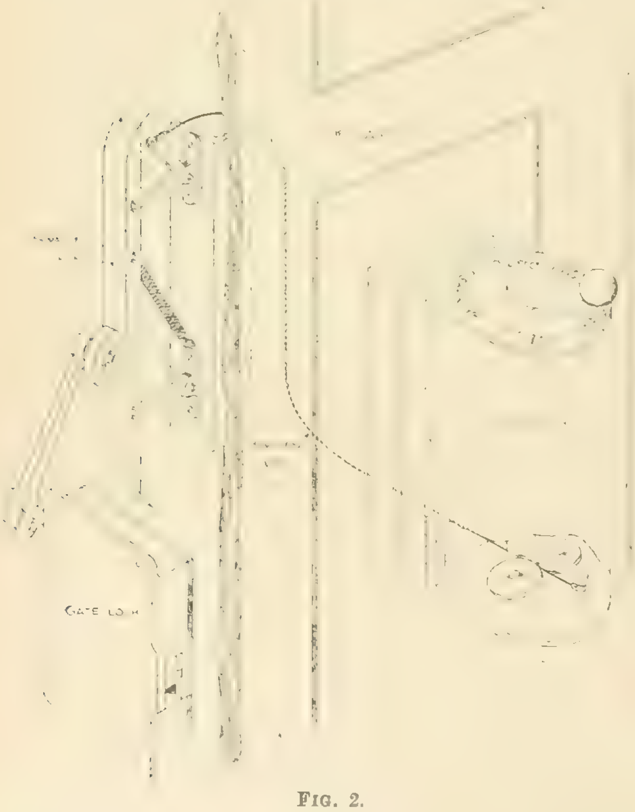

Fig. 2.

The same arrangement can be fitted to push-button lifts and the "ramp" can be lifted either mechanically by the closing of the inner cage gate, or by a solenoid.

It will be appreciated that this device is extremely simple and unlikely to get out of order, and it is, moreover, a purely mechanical job which could not be "short-circulated" by a lazy or incompetent engineer-in-charge. Unfortunately, however, these extra safety devices increase the first cost of the lift, and unless the purchaser is an engineer or employs a consulting engineer to act for him, the necessity and advantage of these safeguards is often not appreciated.

The defects which Mr. Broadbent calls attention to exist in a greater or less degree in the majority of lifts in this country, while, in addition, in many cases no lock of any kind is fitted, and when it is considered that the electric passenger lift is as much a public vehicle as say the motor-omnibus or taxi-cab, it is surprising that no special rules have been drawn up, to enforce the adoption and maintenance of suitable safety appliances.

For **Medway's Safety Lift Company.**
M. D. Scott.

London, S.E., *May 25th*, 1915.

The article in your this week's issue by Mr. Frank Broadbent does not do justice to the efficiency of the safety devices which are at present being used by the best makers. The form of door-latch indicated by his sketch is, doubtless, the prototype of these devices, but the existing mechanisms do not permit of the conditions arising which Mr. Broadbent rightly criticises. The requirements of a satisfactory lock are:—

1. It must be impossible to unlatch any door normally, unless the lift be at that door.
2. It must be impossible to move the car if any door be open.
3. It must be impossible to move the car from any door unless that door be latched.
4. It must be impossible to unlatch the door at which the car is standing immediately current is applied for moving the car.
5. It must be impossible to unlatch the door while the car is passing that door without stopping.
6. The car at the landing should put the mechanism in a permissible condition for unlatching the door without actually unlatching it. A manual operation must follow to unlatch the door.
7. The device must be independent of springs or other appliances for its safe functioning.

Devices are at present in use which fulfil all these conditions, and the writer ventures to suggest that had such a device been used the accident could not have taken place.

Surely this is an opportune moment for inducing some recognised authority to formulate a set of rules to which all lift makers must conform if they desire to have their lift passed for service. Such rules exist in a great many foreign cities, and are generally administered by the police. The London County Council could make itself the authority in this matter and insist that no lift be passed for service until it were officially inspected and approved, a procedure which this body has adopted in other instances where public safety is concerned.

Gilbert Rosenbusch.

London, S.W., *May 15th*, 1915.

INDIAN NOTES.

[From our Special Correspondent.]

Hyderabad (Deccan) is the premier Native State in India. It has an area of 82,698 square miles and a population of 13½ millions. The principal city is Hyderabad, and not far distant is the military cantonment of Secunderabad, where a British infantry regiment is generally located. Electric power was first made use of in the Nizams' palaces about 10 years ago. Additional plant was laid down from time to time, and now the capital city can boast of a very fine electric installation equipped on the most modern lines. It is expected that two new steam turbine sets, each of 1,500 kw. capacity at 3,300 volts A.C., will shortly be put into commission; these should be sufficient for all ordinary wants for several years to come. The greater part of the electric power is used for lighting and fans for the Nizams' palaces—of which there are several.

The Mint and State workshops also consume a fair proportion of the output, and the private consumer and street lighting call for a considerable load. The street lighting is on the glow lamp series principle, with constant current transformers in circuit, and automatic "cut-ins" in case of failure of individual lamps. Most of the principal streets of both Hyderabad and Secunderabad are lit with very satisfactory results. Mr. Gamlen is responsible for the design and lay-out of the modern part of the electric equipment, and has carried out his work in a highly commendable manner. In his twofold capacity as mint master and chief electrical engineer he is a tremendously busy man, and gives the State the best that is in him.

A huge dam is now being built not far from the lake to impound the surplus water of an extensive catchment basin. Primarily this is intended to prevent the possibility of any further floods—such as the colossal one of a few years back, which caused untold damage to life and property; incidentally, it is expected that the water throttled back by this dam may at some time be used as "white coal," and turned to account hydro-electrically.

From the size and population of Hyderabad State it may be thought that large possibilities of electrical business should present themselves; but just yet this is not so. The population is mainly agricultural, growing cotton, rice and general foodstuffs. There are a few manufacturing industries such as spinning, weaving and ginning mills, but these are in a comparatively small way. Under the sway, however, of a progressive ruler, whose word is absolute law, one may expect developments in electrical as well as in other engineering lines.

THE POWER SUPPLY OF THE CENTRAL MINING-RAND MINES GROUP.

Mr. J. H. Rider's paper, of which we have published an abstract in recent issues, was discussed at a meeting of the Yorkshire Local Section of the Institution of Electrical Engineers at Leeds on Wednesday, May 12th.

Mr. Wright said he felt, as a manufacturer, that there were a good many points of great value in the paper, for the reason that it was often said that manufacturers' failings, especially in regard to plant and switchgear, were particularly to be found in the fact that they limited their experiences to the actual process of manufacture, and not to the actual working of the machinery and switchgear which they produced. Therefore, the failures mention in the paper were of great value to manufacturers of plant. It was often the practice of manufacturers of three-phase motors to earth one of the slip rings, but he assumed that that method would not be allowable in any of the motors installed on the supply dealt with by the author, for the reason that if they had an earthed slip ring and a liquid starter, when they started up they would have one of the phases short-circuited. He did not think it was good practice to earth one of the slip rings. With reference to the dimensions of the minimum radial air gap, it worked out as a very fair average for moderate speed motors, but he did not quite understand the last figure in the formula, namely, "minus .25."

Mr. Burnand said he had been interested in the braking with reverse current on the three-phase motors. The amount of energy wasted for the purpose of braking was really very large, and he wondered if the author had had any experience of putting direct current on to the primary of the three-phase winding motor; by that means they got quite an efficient brake, though he doubted whether they would brake down to quite as low a speed as they would be using the eddy-current brake described in the paper. The saving of energy would, of course, be very great—they would only use, perhaps, about 5 per cent. of what was used by reverse current braking. He did not care very much for carbon brushes on the slip rings, preferring copper cores impregnated with graphite. With regard to oil rings, it was always desirable to be able to see the rings move, and there ought to be at least two rings. From the rather painful record of troubles, it appeared that the motors were all supplied by firms of world-wide repute, and he thought the fact that troubles such as the author had mentioned were possible, pointed to a very loose and unbalanced organisation. Many engineering works were run by commercial men rather than by engineers, and if the latter had control they would get a better balanced system of inspection and supervision than had previously been the case.

Mr. Shepherd said they were indebted to the author for giving them such a full and candid opinion of the troubles which he, in common with all users of large plant, had found. With the experience which people had had now there was no excuse for any motor having a frame which was not of sufficient stiffness, particularly when such machines were subject to rapid reversals. Soft or loose cores were quite inexcusable. He knew of several cases where very large plants had given way owing to the external dovetail keys being insufficient in size and insufficiently secured in the circumferential frames to which they were attached. He had always insisted on the core plates being secured to external dovetails, and, as a further precaution, he had always found it better to fill in all spaces—if there were any between the keys —with white metal. He thought other people should follow the author's example in giving descriptions of plant which gave trouble or, rather, descriptions of the trouble experienced, because then engineers could soon come to some definite opinion as to what plant was good and what was bad.

Mr. Yerbury said he was pleased the author had mentioned the troubles he had experienced. He recalled instances of motors with too fine clearances, and in which the slip rings had been made of what appeared to be yellow brass instead of iron or gun metal, and where springs had entirely failed in brush-holders in a short time owing to dust accumulating in the holders. With regard to starting and running resistances, he found in many cases that there had not been a sufficient clearance for air—instead of its being properly circulated it had become stagnant. He was glad the author pointed out the desirability of modifying the proposals of the Engineering Standards Committee with regard to machines and apparatus designed to work within certain limits of pressure. He had had experience of rheostats failing when the pressure was reduced, owing to over-heating having taken place, and had always found that an ample margin of copper and attention to small details had proved a very desirable investment.

Mr. Thackery drew attention to the question of who decided the purchasing of the machinery in South Africa; he supposed it was purchased against the specification which somebody had drawn up. He did not think it was altogether the manufacturer who was at fault, because if he put forward against a specification what was demanded, the order generally went to the lowest tenderer, and if there was no specification that the manufacturer was working against, it would not be wise for him to put in big air gaps and open slots, because he would lose the order on price. It was far better to have a motor which would stand rough usage than one which was very highly efficient, because the cost of repairing the machine was so much more than the extra cost of a reliable motor.

Mr. McClay said the author did not tell them whether the mining companies found the change-over from steam to electric operation financially advantageous. No doubt, from the power company's point of view, the whole thing had been financially successful, but he would like to know what it had been from the consumer's point of view. In this country they found it extremely difficult to persuade people to use electricity and to convince them of the savings to be effected by so doing, and he would like to know how they had done it on such an enormous scale in South Africa.

The Chairman (Mr. T. Roles) said he would like to know how the concerns for which the author had acted, viewed the matter of buying current from a power company as against providing plant of their own. In Yorkshire they often had great trouble in persuading large power users to obtain their supply in bulk from a power supply undertaking, and the private plant still flourished to a very great extent, notwithstanding the fact that prices for current were in many cases very cheap. He agreed with the author in regard to having a proper reserve of generating and transforming plant. Many undertakings had experienced trouble owing to having a very small margin of plant, and many corporation undertakings had been starved of the necessary plant to keep up a proper supply, and had had to pay for it as a result. His idea of reserve plant was that in the case of, say, four turbines, they should have one machine always standing by and another one which could be taken down for repairs at any time.

Mr. Rider, in replying to the discussion, said he had never come across a slip-ring motor with one ring earthed. He had not tried using direct current on three-phase stators for braking, because he considered that the complication was too great and he would have had to use a motor generator. If he had to go in for direct current at all, he would rather have a Ward Leonard winder and have done with it. The troubles he had mentioned taught a great deal if approached in the right spirit. Regarding Mr. Burnand's remarks as to the running of engineering shops, he did not agree that if they were run by engineering men instead of by commercial men things would be better. It all depended on the experience of the engineer. It was no good for an engineer who had experience only in the shops as a designer or as a manufacturer, to think that he knew all about the way to manufacture—that was, to produce a machine which would be satisfactory to the purchaser. The man might know a great deal more about manufacturing than the consumer, but it seldom happened that he knew anything at all about the way a machine which he produced behaved in after life. If engineers who designed machines had to be in responsible charge of a few of them for six months, with the threat of the "sack" if they broke down, they would, he thought, alter a good many of their designs. As the charge for energy was irrespective of power factor or load factor, or anything of that kind—merely a flat rate being charged—the question of maximum demand did not come in at all; all they had to do was to give the power company notice when they were putting down any new plant on the mains, in order that the supply could be ready. If a motor would not last for 15 years it was not worth buying. The point raised by Mr. Thackery as to the purchasing of machinery was an important one. Why should a purchaser be blamed by anybody for taking the lowest offer? The purchaser came into the market and said to a body of presumably respectable contractors: "I want to buy such-and-such an article." He stated his requirements as clearly as he could, and said to the manufacturers—who said they knew all about manufacturing and the way the machine should be made—"What is your price?" The manufacturers fixed the price; not the purchaser. If a manufacturer came along and said: "I want £500 for that machine, and it ought to be £600," it was that man who was the dishonest one, and not the purchaser. If £600 was required for the machine, that amount should be asked for, and if a manufacturer came in and asked for £500 he was playing a low-down game on the purchaser in order to get the work for his shop, knowing he would give something that was not good. If the purchaser had a price put to him by the manufacturer he ought to be able to assume that he was dealing with an honest man, and was justified in taking the lowest price. In his own opinion an efficient machine was one which would do its work day in and day out as long as he wanted it to do it, and would not break down. In reply to Mr. McClay, he said that the change over from steam to electricity and from the old mine steam-driven compressors to the central air supply had been most successful from a financial point of view, and it absolutely founded the advisability of taking energy in large quantities from a respectable power company, he could assume then they need have no further hesitation at all. The firms looked upon the question of buying power from a company instead of getting it from their own plant from the point of view that if they put down a power station to electrify their mines it would cost, say, £750,000, and they could employ that money better in developing their mines. Therefore, they used the money in the mines, and the power company was left to raise the extra capital, and the firms bought their supply from the company. He thought that was a wise view to take, and he would always recommend anybody, if the circumstances were at all similar, to do the same thing. He expressed his agreement with the Chairman as to the desirability of having a reserve of generating plant of about 25 per cent.

THE BOMBAY HYDRO-ELECTRIC SCHEME.

(*Discussion in London on paper read by* Mr. Alfred Dickinson, M.I.E.E., *before the* Institution of Electrical Engineers, *April 29th*, 1915.)

The discussion in London was opened by Mr. Robert Hammond, who congratulated the author on a paper covering so many branches of engineering. The turbine plant operated under one of the highest heads so far used; it would be interesting to know why such a high transmission pressure as 100,000 volts had been adopted for such a short distance, and to what extent a saving in line copper balanced more expensive apparatus as compared with, say, a 60,000 or 70,000-volt line. He thought the vertical shaft type of Pelton wheel allowed of more nozzles being used than was the case with the type adopted. In America, he believed there had been trouble with the swinging of lines carried on suspension insulators.

Mr. T. Callender thought Bombay was to be congratulated on having such a scheme at its door, and on having made up its mind to do better than the conditions existing in English and Continental manufacturing cities and to preserve its beauty.

Mr. J. H. Rider regretted that so much of the plant was of foreign origin; he also thought that a great deal was risked in going in for such a high transmission pressure, and that the efficiency was not improved. There appeared to be a drop of 14 per cent. in line pressure, and that did not agree with a line efficiency of 93 per cent. mentioned. Two separately driven exciters were used, but if one were shut down, and the one running failed, the station would be shut down. Why were not the big units provided with their own exciters? Would it not have been better to use the same voltage for exciters and switch control, so that the battery for the latter could have been used as a stand-by for both services? From experience, he considered belt-driven governors an abomination; they should be direct driven, but the turbine makers apparently would not do this. The author appeared to have deliberately avoided earthing; on the Rand, owing to lightning, they had been driven to earthing at several points. The seven-strand transmission cable offered more surface for corrosion than a single cable. He noted that six-unit insulators were used; the same number of units were employed with only 80,000 volts on the Rand.

Mr. E. Doelly said the belt-driven governor was usual, although the rigid drive had been tried; maintenance trouble arose in the latter case from the transmission of shocks. The security of the pipe joints was due to the water pressure, and this type of joint had been used for over 2,000 ft. head.

Major-General Beresford-Lovett said this was the first instance of such a scheme being financed on commercial lines in India; the promoters had tried to raise the capital here, but had in the end to obtain it in India. They were wise in obtaining expert advice as to the site of the dams, as an earth fissure might wreck such a scheme; they were also fortunate in being able to rail their plant from the docks to the power house, as this was not usual in India.

Mr. G. V. Twiss congratulated the author on the transmission tower construction; he would have been satisfied with a test to three times working load. He thought the insulator system used on the Rand transmission was of the interlinked suspension type, which was 20 per cent. less effective than the type of suspension insulators used by the author.

Dr. Railing said he supposed the low cost of labour had a great deal to do with the practicability of the scheme. It was an instance of diversity factor at the generating end; the water was stored during three months and used over twelve months. Judging from the data given, the temperature rise allowance in the field coils of the machines at the receiving station seemed fairly high; he would be interested to know the power factor of the line with a view to ascertaining the efficiency.

Mr. G. F. Sills said in America single-phase transformers were usually adopted, possibly for ease of transport, and this practice was followed by the author, although it would appear that three-phase transformers were cheaper. He assumed that there had been some trouble in regard to right-of-way for the transmission. In Canada, the Hydro-Electric Commission had had to divert its 110,000-volt transmission route at Toronto to avoid crossing certain places, and the towers were placed in Lake Ontario.

The Author, in a short reply, pointed out that a scheme of that magnitude could not possibly have been carried out except by a combination of specialists, and any credit must be shared by those who had controlled the various sections of the work. In the lake area, as much as 540 in. of rain had fallen in 90 days, but some years it was much less. It was found that the valleys were full of land crab holes, indicating that water was always there, and this was one reason for the use of the sites chosen for the dams.

Petrograd Telephone System.—The Petrograd telephone concession lapses in 1919. Down to 1/14 January, 1914, the development had cost 9,195,303 roubles. The decision as to its further exploitation must be taken in 1916. It is calculated that by 1/14 November, 1919, the subscribers will number 75,000, and a further concession, say for 18 20 years, should be based on 150,000 subscribers by the end of that time.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

6,971. "Cut-out device for dual aeroplane controls." G. Stannard. May 10th.

6,980. "Joint for an electric cable." A. E. Tanner & E. A. Claremont. May 10th.

6,991. "Short-time switch." Landis & Gyr Akt. Ges. May 10th. (Convention date, May 23rd, 1914, Germany.) (Complete.)

6,997. "Dynamo-electric machinery." Siemens-Schuckertwerke G.m.b.H. May 10th. (Convention date, May 11th, 1914, Germany.) (Complete.)

7,006. "Electrical toasting devices." E. C. R. Marks. May 10th. (Landers, Frary & Clark, United States.) (Complete.)

7,013. "Dynamo-electric machines, particularly applicable for engine-starting systems." C. F. Kettering & W. A. Chryst. May 10th. (Divided application on 13,022/14. Convention date, July 14th, 1913, United States.) (Complete.)

7,016. "Process for the manufacture of tapes containing parallel electric wires." A. de Capitani. May 10th. (Convention date, May 9th, 1914. Italy.) (Complete.)

7,080. "Electrical apparatus." British Thomson-Houston Co., Ltd. May 11th. (General Electric Co., United States.)

7,081. "Electrical apparatus." British Thomson-Houston Co., Ltd. May 11th (General Electric Co., United States.)

7,088. "Electric horns." A. H. Midgley & C. A. Vandervell. May 11th. (Complete.)

7,092. "Controlling means for electrically-propelled vessels." Svenska Turbinfabriks Aktiebolaget Ljungstrom. May 11th. (Convention date, September 17th, 1914, Sweden.) (Complete.)

7,112. "Thermostats." H. E. Moul. May 12th.

7,177. "Switching-over apparatus for electrical lighting installations for railway trains and the like." H. Grob. May 12th. (Complete.)

7,178. "Sparking plugs." E. N. Kennedy. May 13th.

7,206. "Electric starters for internal-combustion engines." A. H. Midgley and C. A. Vandervell. May 13th. (Complete.)

7,211. "Electric circuit controlling devices." British Thomson-Houston Co., Ltd. May 13th. (General Electric Co., United States.)

7,213. "Electric cell, battery, or refill for use in connection with portable electric lamps and for other purposes." L. Wahl. May 13th.

7,223. "Control gear for electric starters for internal-combustion engines." E Aron & E. Hill. May 13th.

7,239. "Electric switches." R. W. Bill. May 14th.

7,244. "Means for starting electric motors." G. A. Yarwood. May 14th. (Complete.)

7,263. "Apparatus for pneumatic conveying of solids." British Thomson-Houston Co., Ltd. May 14th. (General Electric Co., United States.)

7,269. "Apparatus for the calculation of mathematical problems arising in the transmission of electric power." W. D. Reid and Callender's Cable and Construction Co., Ltd. May 14th.

7,270. "Electrical measuring instruments operating on the Ferraris or induction principle." E. Fawssett. May 14th. (Complete.)

7,271. "Improvements in electric meters for the purpose of compensating for temperature variation." E. Fawssett. May 14th. (Complete.)

7,280. "Switches." V. Breeze and Allen, West & Co., Ltd. May 14th.

7,283. "Means for employing the exhaust heat of thermo-piles for heating purposes." J. Marschall. May 14th. (Divided application on 6,102/14, March 10th.) (Complete.)

7,297. "Electric lamps." E. P. Morriss. May 15th.

7,304. "Combined formers and heaters for electric radiators and the like." G. Bourne. May 15th.

7,308. "Electric switches." G. Webb. May 15th.

7,311. "Combined interruptor and rectifier for the production of unidirectional high-tension impulses of large capacity as used for X-ray work." A. C. Gunstone. May 15th.

7,316. "Means of controlling power apparatus driven by internal-combustion engines." Thomas Transmission, Ltd., & J. G. P. Thomas. May 15th. (Addition to 2,245/15.)

7,320. "Refining steel by electrical means." S. F. Barclay. May 15th.

7,324. "Ships' stokehold and analogous telegraphic apparatus." W. Chadburn & Chadburn's (Ship) Telegraph Co., Ltd. May 15th.

7,341. "Method of, and apparatus for, measuring electric current." Landis and Gyr Akt. Ges. May 15th. (Convention date, May 18th, 1914, Germany.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

24,219. Dynamo-electric Machines for Lighting Vehicles. G. Inrig and Inrig, Ltd. October 25th. (April 27th, 1914.)

1914.

2,323. Electric Arc Incandescent Lamps. E. A. Gimingham. January 28th.

4,220. Support for the Heating Conductor of Thermic Telephones, and a Method for its Manufacture. P. de Lange & O. Fischer. February 18th. (September 8th, 1913 Addition to 4,184/14.)

8,842. Electric Cables. W. F. Price & Callender's Cable and Construction Co. April 7th.

9,558. Electric Switches. J. H. Tucker & J. A. Crabtree. April 17th. (Cognate application, 21,175/14.)

10,015. Electric Clocks. J. H. Parsons & A. E. J. Ball. April 23rd.

10,504. Electric Relay. W. R. Sykes Interlocking Signal Co. & R. W. Tarrant. April 28th

10,531. Electric Motor Control Systems. British Thomson-Houston Co. (General Electric Co.). April 28th

10,533. Alternating-current Track Signalling. B. H. Peter. April 28th.

10,534. Electrically-operated Point or Signal Actuating Mechanism. B. H. Peter. April 28th.

10,549. Relays connected with Electric Signalling in Mines and the like. H. Davies & Railing April 29th.

10,716. Printing Telegraph Receivers. A. F. Dixon. April 30th. (October 14th, 1913.)

10,775. Telegraph Transmitting Apparatus. S. Lyle. May 1st.

10,807. Selective Signalling Systems for Party Lines. Western Electric Co. (F. T. Woodward acting for Western Electric Co.). May 1st.

THE
ELECTRICAL REVIEW.

VOL. LXXVII. JUNE 4, 1915. No. 1,958.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: June 4, 1915. [No. 1,958.

Page

The Electrical Future of Belgium 781
The Rubber Position 782
The I.E.E. and the War 782
Mercury-Vapour Arc Lamps and Converters (*illus.*) 783
Anglo-Belgian Electrical Co-operation in Belgium 784
German Business Methods 787
War Items 788
Business Notes 789
Notes 794
Admiral Sir Henry Jackson, K.C.B, F.R.S, M.I.E E. (*illus.*)... 795
Electricity in Farming.—I. (*illus.*) 796
Carter Electric Ambulance for Durban (*illus.*) 799
Harry Gustav Byng (*illus.*) 799
Reviews 799
Some Notes on Shunt Regulating Resistances, by Thomas Carter (*illus.*) (*concluded*) 800
City Notes 803
Stocks and Shares 805
Share List of Electrical Companies 806
Metal Market—Fluctuations in May 807
Electric Power in India, by H. R. Speyer (*concluded*)... ... 807
Load Factor, Output and Cost, by C. Ashmore Baker (*illus.*) (*continued*) 808
New Electrical Devices, Fittings and Plant (*illus.*) 810
Correspondence—
  Cab Signalling 810
  Karachi (India) Tramways (Petrol) 811
Legal... 811
Institution of Electrical Engineers 812
New Patents Applied for, 1915 812
Abstracts of Published Specifications 812
Contractors' Column ... ... Advertisement page xx

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1–4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND, N.Z: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

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MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Trèves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT: Wm. Dawson & Sons, Ltd., Manning Chambers Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

NOW READY.

H. ALABASTER, GATEHOUSE & CO.,

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THE ELECTRICAL FUTURE OF BELGIUM.

THERE are in our midst a considerable number of Belgian electrical men who are waiting for the Allied Forces to drive out the somewhat firmly-entrenched invader. They naturally desire nothing so much as to return to their native soil, and resume as far as may be their former occupations; but while they remain with us they are anxious to turn to good account their expert knowledge of electrical affairs in Belgium. In that country, as in others, Germany played the card of economic domination in advance of military occupation. The gallant Belgian people, battered with mailed fist and trampled under foot meanwhile, will rise again, and in doing so they wish to snap for ever the shackles of domination of both kinds. We are strengthening our national organisation to break asunder those brutish military bands—what of the economic ones?

Reference to later pages of this issue will show that an effort has been made by Belgian gentlemen to secure the co-operation of British electrical firms in breaking the German economic hold upon Belgium's electrical trade. We are not sure that their preliminary effort was launched under auspices the most likely to secure success—indeed, we are not quite clear as to what those auspices actually are—but we believe that we represent the position correctly when we say that British electrical firms, whose co-operation is sought, and who at heart, we believe, desire to co-operate, can hardly have been aware of the existence of the movement. We do not for one moment believe that the electrical industry, however busy it may be making shells, would, as a whole, have cold-shouldered a meeting called by the electrical refugees of a nation for which we unanimously have so high a regard. Had the event been announced in time for us to notify our manufacturers and commercial men through the electrical Press, there might have been a reasonable number of British electrical men present to hear the excellent paper that had been prepared by M. R. Steylaers, and to show that as an industry we are not apathetic or disinterested in regard to the electrical future of the stricken country.

However, the slip that we suspect to have been made in the preliminary organisation need not, and should not, stand in the way of suitable fraternisation between Belgian and British electrical engineers, or prevent an adequate discussion of the situation as it was and as it ought to be, and of the best means for bringing definite and practical co-operative effort into being.

In order to assist to that end we have devoted space today to the publication of M. Steylaers's full statement, and we desire to ask our directors, principals, and managers of electrical businesses to study it with a view to discussion. It is proposed to hold a further meeting at which this paper shall furnish a basis for such discussion, and we hope that a goodly number of the aforesaid business men will find it convenient to attend and offer their observations upon the subject. It was obvious that our Belgian friends had somehow or other, somewhere or other, gained an unfortunate impression of the electrical manufacturers of this country, and if our firms had known of the meeting the impression might have gained some justification from the fact that they almost unanimously refrained from attending. Now the British manufacturer has quite enough to carry without being burdened with sins not his own, and we think that it will be as well if something can be done either by our electrical firms individually or through their organised body, to remove the opinion that we are not interested in the future of electrical trade and industry in Belgium.

We are not suggesting that the situation that presents itself is not one of great difficulty, but we do think that nothing is to be lost and everything is to be gained by presenting an open ear and engaging in a free and frank discussion of the problems with those who know the position so well from long and practical experience and who come to us asking for our co-operation.

On two points last week's meeting seemed to be fairly unanimous and emphatic. Belgium asks the British manufacturer to make for her what Germany has made hitherto—not simply what the British manufacturer has been in the habit of making; she also suggests that we shall "change our mind" and "change our methods," so as more hopefully to join forces with her and secure millions of pounds' worth of new business annually.

Will British firms listen to the appeal? We trust that they will do so, and if at all possible will take advantage of the opportunity. The time to consider is *now*.

The Rubber Position.

There was some interruption of business in crude rubber over the Whitsun holidays, but the market has held together very well indeed, a good portion of the improvement witnessed previously having been retained. Business has been fairly active, consumers taking supplies with a good deal of readiness, for they are running chock-a-block with Government orders for tires, and, indeed, for all sorts of material into the composition of which rubber enters. With the end of the month, however, the demand met with on the open market underwent a contraction, but this is always the case when expiring contracts are being adjusted, and a lull sets in pending a fresh movement. There has been lately a fully satisfactory demand for rubber on the part of American interests. There is not the least doubt that United States consumers are feeling the force of the war demands in great volume, and this necessitates the drawing upon the supplies of raw material which are in Europe to a considerable extent.

Rather a nervous feeling has manifested itself across the Atlantic lest there be any interruption in the shipments of material from here, and a distinct desire to cover future requirements has asserted itself. Large quantities of finished goods are being produced in America for shipment to Europe, but the precarious shipping facilities available, to say nothing of the dangers to navigation, have been acting as a deterrent factor in the forwarding of material. Possibly some day effective action will be taken against the Huns still at sea, and the waters cleared for the pursuits of peaceful vessels.

The reports issued by leading plantation companies indicate a steady improvement in the management of the estates. It is quite apparent that the comparatively poor times through which the companies have been passing have induced the exercise of an economy to which, in some cases, they were utter strangers in the heyday of the boom. Costs are now running lower, but there is a considerable divergence, which, however, is to be expected, between the returns of the better managed and more favourably situated concerns, and those which were floated as "ramps" upon the public.

An interesting report has just come to hand from the Acting Controller of Labour in the Federated Malay States, according to which the most notable feature during 1914 was the reduction in the labour force. The quarterly returns furnished to the Kuala Lumpur Labour Office showed a reduction in the Chinese working forces last year of 23,000, and a falling off in the Indian total of over 20,000. The fundamental cause is said to be the various economies introduced, arising from the relatively poor prices obtained for rubber and the consequent necessity of running plantations upon business lines. There was actually a decrease in the area of 474 selected estates of 25,000 acres, while it is rather startling to find that the area of cultivated land per labourer employed increased from 2·31 acres to 2·88 acres.

The F.M.S. cultivated rubber exports for March were 3,418 tons, making a total for the first quarter of 10,303 tons, against 7,323 tons for the corresponding period of 1914, an increase of 2,978 tons. The destinations were as follows:—

	March, 1915.	Jan.-March.	Corresponding period, 1914.
Straits Settlements ...	2,464	6,619	3,858 tons.
United Kingdom ...	921	3,407	2,860 „
Continent of Europe ...	—	1	357 „
Ceylon	33	180	199 „
Other countries ...	—	95	49 „
Total	3,418	10,302	7,323 „

The I.E.E. and the War.

That the Institution of Electrical Engineers has rendered valuable services to the military authorities during the war will be denied by none, and full credit should be awarded to the President, Council and staff for the really arduous tasks that they have been called upon to undertake, and have willingly performed; the amount of labour involved in these duties is not generally realised, and would astonish the members if they were fully informed regarding it. The desire of the members of Council to do everything within their power to forward the interests of their country is beyond question; yet they exhibit a strange reluctance to take any effective action in industrial matters, though these are second in importance only to the urgent requirements of the naval and military authorities.

In our issue of May 21st we quoted a paragraph from the Annual Report of the Institution, which indicated that a special Committee had been appointed by the Council "to keep in touch with the British Electrical and Allied Manufacturers' Association in regard to the question of securing for British manufacturers the trade hitherto done by Germany and Austria-Hungary." The appointment of a Committee to deal with trade questions was an admirable step, though the terms of its appointment were more than a little singular. As shown in the Report, the representatives of the B.E.A.M.A. deprecated any action on the part of the Institution, and the Committee came to the conclusion "that no useful action on the part of the Institution appeared to be possible." The Committee "remains in being for the purpose of advising the Council"—to keep on doing nothing, presumably.

We cannot but express our regret that, even in these strenuous times, the Council displays the same timidity, the same lack of backbone, the same mental paralysis that afflicted it in times of peace whenever that vulgar word "Trade" was mentioned in its hearing. Like the hermit crab, at the approach of an unwelcome visitor, it withdraws into its borrowed shell; on this occasion it seeks the shelter of the B.E.A.M.A. But why can it not act alone?

In the leader referred to above, we welcomed the revolutionary change that had been brought about in the attitude of the Government towards the world of science—a fundamental change that will, we hope and believe, exert a profound influence upon the future of this country in all matters pertaining to industry and trade. The Government announcement followed closely upon the visit of a deputation from the Royal Society, the Chemical Society, and the Societies of Chemical Industry and Analysts. Why had the Institution of Electrical Engineers no share in that deputation? Will the Institution offer its assistance in the nomination of the Advisory Council on Industrial Research? Does it contemplate any action in the matter at all?

In referring to this matter at the annual general meeting of the Institution, the President pointed out that the Council had been criticised on the score of its inability to act in industrial matters, and remarked that the decision that nothing could be done in this instance was arrived at with the full concurrence of the B.E.A.M.A. Things must be left to solve themselves. With all respect, we submit that this was neither an explanation nor an excuse, but rather an aggravation of the fault for which the Council has been taken to task. The assistance of the B.E.A.M.A. in doing nothing was hardly necessary. The trouble is that nothing is done.

MERCURY-VAPOUR ARC LAMPS AND CONVERTERS.

ALTHOUGH the mercury-vapour lamp, and its associate the mercury-vapour converter, have been widely used in this country, they have not occupied a prominent position in technical literature of late; we have, therefore, made inquiries as to recent progress in this branch of electrotechnics, and believe the results will be found of interest.

The mode of operation of the mercury-vapour arc is probably well-known to the majority of our readers; unlike the Moore light, it is a true arc between mercury electrodes in an exhausted container, maintained by vapour distilled or otherwise evolved from the mercury surfaces. When used for illumination, the arc passes through a tube of glass or quartz; at the end containing the anode a bulb is provided, which forms a cooling chamber in which the volatilised mercury is condensed, the anode consisting either of mercury, iron, or carbon, while mercury is always used in the kathode.

The arc is usually started by tilting the tube, when the mercury flows from kathode to anode and completes the circuit; on allowing the tube to fall into its normal position, the arc is struck and maintained by the vapour column. The tube may be tilted either by hand or by a magnetic device.

A momentary cessation of the current extinguishes the lamp, and therefore it cannot operate on a single-phase A.C. circuit; this difficulty, however, is ingeniously overcome with the aid of an autotransformer with its extreme terminals connected across the supply mains and to two anodes in the lamp, while the kathode is connected to the middle point of the transformer winding. Thus one or other anode is always positive to the kathode, and by suitable design it can be arranged that the current never falls to zero. With three-phase supply, the kathode is connected to the neutral point and the phases to three anodes. The accompanying illustration, fig. 1, shows part of a large installation of Westinghouse Cooper-Hewitt lamps, with automatic starting, recently put in at the premises of Messrs. Stretton & Sons, Leicester; there are in all 104 of these lamps, which, thanks to their low intrinsic brilliancy, shed a soft light free from glare and comfortable to work with. The chief objection to the mercury-vapour lamp is the green colour of the light, which, while it does not interfere with the effectiveness of the illumination for most industrial purposes, results in the suppression of the warmer tints, especially of red. This defect, however, can be largely neutralised by the use of reflectors coated with a preparation of rhodamine, a fluorescent substance which absorbs yellow, green, and violet rays, and emits red rays. It will be noticed in the illustration that the lamps are provided with these fluorescent reflectors, the effect of the combination being to produce a light which is practically white; were it otherwise, it would, of course, be quite unsuitable for use in a sewing room.

Another application to which the mercury-vapour lamp has been found exceptionally well adapted is photo-printing, the light being rich in actinic rays, while its colour in this connection is wholly immaterial to the user. Fig. 2 shows a single Cooper-Hewitt lamp mounted on a stand which enables it to be adjusted to any desired position; this lamp is of 2,000 C.P., taking 660 watts, and is used for photographic printing. Fig. 3 shows a swinging frame fitted with similar lamps, which is used for "transfer" photo-printing from drawings on paper not tracing paper—the light passing through the drawing-paper to the sensitised plate.

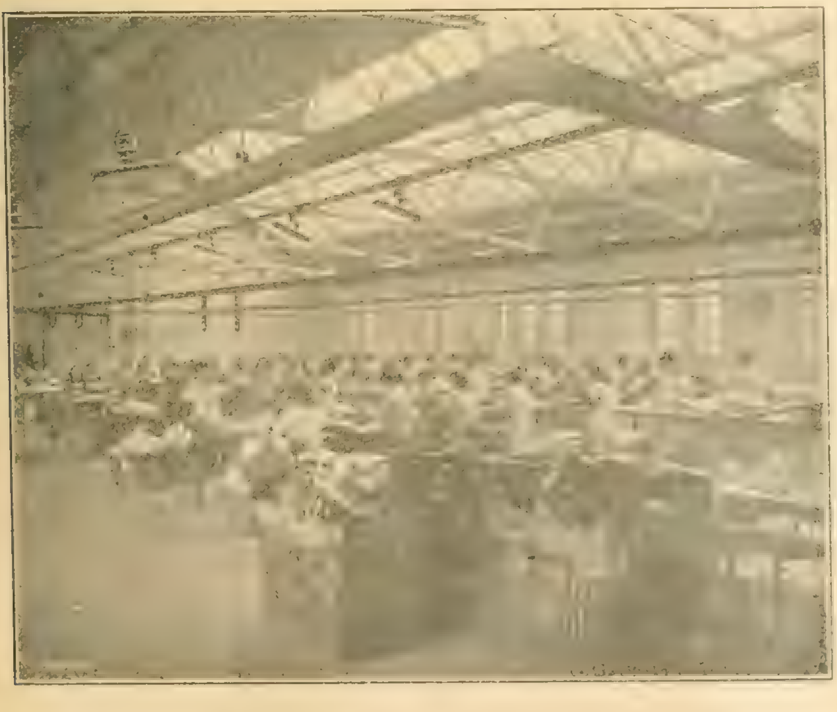

FIG. 1.—SEWING-ROOM LIGHTED WITH MERCURY-VAPOUR LAMPS.

The frame contains 8 lamps mounted in pairs on four tilting reflectors, having a total candle-power of 8,000 C.P., and taking 3.08 KW.; it is suitable for making process plates up to 40 × 40 in., and similar frames are made up to 70 × 40 in.

The use of the lamp for sterilising water and other liquids has been fully described in our pages[*]; the water is passed through a chamber in which it is exposed to the rays from Cooper-Hewitt quartz mercury-vapour lamps, quartz being used in this instance to enable the ultra-violet rays, which will not pass through glass, to escape, and to increase their production by running the lamp at a higher temperature, these rays being the sterilising agents.

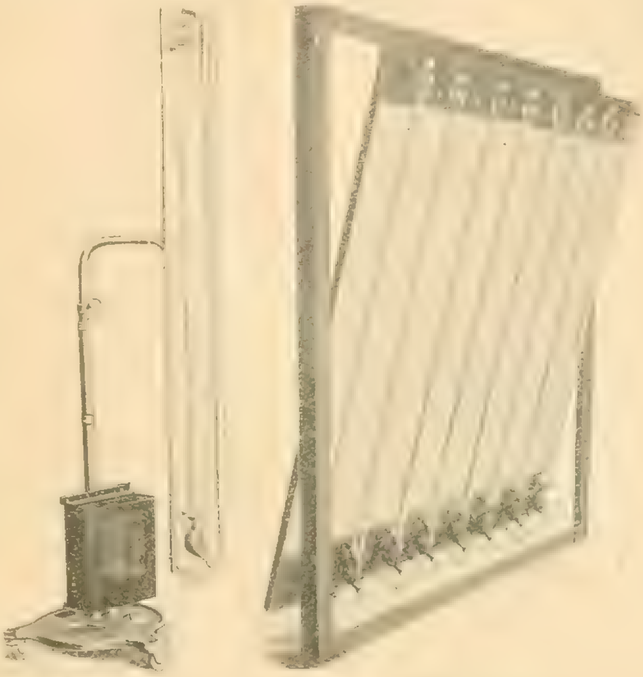

FIG. 2. [illegible] FIG. 3. MERCURY-VAPOUR LAMPS [illegible]

These apparatus are largely used abroad for sterilising public water supplies.

One of the most interesting [illegible] the mercury-vapour arc is to the conversion of alternating to direct current, by virtue of the rectifying property already referred to. In this case the lamp is made in the form of a large bulb with a chamber at the bottom for the mercury kathode, and two or more tubes at the sides to contain the [illegible] three-phase current. The large bulb forms a condenser for the volatilised mercury. The great advantage of the mercury-vapour converter is that it has no moving parts whatever, [illegible] without attendance—a very important feature. With single-phase current a trans- [illegible] auto transformer [illegible] the right voltage, but if this is not the case, separate windings are employed, giving any [illegible] with the kathode or the D.C. leads of the [illegible] the current from falling to zero between successive half-waves.

[illegible]

While the converter has been largely used [illegible] and charging [illegible] equipped with Cooper-Hewitt converters, but the tendency to employ very large currents—often exceeding 100 amperes—of late has militated against their more extended use for this purpose. It is probable, however, that future improvements in the projectors will enable smaller currents to be employed, and in any event it is, of course, possible to run several converters in parallel. For charging batteries, the converter offers exceptional advantages, owing to its self-regulating property and the impossibility of reverse current flowing from the battery through the converter.

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[*] ELEC. REV., Vol. 73, p. 516.

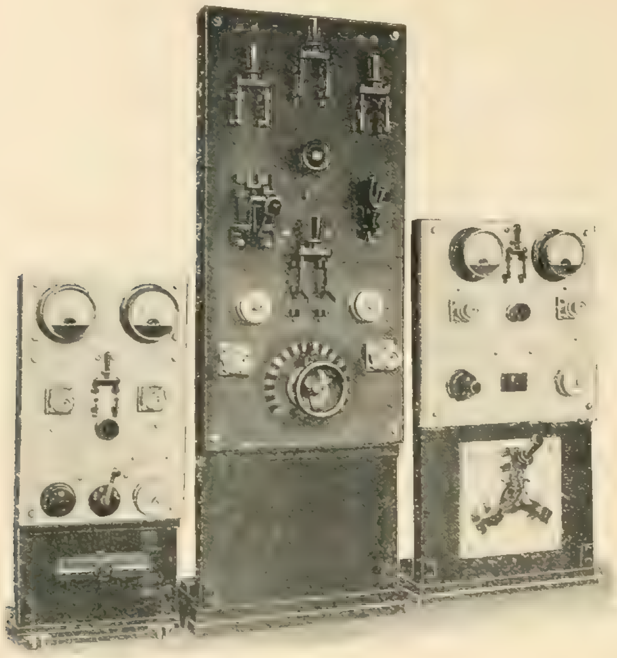


Fig. 4.—Cooper-Hewitt Converter Panels.

We illustrate in fig. 4 some converter panels recently installed by the Westinghouse Cooper-Hewitt Co., Ltd.; that on the left is one of many supplied to the Metropolitan Asylums Board for charging ignition batteries in connection with their motor ambulances (the Board use these converters at all their ambulance stations). The first was supplied for this purpose six years ago. The panel shown works on a 215-volt 83-cycle supply, and gives 5 amperes D.C. at three voltages, for charging circuits of 4, 8 or 12 cells, without supplementary resistances, except the small regulating resistance seen at the foot of the panel. The panel on the right is to be supplied to the Eastern Telegraph Co., mainly for charging batteries, at 10 amperes, 150, 100 and 75 volts, from a 110-volt 75-cycle supply. A special shunt is fitted to provide a small artificial load, enabling the converter to be kept running whilst supplying an intermittent demand for induction coils, etc. The centre panel is one built to the Post Office specifications, to give 30 amperes at 40 volts, when supplied at 200 volts, 50 cycles. The Post Office authorities have a considerable number of these converters in use for charging batteries in telephone exchanges, and it is especially interesting to note that the converter has to be suitable not only for charging the stand-by battery, but also to charge a battery that is actually connected to the exchange switchboard, without affecting conversations. Further, it must be capable of supplying current direct to the switchboard in the event of both batteries being put out of use.

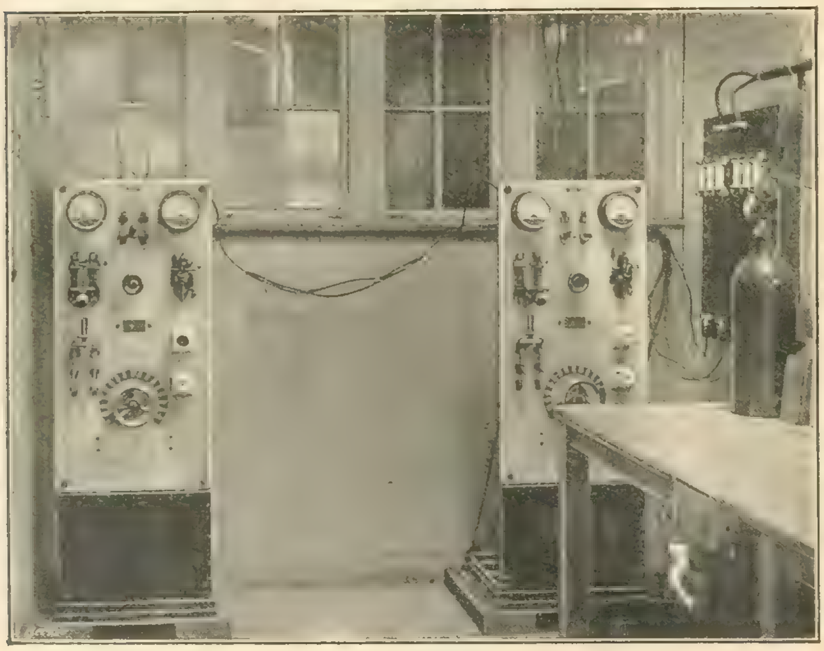


Fig. 5.—Converter Installation at the Naylor Battery Co.'s Works.

By the courtesy of the Naylor Battery Co., we have been enabled to inspect and photograph a pair of panels which they have employed for the past twelve months for forming and charging their accumulators at their works in Balham. An earlier set was installed in 1912, and though at first some difficulties were experienced, these were successfully overcome—as will be gathered from the fact that additional sets were installed. These supply 80 amperes D.C. at 160 to 200 volts, and are fed from an A.C. supply at 205 volts, 50 cycles. Regulation is effected by tappings on the transformer primary. The fact that the apparatus can be left at work for days together without supervision is particularly advantageous in this connection, and the long life of the bulbs—some of which have run for over 4,000 hours—is in their favour. By means of a time switch, the charging process can be stopped at any time desired, and the properties of the apparatus render it particularly suitable for use in garages where electric vehicles are charged—a purpose to which the Naylor Battery Company's installation has been regularly applied, the company having an electric delivery van of their own. In view of the increasing use of electric vehicles, the matter is worthy of the attention of garage owners in areas supplied only with alternating current.

ANGLO-BELGIAN ELECTRICAL CO-OPERATION IN BELGIUM.

In response to an invitation issued "under the auspices of the London Chamber of Commerce and the Belgian Committee for Trade with the Allies," we attended a lecture delivered at Cannon Street Hotel, E.C., on Thursday afternoon last week, the objects of which were announced as follows:—

"To bring together the British electrical supplies manufacturer, and the Belgian buyers, for the mutual consideration of the practical ways and means to establish business relations, immediately the invaded territories are free.

"1. How can the British supplies manufacturer secure the Continental electrical trade, hitherto in the hands of enemy countries?

"2. The desirability of the constitution of a U.B.E. (Union of Belgian Electricians) to act as intermediary between the British manufacturer and the Continental consumer.

"3. The selling and organising policy necessary to achieve this object, on a co-operative basis."

The chair was taken by Mr. A. H. Lawrence, Vice-President of the British Chamber of Commerce in Belgium, who, in opening the proceedings, referred to the opportunity that existed for England to capture the very large business that had been done between Belgium and Germany. The trade was there for the Englishman if he was prepared to make some little effort and sacrifice, but such effort and sacrifice would be well repaid. On behalf of the London Chamber, the speaker said that they would be pleased, through their Electrical Section, to give every assistance to any gentleman who might require it in these matters. The Chairman trusted that the British Chamber in Belgium would be of some use to them and that when they were once again established in Brussels, the Belgian Committee of Trade would be in existence, and that hand in hand with that committee they would be able to drive out the commercial German from Belgium.

The proceedings which followed were chiefly conducted in French. The lecturer, M. R. Steylaers, an electrical engineer who had been prominently connected with a number of Belgian concerns prior to the war, read his lecture, and for part of the time it was read in sections in English also by Mr. Barwick. About half-way through, however, owing to the meeting consisting almost entirely of Belgians—about thirty were present—the English translation was dispensed with. We refer on another page to what we believe to be one of the reasons for the un-English character of the audience.

M. **Steylaers** first expressed thanks to the London Chamber of Commerce and the Belgian Committee of Trade with the Allies, for their efforts in convening the meeting. He was approached by the Belgian Committee to develop through the medium of a meeting such as that a definite and positive policy that could be operated immediately Belgium and Northern France were free. The speaker considered that an open discussion was preferable for the mutual exchange of ideas, to an individual exposition, hence the calling together of the manufacturers of British electrical supplies and Belgian buyers to study the most appropriate means of realising the object expressed in the invitation. Addressing himself to Belgians present, he regretted that at the exhibition along the lines of the Leipzig Fair, recently held at Islington, for toys and cheap ware, space could not be allocated for the exhibiting of the productions of British manufacturers who would take part in the rebuilding of Belgium, and whilst appreciating the spirit that prompted the exhibtion, suggested that, as Belgians, they would have been interested in seeing those products which would enter into the industrial rebuilding of their country. It was admitted that the exhibition was for the development of British trade at home and in the Colonies, but the British manufacturer could not successfully confine his efforts to the British Empire alone. If he was to beat German competition, he must find a world market. The production of cheap articles necessitated an enormous demand, which could not be responded to by the British Empire alone. There was, however, a scheme under consideration to organise an exhibition of the products in which they were interested, and steps were being taken by various committees to obtain a *venue* for this purpose. When these arrangements were completed an announcement would be made in due course. These introductory remarks were rendered necessary to lead up to the policy to be considered, stripped of generalities, without exaggerating the possibilities or ignoring the difficulties. The principal phase was the industrial rebuilding of Belgium, embracing, as it did, the industry of electrical engineering and manufacturing of electrical supplies, and the selling of these products to Belgian buyers at the termination of the war. The speaker considered it a duty to assist in the re-organisation and establishment of the new economical conditions as a compensation for the sacrifices of the Allied Armies. He referred to the already enormous damage, and anticipated the total destruction of the remaining workshops and industries when the affected territories were reoccupied. M. LeRoi Beaulieu, the leading French economist, maintained that from the German point of view the war was not so much a sentimental as an economic war, and subsequent events had substantiated his contention. Belgian machine tools in all factories were being transferred to Germany, raw material had been appropriated, the enemy had stolen and was utilising commercial secrets, and was disclosing in the interested quarters the names of Belgian customers, for it must be remembered that prior to the war German manufacturers were beginning to fear the effects of Belgian commercial development. For present purposes, it was necessary to make a careful analysis of the conditions as they existed before the war.

The greater part of the electrical supplies was either directly or indirectly controlled by Germans. In Belgium there was first, the Belgian Union Co., Ltd. (A.E.G.), in reality a branch of the renowned Allgemeine Elektricitäts Gesellschaft, Chaussée de Charleroi in Brussels, similar to the Parisian concern, the Société Francaise d'Electricité (A.E.G.), 72, Rue d'Amsterdam. As a matter of fact, these companies were Belgian and French in name only. The Belgian company had (if the speaker remembered rightly) a capital of one million francs, and the French company a capital of two million francs. The object of the company expressed in the articles of association was "for the exploitation of workshops for the construction of electrical supplies generally, and particularly the production of the Allgemeine Elektricitäts Gesellschaft, Berlin Co., Ltd., with a capital of seventy million francs. The name of the directors of the so-called French company would indicate their nationality: Messrs. M. Mamroth, Ross, and Koch, together with Messrs. Thurnauw and Burrell, the last two gentlemen being also on the board of the French company for exploiting the Thomson-Houston patents. Due to these directors being associated with both companies, it need only be said that the two interests were not allowed to clash. There was also in Belgium the Siemens-Schuckert Co. and the Siemens & Halske Co. (Rue Thérésienne in Brussels, and Rue de Dunkerque 52 in Paris). The articles of association of these companies stated "that their object was for the sale in Belgium and France of the productions of the two German companies, Siemens & Halske and Siemens-Schuckertwerke Aktien Gesellschaft mit Beschrankter Haftung. Further, the French Siemens' company acquired a large monetary interest in the French concerns of La Compagnie d'Electricitié de Criel, Ltd., with a capital of 3,800,000 francs, with head offices at 19, Rue Louis le Grand, in Paris. This company was the former French concern Dayde & Pille, Paris. The speaker then mentioned the names and directors of other apparently French electrical concerns which were actually branches controlled by the German Siemens company :—

1. La Société Industrielle d'Energie Electrique, 30, Rue Caumartin, Paris. Directors: Messrs. Cahen, Petri, Simler.

2. La Société d'Electricité de Varsovie. Directors: Messrs. Salomon and Cahen.

3. La Société Continentale de Traction et d'Eclairage. Directors: Messrs. Cahen, Petri, Rosenbaum.

4. La Société des Applications de l'Electricité à la Traction. Directors: Messrs. Von Chauvin, et Von Siemens Natalis.

The aggregate capital of these four companies was 32 million francs in shares, and ten million francs in debentures.

In Belgium there was also the Electric Dynamo Co., Lahmeyer, recently acquired by the A.E.G. Against these big German corporations (which, the speaker incidentally remarked, he regretted were partly financed by French and Belgian capital) there existed the Belgan concerns—the Ateliers de Construction de Charleroi, under the financial control of the Belgian group Empain; the Pieper Co., in Liége, for the construction of electric motors; and the Ateliers des Cables de Seneffe, for wire and cables. In France there was the Electricité, the Nancy Co., and Electromecanique Co., producing high standard dynamos, The British trade was represented by the Westinghouse Co., the British Thomson-Houston Co., and the Tudor Accumulator Co., and, prior to the war, the General Electric Co., for supplies. For these concerns, however, the competitive fight was unequal against the financially strong German trusts. The latter, due to their resources, were able invariably to secure the business, being in a position to cut their profits to a minimum. They were able to engage in aggressive selling policies, and, in certain instances, their productions were of a superior quality, particularly the German Siemens productions. This company was favoured with many French and Belgian Government contracts. In France, La Compagnie d'Electricité de Creil (controlled by the German Siemens Co., as stated) were fortunate enough to number among their clientèle the French Admiralty. In 1899 the same concern obtained the orders for searchlights for the fortifications of Bizerte, the electrical equipment for the departmental railways in the Province of Haute Vienne, and the electrical railways of the Bois de Boulogne. In Belgium it was the same; Government contracts were secured by these firms, and, in view of the circumstances, it was interesting to remember the harbour of Zeebrugge, the electrical equipment of which was well known to the enemy, a tactical knowledge which they had employed to advantage against the Allies, as they were well aware. The same remarks applied to the electrical equipment of the forts around Antwerp.

In the wholesale business the same policy was apparent. A concern in Brussels, with a wide Continental reputation, Messrs. Poock & Hermann, possessed perhaps the most complete stock of electrical supplies on the Continent, comprising some 5,000 specialities. Belgian electricians would remember the principals of this company visiting Belgium some ten years ago in the capacity of ordinary salesmen submitting samples. A few years later, backed by the financial support of a number of manufacturers of German electrical supplies on a co-operative basis, they acquired a unique standing in the Belgian market, securing a substantial portion of the trade. Catalogues of an expensive and elaborate nature were freely distributed by this house, and, when one considered the modest nature of their operations in the initial stages, it was obvious that the success attending their activities was only possible with the support of the manufacturers they represented. There were, of course, Belgian wholesale houses, but they were unable to compete with the German wholesaler. These concerns endeavoured to sell outside the Trust, but high individual selling cost, and the question of individual credit, militated against them to such an extent that their success was limited.

Immediately before the war, the A.E.G. Co. were responsible for the last phase of their carefully and skilfully prepared scheme, and approached the [illegible] direct, thereby eliminating the intermediary's profit. [illegible] mitted prices for the execution of [illegible] only in large enterprises, but also [illegible]

Naturally (as was always the case [illegible]) the [illegible] position was endangered; the retailer [illegible] sidered was a violation of his rights [illegible] resentment was strongly expressed, the A.E.G. Co. condescended to withdraw their quotation in favour of a Belgian concern, on the mutual undertaking that in the event of the particular concern securing the business, the order for the material necessary for the execution of the installation be placed with the A.E.G. Co. The result, therefore, was that 95 per cent. of the Electrical Supplies business was dominated and controlled by German manufacturers. They secured the contracts of the public services and private businesses. How could the Belgian wholesaler, however soundly established, profitably meet this competition? They even feared to try, because they realised that the object of the competition was that inseparable from trust and [illegible] policies, namely, to crush every suggestion of competition by selling almost at, and sometimes below cost, and when the purpose was achieved, to inflate prices and thereby redeem the small profits of the past, and create large profits for the future.

The position was identical in the telephone and electrical lamps part of the industry. In Belgium the Telephone Co., La Societé de Téléphone Privée recently had to contend with aggressive competition from the Berliner Co. [illegible] by skilful and persistent publicity, invaded the public services, [illegible] had not to contend with [illegible] competed against [illegible] flooding the market with German raw material and telephone apparatus, employing German labour, and gaining entry into the administrations of [illegible] the Avenue de l'Opera in Paris, the town councils of the 9th and 10th arrondissement in Paris, the town councils of Clichy, Dunkirk, and Maubeuge, and obtained the concession of the telephone installation of the International Exhibition in Lyons. It was not surprising that this free licence of entry had been utilised [illegible]

Relative to the electrical lamps sold in Belgium and France, it was only necessary to name the concerns and trade-marks to determine their origin. As a matter of fact, all the German houses selling these lamps had their own offices in Brussels. They were the Osram Lamps (Auer Gasglühlicht A.G.), A.E.G. Lamp (A.E.G. Aktien Gesellschaft), Pope Lamp (German Pope A.G.), Wotan Lamp (German Siemens). Against this combination the only competing lamps were the Philips and Tantal Lamp, of Dutch manufacture, and the Z Lamp, of Belgian manufacture.

Appealing to his own countrymen, the speaker queried them as to whether they were prepared to continue to be dominated by the German manufacturers, and suggested that the spirit animating all Belgians was the desire to recover their economical independence, in the same way as they were reconquering their territorial independence. The problem, however, was not a simple one, and presented many difficulties. It would necessitate the co-operation of all the interests engaged—the co-operation of the British manufacturers, the co-operation of the Belgian consumers. In a legitimate manner it was possible to commence where the German manufacturer left off, to ascertain by analysis the causes of his success and development, and to extract the best from his operations and apply them to the scheme of reconstruction. But *he must be kept out*, and the Belgian Parliament must, and would, create a tariff wall to assist to this end.

Examining the causes of the development of the German industry generally, and not only confined to Belgium and France, they arrived at the following conclusions as to essentials:—

1. Large stocks on spot, and keen competitive prices resultant of an actual knowledge of productive costs.
2. An elastic credit policy, together with an efficiently trained selling organisation, and the operation of intensive and extensive selling policies.
3. The extensive publicity to focus attention upon German productions.

Relative to the question of stocks, the Belgian and French retailer or contractor had given, and would continue to give, the preference to the supplier who was in a position to execute his (the retailer's) requirements from stock, in large or small quantities, thereby avoiding the investment of his capital in stock. British concerns established in Brussels before the war could substantiate this statement. Purchasers would not hold stocks, and the difficulty of importing material from countries where the language, currency, and measures were different would be appreciated. The Continental electricians worked practically always with the capital of the wholesaler. The ultimate purchaser desired to see samples before purchase, and refused to buy on catalogue. The prevailing conflict had demonstrated that psychologically the German was prone to err, but he appreciated this Continental commercial weakness, and adapted his methods accordingly, with advantage to himself.

The British manufacturer, on the other hand, appeared to be obsessed with the selling power of his catalogue, and considered that through this medium he could create sales and induce customers to carry stocks. Frankly, he was wrong, and the possibility of his securing business along these lines was not only remote but almost impossible. The Continental purchaser sent an employé to the wholesaler for his daily or weekly needs, and often took the liberty of returning any surplus he was unable to utilise.

The policy of cut prices by the German producer might, from the point of view of the British manufacturer, superficially appear to enhance the difficulty of taking advantage of this new market, but a closer investigation would satisfy him, that by a system of specialisation it was not only possible to produce the goods in which the Germans specialised, but to produce them at a *profit*.

Now was the opportune moment for the British manufacturer to take advantage of the forced residence in this country of the Belgian electrical specialists, to collaborate with them as to the potential requirements, and to carefully analyse the question of price and productive cost, and by this process to arrive at such an understanding as to establish a sound and satisfactory foundation.

Concerning the question of credit. Not only had the German manufacturers co-operated in order to maintain stocks, but they had skilfully organised the credit side. Practically the whole German commercial policy was based on extensive credit, made possible by the German banking system, which had made possible German industrial development of the markets of the world. In fact, immediately before the war, it was not unusual for credit to be extended by bankers to the German manufacturer over a period of one or two years, particularly in fancy articles. The complicated process of this credit system might be interesting to consider. The basis was the repeated renewal of bills on the customers in the markets of London and Paris by the German banker, the manufacturers discounting the bills on the customer in the same way with their bankers, with the cash from the operation in the London or Paris market.

A common process was as follows:—When a manufacturer's business reached a volume where his own financial resources would not allow the execution of same, he went to his bankers, who satisfied themselves as to the financial status both of manufacturer and his customers, and entered into an arrangement with the manufacturer as follows:—They, the bankers, agreed to advance 15 per cent. to commence operations, 25 per cent. on the completion of the manufacture of the goods, and 25 per cent. against bill of lading, the outstanding 35 per cent., which represented gross profit, remaining in the bank as a nucleus fund for the next operation on similar lines. Backed by such a financial system it was not surprising that the German manufacturer by the might of his credit monopolised the Belgian market.

In regard to Selling Methods and Publicity, the selling representative was carefully selected and trained, was paid a substantial remuneration which gave him a good social position and made an impression on the customer. If it was not possible for financial reasons to engage such a salesman, the manufacturer would co-operate with other manufacturers producing non-competitive products appealing to the same customers, and the expenses would be shared. The German manufacturer was not a successful pioneer, but essentially a copyist. If he desired to exploit a new market he instructed his most progressive salesman to go to this new market and procure samples of the goods commanding the best sale, with prices and discounts allowed by the manufacturer. He then analysed the proposition to the minutest detail, eliminated any feature that he considered superfluous, and based his productive costs on an enormous output. A few weeks later the salesman was back again offering a copy of the article in question, at lower prices and on better credit terms, so that he was able to secure large orders and contracts immediately. It was this process of elimination that had been responsible for the stigma associated with German manufactures on the Continent, viz., "German rubbish."

The indirect system was more insidious, and was a system of commercial espionage. A German clerk subsidised by a German manufacturer entered a Belgian office or factory, under the pretence of learning the language at a very low salary, and dispatched to his employers the names of potential customers, and kept them furnished with data and information that could be used to advantage. Addressing his Belgian friends, the speaker emphasised the dire necessity to free themselves from the corrupting and pernicious influence of the German domination. Direct and indirect trade with Germany must be met and defeated by aggressive policies, and he called for the abolition of German companies trading under Belgian names.

It was clear that immediately the invaded territories were free and capable of reconstruction, the German supply of cables, tubes, dynamos, wire, materials for high and low tension, supplies for installation, fittings, etc., would not be available, even assuming the Belgian electrician was prepared to purchase from this source. Practically everything would have to be replaced. In Belgian factories cables were being appropriated by the Germans for the utilisation of the copper for producing shells. The electrical conduit systems, central stations and sub-stations were totally or partly destroyed, and as had already been suggested, when the invaded towns were reoccupied the destruction would be complete The problem therefore resolved itself into the question, "Where are these supplies to come from?"

The United Kingdom, and to a certain extent France, produced high standard electrical supplies, and nothing seemed easier than to transfer the business to these countries, but the difficulties were more real than apparent. In the first place the supplies used hitherto were of a different character and nature to those supplied by the United Kingdom and France. In fact it would be necessary, were English supplies sent as used in England, to educate the workmen along totally different lines to what they were accustomed to, and therefore it was obvious that it would be necessary to reduce this difficulty to a minimum. The customer was conversant with his needs and expected to have them satisfied, and would not tolerate having to alter his methods and change conditions to what the manufacturer considered his needs should be.

The object, therefore, of the Belgian electricians should be to induce the British manufacturer to produce such goods as would meet his actual requirements, habits and working methods.

They must not be deceived into the belief that the resourceful German manufacturer would lose the market without making an effort to retain it. If it was possible to get supplies through to a country with which he was at war, the ways and means would be found with less difficulty after the war to retain this business. The speaker was of the opinion that his countrymen would have to fight hard to be masters in their own house.

It was necessary that the Belgian trade should suffer as little as possible as a result of the change involved. This particularly referred to the small retailer who would require all the assistance he could get in order to restore the normal current of industrial activity, interrupted by this crisis for which there was no precedent in the economic history of any nation in the world. The British manufacturer, however, could not be expected to change entirely his commercial methods for the express benefit of Belgium. The primary consideration of the British manufacturer before exploiting a new field was that of the safety of his credit. He desired to make good his operations, and if he was satisfied that the risks were too great he preferred to leave the matter alone. The question expressed frankly was, "The Belgian electrician desires credit, and the British manufacturer wants the business *and the money*." How can these interests be reconciled?

The speaker had occasion to discuss this matter with British manufacturers in his initial efforts to interest them in the Continental markets. His impression was that whilst they were prepared to stock their goods on the Continent, they would only do so after a demand had been created for them. He suggested that this would be willing the ends without the means, but appreciated their reluctance due to the fact that the exploitation of a new market necessitated additional capital. The system of banking prevailing in the United Kingdom did not encourage the manufacturer along these lines, and he was therefore abandoned to his own financial resources, and must develop his business slowly. It was necessary to adopt financial measures for the constitution of a corporation to act as a clearing house to transmit orders to the Allies, the development of Belgian national manufactures taking place during the interim.

The proposal was, therefore, that an organisation be created to act as a connecting link with the manufacturer and the purchaser. This organisation would appeal to the wholesale trade, and replace the German organisation operating before the war. The speaker's suggestion was the creation of a corporation under the name of "The Union of Belgian Electricians" (U.B.E.), displacing the other Union, which was Belgian in name only.

The U.B.E. must be a strong representative association of Belgian electricians with an initial capital of not less than one million francs (£40,000). Its object would be to represent on the Continent British and French manufacturers of electrical supplies, and, when conditions permitted, to encourage the Belgian electrical supplies manufacturer.

Such a corporation patronised, solidly backed, and scientifically organised in regard to the selling policy, would obtain better credit terms from the manufacturers than those extended to any individual outside its scope.

The manufacturer would be in a position to make good his credit immediately. He might give credit as occasion demanded—30, 60, or 90 days, or as the case might be—and he would be in a position to discount his bill on this corporation with his bankers. It would encourage him to place stocks at the disposal of the Corporation and to draw on the corporation for such stock at 90 days, six months, or nine months.

Further, the corporation being on the spot, would have a better knowledge of the financial status of each customer and, moreover, would of necessity be more conversant with the prevailing conditions.

It would be part of the task of the U.B.E. to encourage Belgian industry by placing their orders with the concerns specialising in a certain phase of electrical supplies and who were hitherto exporting their productions, such as the dynamos manufactured by Pieper Co., Liége, already referred to.

In short, the U.B.E. must be the financial crutch whose object was to assist the Belgian electrical industry to rise above its industrial upheaval, with the assistance of foreign suppliers, who would in turn benefit by their share in the enormous demand for their goods. All specialities handled by the corporation would be sold under the manufacturers' name and trade marks, and every effort would be made to place the business with those manufacturers interested in the corporation, thus creating a goodwill for the manufacturers' goods. Was this proposal worthy of consideration by the British manufacturer? The time for talking was past, the time for practical effort was now! The opportunity must be accepted NOW, otherwise Belgium would be reluctantly compelled to re-open relations, because of urgency, with the nation which had prostituted all that she held most dear. A peroration of rhetoric in regard to the national side of this people would not be acceptable to business men met together for a business purpose, but would it not be repugnant to the finest feelings of this nation to be obliged to turn to her enemies for the material to rebuild her battered cities, her demolished and ruined towns and villages made such by the ravages of these enemies? The prospect of Germany making profit at the expense of the brokenness of Belgium would be an inconceivable irony.

Belgian electrical experts in this country waiting for their country to be freed might be here a few weeks, or perhaps a few months. This period should be utilised by these gentlemen and British manufacturers for an interchange of ideas, because the moment the invaded territories were free the refugee population in this country and France would rush back to their homes and would commence themselves to rebuild their country out of the ashes. The speaker, in closing, emphasised that which had punctuated the whole of his discourse—"THE TIME TO ACT IS NOW!"

Mr. TOWNSEND, who said he represented the selling end, addressed the meeting at some length. He was disappointed to see so few British manufacturers present, and dwelt generally upon such matters as the study of productive costs, the importance of the selling end being right, the necessity for standardisation of specialities, the importance of co-operation and intensive advertising. "Combination must be met by combination, syndicate by syndicate, publicity by publicity."

Suggestions having been made that the absence of British electrical manufacturers from the meeting was due to apathy on their part, Mr. Albert Bridge (ELECTRICAL REVIEW) asked those present to suspend their judgment on that matter until they knew whether British electrical manufacturers were aware of the proceedings, whether they had been approached through their organisations, and whether such notices as were issued to the Press were issued too late for the matter to be announced in any way before the meeting actually took place. He thought Belgian gentlemen present could feel assured that British electrical men were not indifferent or apathetic in regard to the future position of electrical affairs in Belgium. It had been the ELECTRICAL REVIEW'S privilege to welcome to this country and assist many electrical engineers who had come here after the German onrush, and he believed that the hearts of all British electrical men were with them; let them not too hastily hold them guilty of apathy. M. Steylaer's excellent address contained much valuable material, but it told again the same story as had been heard for many years past of the methods adopted by German interests in all parts of the world for undermining others' trade. He believed that British electrical manufacturers were with those present in their desire and determination to rid Belgium for the future of the German electrical domination.

As the result of suggestions from the meeting, it was proposed that another meeting be held on a date to be fully and well announced so that British electrical firms should be afforded a better opportunity of discussing the subject, M. Steylaer's paper forming the basis for such discussion.

GERMAN BUSINESS METHODS.

IN the course of his address to the Sales Managers' Association on "German Business Methods as seen by a Canadian Resident in Berlin," Mr. J. H. Vickery said he was not qualified to refer to those business methods in detail, but he spoke as a lawyer who came into contact with a great many kinds of business in Germany. He was first struck by the "great wedding," "the nuptual union between theory and practice, the fructification of science by its application to commerce, to industry," and to the welfare of the community generally. Mankind did not exist for science, but science existed for mankind. The Germans had been more practical than we in the application of science to increase the store of human happiness (Who said *Lusitania*? Who said Zeppelin?). Some 21 great German Universities had taken a leading part in the study of applied science—that was a difference between the German and British University. Oxford and Cambridge were magnificent institutions, but they were not perfect. An American professor in Berlin had said that the German University was not an institution of education, but one of instruction, to instruct the mind, to give it a store of knowledge, to fit it out with all the details which it required to enter into the practical work of commerce and industry. Those who left the British Universities might not have the mind stuffed so very full of the facts of human knowledge, but they possessed a greater ripeness of character, and a greater knowledge of the mutual psychology of the people. The American professor thought that the American University combined the better features of both systems; certainly on its practical side the Cornell University was admirably fitted to prepare a young man to enter his life's work. University education had come to be regarded in Germany as a *sine quâ non* for almost every man who made any pretension to "culture." There were 21 such institutions of learning, with a total student membership of nearly 70,000, and there were 11 technical high schools with something like 17,000 students. There were 400 other institutions of various kinds for the study of almost everything that entered into human life, and there were the so-called continuation schools for enabling the student, when he went into the workshop, to keep up the habit of being a student, in his spare hours. Scientific training was the one great thing upon which they had expended their best efforts—in the eyes of an American observer there was nothing comparable to it in the whole world.

The speaker next referred to the subject of selling, marketing, and distributing goods, and said that the power of the people to develop their natural products and to create artificial products had been supported by a wonderful linking up of the scientific institutions and of the administrative, political, and even diplomatic institutions of the Fatherland. That was one reason why their success had been so prominent. There had been no working at cross purposes; there had been team work. In regard to linguistic aids to marketing and selling, the ability to command one or more foreign languages constituted an aid of undoubted value. The commercial value of foreign languages had long been recognised by Germany; facility of acquiring and speaking them had constituted a most valuable factor in the development of German commerce and industry. We must spend less time studying ancient languages and devote more to a better understanding of the languages spoken by the Allies. The influence of law upon commerce and industry was next referred to by Mr. Vickery. He gave a few illustrative examples to show the process of linking up law with actual business. Accident insurance was mentioned, also transport. The question of internal transport was one that had received close and thorough consideration in Germany from many points of view. The Government owned and controlled the railway system, and there was a truly wonderful system of inland waterways linking up the German rivers and harbours. The far-reaching State control of the railways had been exercised in the interests of business and of the industrial public, and therefore by necessary implications in the interests of the State itself. It had been found possible to combine rigid economy of administration with high efficiency of service. The canal system afforded a remarkably cheap transport for slow freights, and at all times of the year except mid-winter long lines of man, horse and machine-propelled barges might be seen gliding slowly along the canals of the Fatherland, laden with goods; the main thing was that the freight was remarkably cheap. On the influence of political policy on business, the speaker said that the chief business of the statesman and the chief business of the diplomat was to order commerce and industry in their widest sense as the foundation of human existence from day to day. According to the German view, commerce, industry and all other peaceful pursuits became part and parcel of a huge militant system founded on power, brutal, egotistic and devoid of that altruism of a people who recognised and welcomed the rights and claims of other nations. According to this view there was no room in this game of life which men and nations play, for anything like friendly competition or for generous rivalry, such, for instance, as had been found compatible with the hundred years of peace as touching the relations of the United States and Great Britain. According to the German idea, all was war! war! war! Peace was merely another state of war—it was warfare in abeyance until the rivalries happily ripened into the hostilities of the battlefield, and war became the noble consummation of the conflict for which the so-called peaceful pursuits had laid the foundation. This was the process which had been going on in the mind of militant Germany for a number of years. This fact explained the remarkable growth of the Social Democratic party in Germany, which, although everything had been done to make it happy and contented, as, for instance, accident insurance, old age pensions, sick insurance, education, and the greatest possible freedom in personal habits, was, nevertheless, discontented, did not like the Kaiser, did not like his ministers, and did not like the whole business. When the war was over a good many things were going to be discussed in the Fatherland, and he thought that the Social Democrats would play a leading part in that discussion. We, to-day, were fighting the same fight as the Social Democrats had themselves been fighting for years, the fight for constitutional responsible Government.

Mr. Vickery put in a plea for a reconciliation in this country between Free Trade and Protection. The matter was acquiring a new meaning in these days, that was his excuse for touching it. The gradual evolution of Greater Britain into something which might be called a federation must, in the course of the years, bring with it as an economic and historical necessity something like an extension of the principles of Free Trade in the shape of inter-Imperial trade. The necessity for the better linking up of all the functions of Government and of business and education —the mobilisation of our resources—was Mr. Vickery's closing point.

WAR ITEMS.

War Exhibition.—In view of our incalculable indebtedness to the gallant Belgian nation, a War Exhibition has been organised to assist the funds of the Belgian Red Cross Anglo-Belgian Committee. It is designed to present in an interesting and instructive manner an idea of the extent to which science and industry are being utilised in every branch of the present gigantic struggle. There will be a magnificent 13,700 sq. ft. mural panoramic representation of Belgium. This portrays amongst other scenes the beauties of Brussels, Antwerp and its magnificent port, Bruges (the Venice of the North) with its many bridges, Ghent, Ostend and the Coast, Liége, Namur and the Valley of the Meuse, including the ill-fated Dinant, Louvain, Malines, Ypres, and Visé, the first town to fall temporarily under the iron heel of the barbaric Hun. Season tickets are being issued at £1 1s. each, carrying the privilege of the holder admitting a different friend at each visit if desired. It is hoped that a large application by the public who desire to help will be made for these season tickets, and it may be mentioned that they will be available on all the National and International Days which are being arranged throughout the season. The Exhibition comprises seven sections, No 4. of which will relate to science and industry as applied to war, including the latest scientific instruments used in connection with war. The Prince's Skating Club, Knightsbridge, S.W., has been selected as the most suitable place in which to hold the Exhibition. Offers of interesting War Trophies as loan exhibits, or assistance of every kind towards making the Exhibition the great success it deserves to be on account of its object, will be welcomed by the Hon. Organising Secretary, War Exhibition, London Chamber of Commerce, 97, Cannon Street, London, E.C.

Board of Trade Inquiries.—The B. of T. Commercial Intelligence Branch has issued list No. 22, to date May 22nd, of inquiries received by it for sources of supply of goods.

Commercial Travelling after the War.—At the annual conference of the United Kingdom Commercial Travellers' Association held in Manchester last week, Sir William Mather, of the firm of Messrs. Mather & Platt, Ltd., was elected president. He was unable to be present, but in the course of a letter which he wrote to the conference, Sir William said that after the war the education necessary for an efficient commercial traveller must be largely developed on the lines of cultivating the scientific and technical, as well as the literary branches of knowledge. A higher general intelligence and all-round capacity would be needed to improve Great Britain's position among the progressive nations of the world. Though they must at any cost crush the vain-glorious and infamous means which the German Government had adopted with the object of enabling Germany to become the autocrat of the world, they could not, nor did they desire to, prevent the people of that country from reaping in the future the results of their indomitable perseverance and extreme efficiency in every department of peaceful activity which their educational methods had created. We could not conquer to subjection the people of Germany as competitors in trade and industry, but we could command our due share of the fruits of knowledge and enterprise throughout the world, so that we might continually enjoy, if we developed continuously the high intelligence necessary, a pre-eminent place in the competition of intellect that would follow this world war. Touching on the cultivation of closer relationship with Russia, Sir William said that the study of the Russian and French languages would amply repay the commercial traveller.

Glasgow Tramway Recruiting.—Glasgow tramway officials are meeting with much success in recruiting for the various battalions raised by the T.C. Last week 400 men were enlisted for the 15th, 16th, and 18th Highland Light Infantry, the Royal Engineers and the Royal Field Artillery. The infantry corps are located at Gailes Camp and the artillery and engineers at Ayr. Depôt companies are being formed for the 15th and 16th H.L.I., the main bodies having gone to the South of England to complete training.

Anti-German Outbursts in South Africa.—Our Cape Town correspondent writes:—"As a protest against the sinking of the *Lusitania*, the employés of the Victoria Falls Power Co., at Brakpan, sent an ultimatum to the management stating that unless all Germans, naturalised or unnaturalised, were dismissed, they would strike.

"In the rioting at Johannesburg the offices of Siemens, Ltd., and of the A.E.G. Co. have been destroyed by fire. In Cape Town the hardware and electrical stores of Koch & Dixie were set on fire and all windows smashed; a considerable amount of stock was also damaged. Some damage was also done to the premises of Leemans Bros., electrical contractors, in mistake, the firm being Hollanders and not German."

British Industries Fair, 1916.—We are informed that in view of representations made by the exhibitors and buyers at the British Industries Fair, which was recently held in the Royal Agricultural Hall, the Board of Trade have decided to hold another Fair in London early next year.

Personal.—Mr. Arthur B. Crump, late of the staff of Messrs. Willans & Robinson, Ltd., of Rugby, has received a commission as lieutenant in the South African Heavy Artillery, and is on service in German South-West Africa. When at Rugby he was in the Howitzer Battery.

Mr. T. A. Nunwick, of Manchester, has received a cable from Mudros, from his son, Midshipman A. C. Nunwick, late of H.M.S. *Triumph*, stating that he is safe and well. He has also received a telegram from the Admiralty to the same effect.

Mr. Haydn Harrison has been appointed lieutenant in the R.N.V.R., attached to H M.S. *Vernon* for special work in connection with the Admiralty. This will, of course, necessitate his absence from town, but his business at 11, Victoria Street, will be carried on as usual.

The following appear in the *London Gazette* among the names of aliens to whom certificates of naturalisation have been granted during May, 1915:—

Myhre, Einar (Denmark), electrical engineer, residing at Blackheath.

Parshall, Horace Field (U.S.A.), consulting engineer.

Vasile (Vessel), George (Roumania), electrician, residing at Ferndale, Glam.

Mr. P. Grice, who has just been gazetted Second Lieutenant, is the second son of Mr. and Mrs. J. Grice, of Charnwood House, Rothley Plain, Leicestershire. After leaving the Leicester Technical School, he spent three years at Messrs. Siemens Bros. Dynamo Works, Stafford, prior to accepting a position with the Newcastle-on-Tyne Electric Supply Co., Ltd. After a stay of four years—during which time he was a member of the Newcastle Section of the Institution of Electrical Engineers, and gained an Institution premium for a paper read, Mr. Grice obtained an appointment with Messrs. A. Reyrolle & Co., of Hebburn-on-Tyne. When the war broke out, together with several friends he came to London and joined the Royal Engineers (Signal Co.).

Roll of Honour.—Private Robert Davies, of the 2nd East Lancashire Regiment, formerly in the employ of Messrs. Chas. Macintosh & Co., Manchester, has died at Boulogne from wounds received in the fighting at Ypres.

Private Tom Hayes, of Thornton, Fylde, who has been killed in the Gallipoli Peninsula, was formerly electrician at Rossall School.

Corporal John Albert Carroll, of the King's Own Royal Lancaster Regiment, Queen's Road, Harpurhey, Manchester, formerly employed by the National Telephone Co., Manchester, has been killed in action at Ypres.

The *Times* reports that Senior Engineer Stanley John Reed, who lost his life in the *Princess Irene*, received his engineering training at Barrow, and was an expert in turbines and submarines. He had received the Telford Medal of the Institution of Civil Engineers for a paper on turbines.

BUSINESS NOTES.

Consular Notes.—BRAZIL.—The *Diario Oficial* of March 2nd reports a new development of American enterprise in Brazil in the authorisation of the establishment of a branch in Rio de Janeiro of the National City Bank of New York. The American Government has recently been studying carefully the question of the effect on trade with South America of the nationality of the banks, and has determined as far as possible to develop American banking business with South America, largely with the view of facilitating commerce with that country.

URUGUAY.—The American Consul at Monte Video reports that the new president of the National Power Houses Board, Senor B. Lascoity, Usina Electrica de Monte Video, has given out an interview stating the intentions of the Government in regard to electric power in Uruguay. The object is to give good service to the public and to devote profits to improvement of the service and the reduction of rates. It is hoped to reduce the rate for small industries in Monte Video from 5½ to 4½ cents per KW.-hour, an advantage already enjoyed by the larger industries; those taking power on a larger scale get it for 2 cents. The board is also considering means to reduce the rates for poor people and for employés of the power house. The present tariff is 12 cents per KW.-hour, and a reduction of from 2 to 4 cents is anticipated. Light and power will be extended to the principal towns. La Paz and Las Pildras are about ready. At Pando and Tacuarembo the power houses now building will be finished in four or five months. The Government expects to purchase the Corporation-owned power houses, and is already negotiating for those at Paysandu, Rivera and San Jose. It is stated that part of the profits of the national electric light and power system will be applied to the construction of the national telephone lines, which will be underground in the capital city and aerial in the interior. Tenders will be called for to supply either an automatic or a manual system, and the kind of system will be decided upon after the bids are made. The line will cover a wide area, embracing the capital and contiguous departments. The total cost is placed at about £500,000. To effect all this the governmental power house (Usina Eléctrica de Monte Video) must be considerably improved. It is intended to increase its capacity with an alternating turbine of 8,000 KW. Another plan under consideration is to transform some of the boilers in order to burn crude petroleum, which is cheaper than coal and vacillates less in price.

There are two electric car lines in Monte Video—La Transatlántica, a German company, and the Sociedad Comercial, which is English. In addition, the Uruguayan Government operates a horse car line, the Tranvia del Norte. It has been decided to electrify this line, and a meeting of the directors will be held as soon as the President, who has been ill, can attend. Certain details will be decided upon and bids invited. It is estimated that about £300,000 will be spent for rails, cars, wires, &c.; in fact, everything will be purchased except equipment for a power house, which the Government already operates. The first work is to cover a line of about 10 miles, but will later be extended to twice that length. "The power house will necessarily be enlarged later, at which time there will be an opportunity to sell American machinery and equipment. The present machinery is of English make. The director from whom this information was obtained does not think it is worth while to send mail offers or catalogues. The only effective method is to send a representative who can close the deal in one or several lines. He should bring photographs or drawings and data to lay before the board, and be prepared to stay until the deal is completed. No further details can be had at present."

Catalogues and Lists.—MESSRS. OZONAIR, LTD., 96, Victoria Street, London, S.W.—Illustrated and priced leaflet describing their Ozonair domestic water steriliser.

MIDLAND ELECTRIC MANUFACTURING CO., LTD., Stafford Works, Rea Street South, Birmingham.—New catalogue (42 pp.) giving prices, brief particulars, and illustrations of their various "Mem" switchgear, including ironclad switches, switch and fuse units, supply panels, ironclad fuses and fuseboards, fuse carriers, tubular switches, open traction switches, accumulator switchboards, and other manufactures. The list contains a number of new lines, and an accompanying circular which refers to delays consequent upon war conditions, gives dates upon which delivery can be given of particular lines shown in the catalogue.

MESSRS. BROWN BROS., LTD., Great Eastern Street, London, E.C.—Leaflet giving tabulated prices of round polished silver steel in 13-in. lengths.

MESSRS. J. & W. B. SMITH, 15-23, Farringdon Road, London, E.C.—New illustrated price list (8 pages) of electric fans of ceiling, desk and bracket, ship and railway carriage types.

Lamp-Colouring Varnishes.—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., announce that owing to the increase in the price of aniline dyes they have found it necessary to advance the price of lamp-colouring varnishes by 20 per cent. The price of Siemens's lamp obscurer, which is an etching fluid, is also advanced 20 per cent.

Battery Manufacture in Spain. — La Sociedad Fabrica Nacional de Accumuladores, S.A., is the name of a new company which has lately been formed in Madrid to establish works for the manufacture of accumulators in accordance with the patents taken out by D. R. Serrano and D. José Mendoza.

Book Notices.—*[illegible]*. By A. W. Marshall and G. Gentry. London: Percival Marshall & Co. Price 6d. net.—This little book will be found useful, not only by amateurs, for whom it was primarily intended, but also by engineering students, apprentices and others, who in these days of precision must be acquainted with the construction and use of refined instruments of measurement. All the appliances in common use appear to be included, and the treatment is lucid and interesting.

Every Boy's Book of Electricity (Percival Marshall, price 1d.) is a simple introduction to electrical apparatus and the uses of electricity, in the plainest language, and with clear illustrations. It should have a wide vogue amongst our budding Edisons.

"*Bulletin* de la Société Internationale des Electriciens." Vol. V. No. 42. May, 1915. Paris: Gauthier-Villars. Price 3 fr.

"Tait's Electrical Directory of Australia and New Zealand." 1915. Melbourne: *The Commonwealth Engineer*. Price 5s. 1d.

Journal of the Institution of Electrical Engineers. Vol. LIII, No. 249. June 1st. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—This issue contains Sir John Snell's Address to the Students' Section, and the following papers: "Development of Main-Line Signalling on Railways," by W. C. Acfield, and "A Plea for Scientific and Technical Commissioners," by W. P. Digby.

"*Engineering* Directory of Advertisers." No. 60. April, 1915. London: "Engineering," Ltd.

"Science Abstracts." Sections A and B. Vol. XVIII, Part 5. May 28th, 1915. London: E. & F. N. Spon. Price 1s. 6d. each.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXXI, Part I. May, 1915. Newcastle: The Institution. Price 5s.

Private Arrangements.—ATLAS ELECTRICAL CO., LTD., High Street, Charing Cross Road, London, W.C.—A meeting of the creditors was held on Tuesday at the offices of Messrs. Peter Thomas & Clark, solicitors, 53, Cannon Street, E.C. The statement of affairs presented showed liabilities of £670, all of which were due to trade creditors. The total assets were £714. From that amount had to be deducted £450 due on debentures, leaving net assets available for the creditors, subject to the costs of the receivership, of £263 16s. 4d. It was stated that the company was a private one and was formed in May, 1913, with a nominal capital of £100 divided into £1 shares. Debentures for £450 were issued for cash in November, 1913. When the company was formed only about 25 shares were subscribed for in cash. Recently creditors pressed, and the debenture-holders appointed a Receiver. The principal debenture-holder was Mrs. Clegg, the wife of Mr. W. H. Clegg, the managing director of the company, and that gentleman was appointed to act as the Receiver. After a short discussion, a resolution was passed in favour of an application being made to the Court for the appointment of Mr. G. Corfield to act as the liquidator in the voluntary winding up. The following are creditors:—

Grevener, J. & H.	£31	Scupham & Woods	£20
Siemens Bros. Dynamo Works	22	Pope's Electric Lamp Co.	133
Electrical Co.	20	Sceando Lamp Co., Ltd.	101
Gent & Co.	34	Yorkshire Cable Co.	[illegible]
Imperial United Lamp Co.	45	Marbo[illegible], Ltd.	11
Fanger, J.	16	Atlas Carbon & Battery Co.	11
United Incandescent Lamp Co.	30	Credenda Conduits Ltd.	11

W. T. CORNELL, LTD., electric light engineers, 4, Church Walk, Kensington, London, W.—A meeting of the creditors was held on Saturday, when the liquidator reported that the liabilities to the trade amounted to £210, while the assets were valued at £48. The company was registered on April 5th, 1914, with a nominal capital of £500 in £1 shares. The directors were Mrs. Cornell and her son. The former held 493 shares, while the remaining seven shares were held by the signatories. The company was formed to acquire the business previously carried on by the late Mr. W. T. Cornell. The principal creditors were the General Electric Co., whose claim amounted to £130, and at their wish the meeting was adjourned.

J. T. MAYFIELD, electrical engineer, 63, Cannon Street, London, E.C.—A meeting of the creditors was held on Monday, when a statement of affairs was presented showing liabilities of £605. The indebtedness to the trade was £535, and there was a partly secured cash creditor for £190. The business was originally carried on by the father, Mr. J. T. Mayfield, who died intestate in June, 1910. An arrangement was then entered into by which the debtor should take over the business and pay his mother an annuity of £200. The partly secured cash creditor was the debtor's mother, and her security consisted of an assignment of the book debts. After a short discussion, it was decided that a deed of assignment should be executed to Mr. G. E. Corfield, of Corfield & Cripwell, who was instructed to make a further investigation, and report to an adjourned meeting.

Prices Advance.—MESSRS. A. P. LUNDBERG & SONS announce that in consequence of further increases in the costs of labour and material, the net amounts shown on invoices will be subject to an increase of 15 per cent. until further notice, instead of 5 per cent. as hitherto.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., announce that owing to increased prices of raw material, they have found it necessary to advance the list prices of fittings and glassware by 10 per cent. as from June 1st.

Bankruptcy Proceedings. — C. WRAY, mechanical and electrical engineers, Bradford.—A supplemental dividend of 7½d. in the £ is payable to-day (June 4th) at the Official Receiver's office, 12, Duke Street, Bradford.

Liquidation. — COAST DEVELOPMENT CORPORATION, LTD.—This company is winding up voluntarily, with Messrs. A. F. Whinney and J. F. Stovell as liquidators.

Portland Cement Works for Queensland.—Owing to the shortage of German and Belgian supplies, a good deal of attention is being given to the manufacture of Portland cement in the Colonies and other places abroad where limestone, shale, or clay and coal can be obtained of suitable quality, and in sufficient quantities to make the manufacture likely to be successful and remunerative.

The Queensland Cement and Lime Co., Ltd., has now arranged to establish a works at Darra, near Brisbane. The plant is designed to produce about 40,000 tons of cement per annum. The complete contract for the supply and erection of the plant has been placed with Messrs. Noyes Bros. (Sydney), Ltd., engineers and contractors, who have had a large experience in connection with similar work in Australia.

The plant will be of the most modern description, and is all being obtained from British manufacturers. The grinding mills will be of the combination ball and tube mill types. The kiln will be 140 ft. long and 8 ft. diameter, and with the elevators, conveyors, slurry mixers, pumps, &c., will be electrically-driven, direct coupled wherever possible.

The motors are for three-phase, 50 cycles, 440 volts, and the works will be complete with its own electrical generating plant, including alternators, direct coupled to vertical high-speed engines, condensing plant, boilers, &c.

The general lay-out of the plant shows that it is expected that very soon the works will be duplicated, and later on further increased.

Bennis Contracts. — Messrs. Ed. Bennis & Co., Ltd., of Little Hulton, Bolton, inform us that something like 80 per cent. of the work on which they are at present engaged is in connection with War Office contracts. They have sent us an imposing list of other contracts recently placed, including the following :—

Rotherham Corporation Electricity Station.—Four sprinkler stokers and compressed air furnaces for 8-ft. diameter Lancashire boilers; also two pair of chain grates, 6 ft. 6 in. wide by 11 ft. 5 in. long. Repeat order.

Liverpool Corporation Electric Supply Department, Lister Drive Station.—Relinking two chain grates of another make, with the Bennis patent links.

Hastings Tramways Co., St. Leonards-on-Sea.—Relinking four chain grates of another make, each 4 ft. wide by 11 ft. 3 in. centres.

Fire Prevented.—The sensitiveness of electric fire alarms was well exemplified in a recent instance when the Fire Brigade was automatically called to a printing office in the City at 10.35 p.m. There was no fire, but the heat given off by a gas jet, which had been left burning in a confined space, and had already blackened some wood laths, had sufficed to actuate the alarm in time to prevent an outbreak. The system was installed by Associated Fire Alarms, Ltd.

Patent Application.—Mr. A. C. Hyde and the Vactite Wire Co., Ltd., have applied for restoration of Patent No. 17,817 of 1907 for "Improvements in making electrically conducting joints in metallic-filament incandescent electric lamps."

For Sale.—Offers are invited by the borough electrical engineer of Leigh (Lancs.), for the purchase of a boiler, 3,175 sq. ft. heating surface. Messrs. P. Huddleston & Co. will sell by auction a large quantity of electrical apparatus, including motors, cable, switches, telephones, &c., at Dalling Road, Hammersmith, W., on June 9th. Particulars are given in our advertisement pages to-day.

Trade Announcement.—Messrs. Fletcher's Electric Fittings Co., Ltd., electrical fittings makers, are vacating their premises at 30, Sutton Street, Holloway Head, Birmingham.

LIGHTING and POWER NOTES.

Aberdeen.—The Electricity Committee reports that the number of units of electricity generated last month showed an increase of 40,000 over the corresponding period of last year.—*Aberdeen Journal.*

Aylesbury.—E.L. Scheme Inaugurated.—The electricity works, constructed by the U.D.C., were opened on May 27th, the scheme being explained to the visitors by the resident engineer, Mr. W. H. Turnbull.

Bath.—The Diesel engine at the Corporation electricity works, which has been dismantled since early in 1914, is to be reassembled with the addition of certain improvements, at an estimated cost of £150, and will be running in about 10 weeks' time.

Birmingham. — Year's Working. — The annual accounts of the Corporation Electricity Supply Committee, for the year ended March 31st, 1915, show that the total number of units sold as compared with the previous year was as follows :—

	1915.	1914.
Low-tension—		
Lighting	8,726,306	8,341,027
Power...	21,460,141	19,192,304
High-tension	28,536,161	22,193,274
Tramway supply	24,186,574	24,040,573
Total ...	82,909,182	73,767,178

The total value of units sold was £379,625, compared with £346,561 in 1914. The output for lighting and power, excluding tramways, shows a substantial increase, the units sold being 18·1 per cent. higher than in the previous year. The money value of this supply shows an increase of 14·1 per cent. The output for tramway supply shows an increase of 0·6 per cent. The gross profit on the undertaking was £192,376, and after meeting all charges for interest, &c., there remained a balance of £60,385, of which £25,000 has been carried to renewals fund, leaving £35,385, which it is proposed to carry to the credit of the borough rate. This is approximately £10,250 more than the contribution of the previous year.—*Birmingham Daily Post.*

Bispham.—Loan Sanction.—The U.D.C. has received from the L.G.B. sanction to a loan of £3,586 for E.L. purposes.

Blackburn.—New Scheme Deferred.—The scheme for the new generating station at Whitebirk has had to be deferred owing to the refusal of the Treasury and L.G.B. to sanction the necessary loan.

Bolton.—Increased Prices.—In view of the increased cost of generation, due to the price of fuel, the Electricity Committee has decided that, from May 28th, current for lighting be charged at 4d. per unit instead of 3·5d. For power purposes the charge will be increased over the present prices by about 10 per cent. For the first time for a number of years, no grant is being made to the relief of the rates.

Bournemouth.—Reduced E.L. Charges.—According to a local paper, the Bournemouth, Poole and District Electric Supply Co. is making a reduction of ½d. per unit in the price of current. This is equivalent to an 8 per cent. reduction.

Bury.—Rate Relief.—Of the profit of £2,038 on the electricity undertaking for the past year, £1,000 has been allocated towards the relief of the rates, and the balance has been placed to reserve fund.

Cape Province.—The ratepayers of Beaufort West have passed a resolution urging the Municipal Council to proceed at once with the electric lighting scheme, sanctioned eight months ago, but postponed owing to the war.

Carshalton.—Refuse Destructor.—The U.D.C. has decided not to join with other local authorities in the provision of a refuse destructor, it being considered that the power from a destructor cannot be utilised for other remunerative purposes.

Continental Notes.—Spain.—A new company has been formed in Barcelona with the title La Sociedad Central Electrica de Villarrodona to establish a small central station for the supply of electrical energy for lighting and power purposes in the town and district of Villarrodona.

France.—Our contemporary, the *Gas World*, quoting a French paper, refers to the damage done to Rheims gas and electricity works. It appears that the electricity works were struck by two shells, damaging the machinery, and that both underground and overhead mains have been badly cut about. The damage to the gasworks was much more extensive, but by prompt action serious results appear to have been avoided.

Cuba.—The following persons have been granted permission to install electric power and lighting plant :—Senor Wenceslao Sánchez Cifuentes, at San José de los Ramos, Province of Matanzas; Senores Pérez y Hno., at Nueva Gerona, Isle of Pines; Senor Lino Rodriguez, at Florida, Province of Camaguey; and Senores Abreu y Hno., at Florida. The *Gaceta*, which contains particulars regarding the installations to be carried out, may be consulted at the Commercial Intelligence Branch of the Board of Trade.

Darlington.—Increased Prices.—In view of the high price of coal, and to meet the additional charges for war bonuses to employés, the Electricity Committee of the T.C. has increased the price of current for lighting by ½d., and for power by ⅛d. per unit.

Derby.—Loan Sanction.—The T.C. has received the sanction of the L.G.B. to a loan of £12,550 for E.L. purposes. The E.L. Committee has recommended the Council to increase the charges for current by 10 per cent. in consequence of the high price of coal.

Dublin.—Year's Working.—The report of the Electricity Committee for the year ended March 31st last shows a net profit of £748 on the year's working, as compared with an estimated profit of £9,024. The falling off in consumption during the year was 284,000 units, representing £8,687. The decrease in the working expenses as compared with the estimates amounted to £2,753, but capital charges increased by £2,443. For the current year the capital debt charges are estimated at £55,653. If the present rates are retained the Committee estimates a deficit on the current year of, approximately, £21,334, and it is suggested that the deficit should be spread over more than one year by utilising the small reserve of working capital, which, with the slight profit of the year just closed, should amount to £9,600, and to make an increased charge of ½d, on the lighting rates and ¼d. per unit on the power rates, the additional charge to be borne for two years.

Erith.—Bulk Supply. — The U.D.C. has decided, subject to the approval of the B. of T., to afford a bulk supply of current to the West Kent Electric Co., for distribution to houses being erected in Colyer's Lane.

Glasgow.—It is considered that the Electricity Committee will be faced with the necessity of increasing the rates both for lighting and for power by 10 per cent., owing to the increased cost of coal, &c.

Haslingden.—Revised Prices.—The Corporation has decided that the charge for electricity supplied to places of worship, workshops, offices, banks, warehouses, and to other short-hour users, be reduced from 5d. per unit to 4d. per unit from July 1st next. In future 2½ per cent. discount is to be allowed on accounts for electricity for heating purposes, provided payment is made within 14 days.

Hebden Bridge.—In order to encourage the day load, the Electricity Committee has introduced a new scale of discounts, varying from 5 to 62½ per cent., according to quantity taken. If the total consumption exceeds 100,000 units a year, the excess units will be charged at ⅝d. per unit without discount.

Hereford.—Year's Working.—During the year ended March 25th, 1915, the Corporation Electricity Department sold 1,303,800 units, as compared with 850,011 in the previous year, showing a phenomenal increase of 453,789 units, or 53 per cent. The power units sold numbered 1,039,114; the maximum load reached 585 KW., and the load factor 25·44 per cent. The generation cost per unit sold was ·651d., as against ·771d., and the total cost 1·52d. as against 2d. per unit. The average price obtained was 1·512d. per unit, this showing a small deficit (£59) on the year's working, as compared with a surplus of £105 in the previous year. The total revenue was £8,215, and the gross profit was £3,605. The report of Mr. Kerr, the city electrical engineer, mentions that eight months of war had decreased the lighting revenue by £300; a deficiency of condensing water—since remedied—is also estimated to have made a difference of £300 in production costs, and in addition the rising price of fuel has adversely affected the costs. Over 120 consumers were added during the year, and the consumption per head of population is now 56·73 units.

Owing to the increased cost of production and the decreased consumption of current, the Electricity Committee has decided to increase the charges for current, except where prices are fixed by contract, by 10 per cent. as from June 1st.

Holmfirth.—E.L. Scheme.—The erection of the generating station for the E.L. scheme has been commenced by Mr. R. Turner; the poles for the overhead lines are being put up by Messrs. Broadbent.

India.—Electrical Mining Regulations.—According to *Indian Engineering*, the question of arranging for a more systematic inspection of electrical installations in coal mines in India is at present under the consideration of the Government of India. At present inspections of electrical machinery, whether installed in mines or elsewhere, are made by Inspectors under the Electricity Act. In order to make them more thorough and effective, an Inspector under the Electricity Act will probably be required to reside permanently in the principal coal-mines area, probably at Dhanbaid, and to devote practically all his time to inspections of installations at the mines.

London.—At the recent conference between the County Council and municipal electricity suppliers in connection with the London electricity supply, it was pointed out to the L.C.C. that to ensure any Bill it might wish to bring in being successful, it would be necessary to consult the B.C.s before the Bill was formulated and not after it was drawn up, so that the B.C.'s suggestions might be embodied. According to the *East London Advertiser*, the L.C.C. has agreed to meet the Councils concerned on the question.

Mansfield.—The T.C. has decided not to increase the generating plant at the electricity works at the present time on account of circumstances arising out of the war.

Nuneaton.—Electric Cooking, Street Lighting, &c.—The T.C. has decided to purchase, at a cost of not exceeding £40, suitable electric cooking apparatus, and to grant a war bonus to the electricity works staff. Provided the order for conversion is placed at once by the Highways Department, the Electricity Committee has decided to take over and light 97 street gas lamps on the route of existing mains in November next.

There was a net profit of £878 on the working of the electricity undertaking during the year ended March 31st last.

Salford.—Price Increase.—The Electricity Committee has decided that the price of energy for lighting and power be increased 7½ per cent. from July 1st next, except as regards that supplied to the tramways department, or under special agreements for unexpired periods, entered into prior to October 1st last.

Sidmouth.—Refuse Destructor.—The question of providing a refuse destructor for the urban district has been deferred, owing to the refusal of the L.G.B. to sanction a loan for the work.

Southampton.—Electric Vehicles, Loans, &c.—In view of the successful operation of the electric van which was put into service recently, the Electricity Committee has decided to exercise its option on an additional chassis, and equip the same for use on the mains. At the outbreak of war the Government commandeered the 500-KW. rotary converter on order from the British Thomson-Houston Co. In view of the fact that since the service of tramcars has been increased, the electrical engineer now supplies the cars from the 1,000-KW. sets, the company was approached as to the cost of a 750-KW. set arranged so that the tramways could be supplied from it when required. It has now been decided to purchase the machine at £1,909, and to apply to the L.G.B. for sanction to borrow the cost. In reply to the Council's application for further sanction to loans of £8,000 and £6,000 for mains and services, the L.G.B. has intimated that it is not prepared to give its sanction unless in respect of extensions to factories engaged in the making of munitions.

Southport.—Price Increase.—An advance of 10 per cent. on the price of electricity to consumers for all purposes is to take effect from June 24th next. Following the lead of Southport, the Birkdale District Electric Supply Co., Ltd., which supplies the Birkdale area, has announced an increase in the price of electricity of 10 per cent. to commence on June 30th.

Spenborough.—Price Increase.—A new scale of the electrical charges has been prepared in connection with the Council's electricity undertaking, which will operate from July 1st, and provides for (*a*) the abolition of a 10 per cent. addition on the net amount of consumers' accounts, which came into force on January 1st, 1913; (*b*) that charges for current for heating and power be 2½d. per unit on a minimum consumption of 150 units per quarter per H.P. of demand, and 1¼d. per unit above such minimum, with sliding scale discount for payment within a month of demand; and (*c*) that the charge for lighting current be 4¾d. per unit, with a discount of 5 per cent. for payment within a month of demand.

Stalybridge.—Proposed Loan.—The Joint Tramways and Electricity Board has decided to apply to the L.G.B. for sanction to borrow £4,000 for transformers and mains for munition factories.

L.G.B. sanction has been received to the borrowing of £12,921, and mains extensions are to be carried out.

Walthamstow.—Increased Prices.—The Lighting Committee has decided to increase, as from the June quarter, the prices charged for current by 15 per cent., except in the case of contracts. As regards prepayment meters, it is proposed to charge the consumer an equivalent of 15 per cent. upon the sum taken from the meter. The engineer is to negotiate with those consumers who have period contracts, with a view to their paying the increased price without prejudice to the terms of the contract.

West Bromwich.—Year's Working.—The accounts of the electricity undertaking for the year ended March 31st last show a net profit of £878, which is to be carried to net revenue appropriation account. The total income of the undertaking was £20,252, or an increase of £1,938 as compared with the previous 12 months. The receipts from the sale of current show an increase of £1,824. The L.G.B. has sanctioned the borrowing of £3,300 for mains and £3,444 for new boiler, pipework, feed pump, transformer, switchgear, regulator and cable connections. Application is to be made for the consent of the B. of T. to put up another overhead main in order to give a larger supply of current to the premises of Messrs. J. Brockhouse & Co., Ltd.

Wharfedale.—Proposed E.L. Scheme.—The conference of representatives of various local authorities to consider the possibility of a joint scheme of electric supply, in view of the withdrawal of the Yorkshire Electric Power Co.'s Bill, was held last week at Yeadon. Representatives were present from the Councils of Yeadon, Rawdon, Guiseley, Otley, Burley and Wharfedale Rural Councils. A resolution was adopted in favour of the production of the current inside the area covered by the local authorities represented, and a committee was appointed to obtain information as to the cost of purchasing energy in bulk from every available company or Corporation within reach, and also as to the best means and the cost of obtaining a combined provisional order.

Worcester.—War Bonuses.—The Electricity Committee has recommended the T.C. to grant a war bonus of 2s. 6d. per week to certain members of the electricity works staff, and 2s. per week to others.

TRAMWAY and RAILWAY NOTES.

Australia.—A very large expenditure is contemplated in connection with the electric tramway extension for the eastern suburbs of Melbourne. Two lines already in hand involve an estimated expenditure of £215,000, and other lines are in contemplation involving a further expenditure of £118,000.—*Melbourne Age.*

Birmingham.—Year's Working.—The annual accounts of the Corporation tramways department for the year ended March 31st last show a total revenue of £647,014, as against £635,471 for 1914. Working expenses amounted to £473,879, as compared with £445,507 in the previous year, leaving a gross balance of £173,135 and after paying interest and sinking fund charges, the net surplus for the year was £47,596, of which £17,596 was placed to reserve fund, the balance, £30,000, being transferred to the credit of the borough rate account. The total car-miles run were 14,232,902; the average traffic revenue per car-mile 10·793d., as against 10·563d.; the average working expenses per car-mile 7·991d., as against 7·494d. in 1914; and the percentage of working expenses to receipts 73 as against 70 per cent. in the previous year. It is believed that the loss in traffic due to the war was between £40,000 and £[illegible].—*Birmingham Daily Post.*

Bolton.—STRIKE.—A settlement of the tramway strike was arrived at on Tuesday, and the car service was resumed on Wednesday, after three days of idleness. The men returned to work in consequence of an offer made by the Committee that no notice would be put up requiring them to work proposed extra cars; this overtime will be worked voluntarily. A further promise was made to the men that other grievances would be considered.

Chester.—The Tramways Committee has received a letter from Capt. Gosset, stating that it was quite possible that sanction could be obtained for wounded soldiers, who were unable to return to the Front, to accept positions as tram conductors, and so relieve those eligible for enlisting. The Committee has agreed to employ such men as are capable of doing the work, as vacancies occur.

Coventry.—FEMALE LABOUR.—Women conductors are to be employed on the less frequented tramway routes. *Birmingham Daily Post.*

Glasgow.—YEAR'S WORKING.—The tramway department's financial year closed on May 31st, and it is stated the net receipts will reach £1,070,353, or about £8,000 below the record total of last year. The number of passengers carried was about 300,000 less, though this is looked upon lightly, as last week, for instance, the number of tickets issued reached the remarkable figure of 7,039,490. This represents more than the total population of the city patronising the cars daily.

Hull.—YEAR'S WORKING.—A net profit of £14,574 was made on the tramways for the year ended March 31st last; £10,000 of this has been allocated towards relief of the rates, and a sum of £6,076 has been carried to reserve fund.

London.—L.C.C. TRAMWAY STRIKE.—The joint executive of the two Tramwaymen's Unions decided late on Monday night to recommend all L.C.C. tramway employés who are above military age to return to work.

A notice was issued on Monday by the Council's tramway manager that since the majority of the men above Army age have returned to work, although men who are eligible for service in the Forces will not be taken back, those who enlist will receive favourable consideration for reinstatement, as far as may be possible, after the war; and any man of military age unable to enlist may appeal to the chief officer and state his reasons, and he will consider whether any special circumstances allow an exception to be made in his case.

The M.E.T. Co.'s employés have all returned to work, the company having made no stipulation in regard to enlistment.

Newcastle-on-Tyne.—FEMALE LABOUR.—At a meeting of the Tramways Committee on May 26th, the general manager reported that since the last meeting 48 women conductors had been trained, 24 were in full charge of cars, and the rest were in training on cars. Their employment had been an unqualified success, and had surpassed all anticipations. Applications for further women conductors were desired. The Committee decided to abolish ½d. workmen's fares, the minimum fare to be 1d.

Ramsbottom.—RAILLESS TRACTION.—The first of the new railless cars, which has been built on stronger lines than the earlier ones, was delivered last week, and a trial run was stated to be satisfactory. The chassis is heavier, the wheels larger in diameter and provided with wider tires, while more flexible springs are fitted. Another car is on order, and the older cars are to be altered to conform with the new design.

Salford.—FEMALE LABOUR.—The women who have been training as tramway conductors are to be on duty about 5½ hours daily (Sundays excepted), to work "emergency cars" in the mornings and evenings, when people are going to or from business. Mr. G. W. Holford, general manager, has addressed a notice to the men explaining the circumstances under which the women are being employed and asking the men to assist the newcomers as far as possible. A notice has also been issued in which the Tramways Committee appeals for the kind co-operation and consideration of the travelling public under the new conditions.

Stalybridge. — The Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways and Electricity Board, on May 26th, sealed precepts on the four Corporations amounting in the aggregate to £7,000, being the amount of the deficiency in the net revenue of the Board to March 31st last.

Sunderland.—YEAR'S WORKING.—During the past year the Corporation tramways earned a total revenue of £75,615; the total working expenses were £41,549, and the amount carried to net revenue account £34,066. Interest on capital absorbed £6,463; repayment of loans, £10,374; renewals fund, £9,602, and £5,000 was paid to the borough fund in aid of the rates. The reserve and renewals fund, which stood at £39,508 on March 31st, [illegible] increased to £[illegible].

U.S.A.—SUBURBAN RAILWAY ELECTRIFICATION.—The report of the engineer of the Wisconsin Railroad Commission, following an investigation of transportation facilities in the metropolitan district of Boston, recommends the electrification of the following lines centring in that city, which the Public Service Commission promises to consider with a view to their gradual conversion:—The Saugus and Medford branches of the Boston and Maine Railroad; the West Roxbury branch of the New Haven, and the Newton Circuit of the Boston and Albany Line. These are steam-operated at the present time, and it is proposed to reconstruct them by the laying of parallel track for local trains which would be run from the termini of the Boston Elevated Railway's present tunnels and elevated structures. The scheme contemplates the creation of three main routes intersecting at the centre of the branch; about $15,000,000 would be required.—*Electrical Review and Western Electrician.*

NORFOLK AND WESTERN ELECTRIFICATION.—According to the *Railway Gazette*, this is the first line where the high-power electric locomotive has superseded the Mallet compound steam locomotive. The line electrified is in the Pocahontas coalfield, about 35 miles in length, and the traffic consists principally of coal. This is handled under closely competitive conditions, and a very large volume has therefore to be moved in order to make the traffic profitable. At present the amount carried daily is from 40,000 to 60,000 tons, and it is conveyed in trains weighing about 3,250 tons, consisting of steel hopper cars of 100 tons capacity carried on six-wheel bogies. There are long and heavy grades, rising 1 in 75 and 1 in 100, and a long 1 in 50 down grade. Hitherto, three Mallet compounds have been required, and the average speed has been 7 M.P.H., but with the new electric locomotives, the motors of which, during acceleration, develop as much as 11,000 H.P., and while running at regular speed on the up grade a continuous output of 8,000 H.P., take the trains at an average speed of 14 M.P.H. In view of the serious financial strain through which the railways of the United States are now passing, and the fact that no railway would at present undertake electrification unless the prospects were very reassuring, the work now being done on the Norfolk & Western, and on the Chicago, Milwaukee & St. Paul, is very significant.

West Bromwich.—YEAR'S WORKING.—The net profit of the Corporation tramways last year was £192, which is to be carried forward. On the other hand, on the motor-'buses there was a net deficiency of £135, which will be a charge on the borough fund during the current year.

York.—TRAMWAY EXTENSION.—The L.G.B. has sanctioned the proposed extension of the tramways from Nessgate to Hull Road.

TELEGRAPH and TELEPHONE NOTES.

A Telegraph Spy.—It is reported that the parish priest of Caporetto, an Austrian village, has been court-martialled and shot by the Italians for treasonably communicating with the Austrians by means of a secret telegraphic apparatus.

Argentina.—It is announced at Buenos Ayres that telegrams for Germany and Austria must in future be sent by way of the U.S. wireless station at Sayville.—*Journal Télégraphique.*

New Cable.—The Greek Ministry of Ways and Communications has decided to connect the Epirus with the Isle of Corfu by a submarine cable *viâ* Santiquaranta. — *Journal Télégraphique.*

North Sea Cable.—It is reported that Great Britain has given the Norwegian Government a guarantee that she will respect the Great Northern Telegraph Co.'s steamers while they are repairing the Anglo-Norwegian cables. Norway has asked Germany to give a similar guarantee, but no reply has been received.

Panama Canal.—The U.S.A. Government is building three steel towers 198 m. high near the Canal, to carry the antennæ for the Panama wireless station. The towers measure 45 m. wide at the base and 3 m. at the top, and will weigh about 1,000 tons.—*Journal Télégraphique.*

Straits Settlements.—The American Consul at Singapore reports that a permanent wireless station at Singapore has recently been erected to be controlled by the Government. It was anticipated that the plant would be in operation by the middle of April. The apparatus is a complete Marconi 5-KW. outfit, having a range of 400 miles, which can be exceeded under favourable conditions. The towers are 250 ft. high, and the total cost is estimated at about £23,000. At the outbreak of war a temporary wireless station was erected on the top of a building in the centre of the city, but it is not a high-power station, and has been maintained for the Naval Intelligence Bureau. It is announced in the Government *Gazette* of the Federated Malay States that 10 acres have been acquired in Penang and Butterworth for a wireless telegraph station.

Uruguay.—Dr. Enrique Wilson, on behalf of a North American syndicate, has applied to the Government for permission to establish a powerful wireless telegraph station, with which Uruguay would be able to communicate directly with Panama and New York, and by means of these stations, with Europe.—*Review of River Plate.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—Corporation Electricity Works. One year's supply of small steam coal. Mr. J. A. Ball, City Electrical Engineer.

Australia.—MELBOURNE.—July 14th. Victorian Railway Commissioners. Supply of 60,000 flame arc carbons for use in Ganz flame arc lamps (Contract 28,811).—*Australian Mining Standard.*

Victorian Railways. July 14th. Aluminium feeder, insulators, anchoring clamps, &c., for the St. Kilda-Brighton electric street railway. Contract No. 28,817. Particulars at Contractor's Room, Spencer Street, Melbourne.

August 11th. One 1,000 KW. D.C. generator complete, liquid starter, &c., for City Council. See "Official Notices" to-day.

ADELAIDE.—July 14th. Galvanised-iron wire, for P.M.G.'s Department. See "Official Notices" to-day.

SYDNEY.—July 12th. Metropolitan Board of Water Supply and Sewerage. Two steam turbines and condensers at Ryde pumping station, for the Chatswood pumping plant. Secretary, 341, Pitt Street, Sydney.

July 19th. Council. Meters for the Electric Light Department, Town Hall. Specification 10s. 6d.

July 19th. Council. Maximum-demand indicators. Specification (10s. 6d.) from Electric Light Department.

July 19th. Municipal Council. One or two 12,000-KW. turbo-alternators (Contract No. 363).* A copy of the specification can be obtained from the City Electrical Engineer, Sydney.

July 19th. Steel towers for 33,000-volt transmission line. Specification (10s. 6d.) at E.L. Department, Town Hall.

July 21st. N.S.W. Government Railways and Tramways Department. One 250-K.V.A. turbo-generator.*

PERTH.—July 7th. Deputy P.M.G. 31,000 porcelain or alternatively stoneware insulators (Schedule 432 W.A.).*

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Birkenhead.—June 10th. Rough slack (washed and unwashed) and small coal (washed and unwashed) for the electricity stations for six or twelve months. Borough Electrical Engineer.

Bridlington.—2,000 tons of coal, for the Corporation electricity works. Mr. A. J. Beckett, Electrical Engineer.

Cleckheaton.—June 9th. Slack coal (3,000 tons) for the Spenborough U.D.C. electricity works. Mr. J. H. Linfield, Clerk, Town Hall.

Dublin.—June 7th. Electric passenger lift for Irish United Assurance Society. See "Official Notices" May 28th.

Eccles.—June 9th. Corporation. Installation of the electric light at the Anson Street Council Schools, Winton. Forms of tender (10s.) from Mr. E. Parkes, Town Clerk, Town Hall.

Edinburgh.—June 21st. Two 5,000-KW. turbo-alternators and condensing plant, for Portobello supply station. See "Official Notices" May 21st.

Glasgow.—June 7th. The Trustees of the Clyde Navigation invite tenders for a year's supply of electrical stores. Mr. T. R. Mackenzie, General Secretary and Manager, 16, Robertson Street.

Grays.—June 10th. U.D.C. Six or twelve months' supply of Griff, Babbington or Stockingford hard steam coal for the electricity station. Electrical Engineer, Grays Thurrock U.D.C.

Kirkcaldy.—June 11th. Corporation. 100 half-watt 1,000-C.P. lamps and lanterns for street lighting. See "Official Notices" May 28th.

London.—L.C.C.—June 4th. Installation, 260 wiring points, 345 lights, also electric bells, at the County Secondary School, South Hackney. See "Official Notices" May 21st.

ST. PANCRAS.—June 14th. Corporation. Twelve months' supply of Welsh and steam coal for the electricity stations and baths.

WEST HAM.—June 14th. Installation of lighting and water-heating apparatus at Knox Road Special School, for Education Committee. See "Official Notices" May 28th.

Manchester.—June 16th. 40-KW. steam dynamo for Cottage Homes, Styal, for Manchester Union. See "Official Notices" to-day.

Rangoon.—August 11th. Installation of a system of fire-alarms, for the municipality. Specification (10s.) from Messrs. Ogilvy, Gillanders & Co., 67, Cornhill, E.C.

Redditch.—June 11th. H.T. three-phase switchboard. See "Official Notices" May 28th.

Rhondda.—June 4th. U.D.C. Water-storage tank (30,000 gallons), for Porth electricity works. See "Official Notices" May 28th.

Tasmania.—LAUNCESTON.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

HOBART.—July 5th. Lead-covered telephone cables; glassware and other material for batteries; telephone instruments, &c., for P.M.G.'s Department. See "Official Notices" May 28th.

CLOSED.

Bridlington.—The Electricity Committee recommends the acceptance of the tender of the New Destructor Co., Ltd., at £6,332, for a refuse destructor on a site adjoining the electricity works.

Buxton.—The U.D.C. has accepted the tender of Messrs. Day & Ferguson for 2,000 tons of Pilsley hard slack coal for the electricity works.

Derby.—The T.C. has sealed a contract with the Derby Kilburn Colliery Co., Ltd., for coal for the electricity works.

Dublin.—The Corporation Committee of Supplies has recommended the acceptance of the tender of Messrs. J. McKelin and Co., for 12 months' supply of Scotch steam nuts at 25s. 11d. per ton, for the electricity generating station.

Hammersmith.—The Electricity Committee reports that for the annual supply of box frames, covers, boxes, &c., Messrs. W. Lucy & Co., the second lowest tenderers, have intimated that they would require an additional 7½ per cent. on the prices tendered by them. In view of this increase and that the requirements of the department will be less than was anticipated, the Committee recommends the purchase of these items in the open market as favourable opportunities occur. The Committee reports the purchase of 50 tons of Babbington 2-in. slack coal at 19s. [illegible] per ton.

Haslingden.—The Tramways and Electricity Committee has accepted the tender of Mr. J. Milne, for petrol required during the period ending March 31st next.

Leyton.—The U.D.C. has entered into contracts with the Electrical Apparatus Co., Ltd., the British Thomson-Houston Co., Ltd., and the Reason Manufacturing Co., Ltd., for ordinary meters, and with the B.I. and Helsby Cables, Ltd., for slot meters, for a period of twelve months.

Manchester.—The Engineering Sectional Committee of the Education Committee has approved the renewal of certain plates in the Tudor storage battery, at £250.

The Education Committee has accepted the tender of Messrs. R. Seddon and Sons for installation of electric light at the new Islington School Clinic, and the tender of Messrs. R. O'Brien & Co. for a telephone at Alder House.

The following tenders have been accepted by the Electricity Committee:—

Three 1,200-K.V.A. static transformers.—British Westinghouse [illegible]
Cable.—B.I. & Helsby Cables, Ltd.
Purchase of scrap copper and scrap cable.—B.I. & Helsby Cables, Ltd.

The Tramways Committee has accepted the tender of Messrs. Isaac Bentley & Co., Ltd., for linseed oil.

Meter Contracts.—Messrs. Ferranti, Ltd., have secured a contract from Glasgow Corporation for the supply of continuous-current electricity meters for the year ending May 31st, 1916.

Messrs. Chamberlain & Hookham, Ltd., have received contracts for meters for the coming year from Glasgow and Falkirk.

The Hornsey B.C. has placed a contract with the British Thomson-Houston Co., Ltd., for their direct-current ampere-hour meters for 12 months.

New Zealand.—WHANGAREI.—For electric wiring and the installation of meters for the B.C. the following tenders were received:—

National Electrical and Engineering Co., Ltd.	[illegible]
A. & T. Burt	[illegible]
Turnbull & Jones	[illegible]

—[illegible]

Salford.—The Electricity Committee has accepted the following tenders:—

H.T. cable and control panel, £[illegible]71.—British Westinghouse [illegible]
Wet air filter, £327.—Heenan & Froude, Ltd.
Transformer, £1[illegible].—Ferranti, Ltd.
Purchase of scrap copper, £1[illegible].—B.I. and Helsby Cables, Ltd.

South Africa.—The Johannesburg Municipality has accepted the tender of the Telegraph Manufacturing Co. for five miles of trolley wire, at £29 1s. per mile.—[illegible]

FORTHCOMING EVENTS.

Association of Mining Electrical Engineers (Notts. and Derbyshire Branch).—Saturday, June 5th. At 3.30 p.m. At University College, Nottingham. Paper on "Experinces with Electrical Plant," by Mr. A. Smethe.

Royal Institution of Great Britain.—Monday, June 7th. At 5 p.m. At Albemarle Street, W. General Meeting.

Institution of Mining Engineers.—Thursday, June 10th. At 11 a.m. In the rooms of the Geological Society, Burlington House, Piccadilly, W. General Meeting.
Friday, June 11th. Visit colliery sinkings near Coventry.

North of England Institute of Mining and Mechanical Engineers.—Saturday, June 12th. At 2 p.m. At Newcastle-on-Tyne. General Meeting.

Salford Technical and Engineering Association.—Saturday, June 12th. Visit. Manchester Corporation Electricity Works, Stuart Street Power Station.

NOTES.

The Electrical Future of Belgium.—With reference to our leading article on this subject and the full report of a paper by M. Steylaers, we have pleasure in publishing the following letter :—

"Sir,—Referring to our letter dated 17th ult., we are now in a position to inform you that we intend to convoke a new meeting between the Belgian and English manufacturers within two or three weeks. We will inform you the exact date within a few days. The Belgian Committee for Trade with the Allies have put their rooms at our disposal in 43, Shoe Lane. Will you be in a position to induce the English manufacturers to attend this meeting, which seems more necessary than ever to begin to talk about taking energetic measures towards the production of our future business against German trade?

"I do not know whether you are fully aware of what is happening at the present time in Germany with regard to preparing for the economic struggle with the Allies after the war. It will be sufficient to state that at the present time already hundreds and thousands of small labels are being made in Germany in electrotype with the mention, 'Not made in Germany.' Do you see what this means? Are you fully aware that Germany after the war is going to conduct, through neutrals and even through many of our own countrymen, a campaign against her own goods, and is going to brand her own goods with her own labels, 'Not made in Germany'?

"This may be something like a false signature, but we are already getting accustomed to such mean acts, which would be reproved by the honest tradesman. I will tell you something more. Are you aware that already now active steps are being taken by German business men with neutrals, and also with Belgian and English people, to induce them to act after the war on behalf of German trade, as what we call in French *Prête Nom!* This means that:

(1) The Germans realise perfectly that they have absolutely lost the war;

(2) That they have absolutely lost the goodwill;

(3) That they consider the end of the war to be much nearer than many people think, a fact which they know better than ourselves, because they can calculate better what is their real power and resistance on the economic point. All these facts stated above are proved by personal witnesses actually in Germany who are studying these economic sides to the very foundations.—Yours faithfully,

"R. Steylaers.

"7, Idol Lane, London, E.C., *June* 1[illegible], 1915."

The Latest "Magnetic" Invention.—One of the most bare-faced devices to ensnare the credulous that we have ever met with has recently been brought to our notice by the city electrical engineer of Londonderry, Mr. R. V. Macrory, who laments the fact "that hands are now employed in producing such rubbish at the present time, when so much useful work is being delayed." It consists of two thin wires, of iron and some other metal, about 7 in. long, twisted and soldered together at one end like the letter Y, with the tail of the Y coiled in the form of a small helix. This device is called the "sun-ray magnet," and is described in a cleverly-written leaflet ("No. 1, Vol. I") as a "Great scientific gardening discovery," a "simplified 'wireless' method of electrifying the soil and its plant life with 'Sun-Ray Magnets.'" The leaflet is ornamented with quotations from Swift and Emerson, and on the last page, with consummate impudence, refers to our articles on the uses of electricity in agriculture and horticulture. The two straddled legs of the "magnet" are to be pushed into the soil a few inches from the plant, in a position "that is most open to the sun and the atmospheric electric currents." If the soil is hard, it should be loosened all round the plant—a process which, it will be noticed, is itself likely to aid plant growth, though the improvement will, by the superficial, be attributed to the use of the "magnet." Careful instructions are also given to water the plant regularly, on the score that "a plant aided by a 'Sun-Ray Magnet' is able to absorb more moisture," and we are artlessly informed that "in continuously dry soil the Electrically-stimulated plant does, perhaps, less well than without Electricity"! As a proof that the "Magnet" possesses electrical properties, the two ends are shown connected to a sensitive galvanometer, while the soldered junction *is held between the finger and thumb.* Naturally, the thermoelectric current thus produced deflects the needle, and the doubter is convinced. But it is claimed that in use "the 'Sun-Ray Magnets' act as 'conductors' of the Infinite Electrical Currents of the atmosphere."

We will not follow the leaflet through its ingenious manipulations of genuine experimental facts on the effect of electricity on the growth of plants, its clever illustrations of plants alleged to be grown with and without the "sun-ray magnet," its specious arguments, undoubtedly compiled by some person of education and ability who ought to be better employed. We only hope that our readers will miss no opportunity of putting their florists, seedsmen, ironmongers and other tradesmen on their guard against this plausible imposition—which is priced at 1s. for 6 and 5s. for 40.

I.M.E.A. Meeting, 1915.—The twentieth annual general and business meetings, which this year take the place of the usual Convention, will be held in London at the Institution of Electrical Engineers, Victoria Embankment, W.C., on June 17th and 18th, as follows:—

June 17th, 10 a.m.—Report by A. S. Blackman (Sunderland) and T. Roles (Bradford), on behalf of Point Five Association, on "The Practical Result of the Point Five Tariff," followed by a discussion.

2.30 p.m.—Report by F. Ayton (Ipswich) on "The Use of Electrical Vehicles in Municipal Service," followed by a discussion.

5 p.m.—Parade and demonstration of electrical vehicles on the Embankment.

June 18th, 9.30 a.m.—Council meeting.

10 a.m.—Annual general meeting.

A meeting of the Point Five Association will also be held at Tricity House, Oxford Street, W., at 7 p.m., on June 17th.

The Council's headquarters will be at the Hotel Cecil. The usual visitors' list will on this occasion be suspended; there will be no social functions, and it is not proposed to invite ladies. The meetings will be restricted to members and official delegates, and these are invited to consider themselves hon. members of the Municipal and County Club, Whitehall Court, on the dates mentioned.

The secretary is Mr. C. McArthur Butler, 28, Bedford Square, W.C., to whom inquiries should be addressed.

Cricket Match.—A match—British Westinghouse Electric and Manufacturing Co., Ltd., Supply Department *v.* Harland Engineering Co.—was played at Birchfields Park, Manchester, on Wednesday evening, May 26th, the result being an easy win for the former. The following are the scores:—

Westinghouse.		Harland.	
D. Sanderson, b Craven ...	12	Jones, b Elliott	0
Van Leeman, b Hobson ...	26	Wilson, b Cheetham ...	4
J. R. Cheetham, b Craven ...	6	Hobson, c Edwards, b Cheetham	6
N. Armstrong, b Hobson ...	4	Cowlishaw, c Van Leeman, b Elliott	0
D. E. Elliott, b Hobson ...	1	Mann, c Edwards, b Cheetham	3
O. C. Oakley, b Hobson ...	7	Craven, c & b Cheetham ...	0
J. Wandsworth, b Craven ...	13	Kemp, c & b Elliott ...	3
T. Clough, run out	4	Goldenberg, b Elliott ...	0
Edwards, not out	8	Ross, b Elliott	0
Nickson, not out	3	Kay, b Elliott	0
Carroll, to bat	—	Hartley, not out	2
Extras (for 8 wickets)	7	Extras	4
Total	91	Total	22

Indian Notes.—Our Indian correspondent writes:—

Naini Tal.—The United Provinces Government have before them a scheme for a hydro-electric installation for the hill station of Naini Tal, which is about 7,000 ft. above sea level. The town is a fairly populous one in the hot season. There are at present three or four isolated electric plants, but coal fuel is extremely expensive, oil is also costly, and the Forest Department look with disapproval on wood-consuming plants; hence it is that a hydro-electric plant is looked on with much favour. The details of the scheme are not yet obtainable, but tenders may be asked for within a reasonable time.

The electrical inspector to the United Provinces, Mr. Tufnell, has just taken a commission in the Army, and has left India for the front in Flanders; he has left a very capable assistant, Mr. Warren, to take over his duties during his absence. Electrically speaking, the United Provinces is tremendously busy just now, with Lucknow, Allahabad, Agra, and possibly Bareilly and Naini Tal on the cards, each for electrification within the near future. Progress may, however, be slow as the capital for the undertakings has to be obtained not from Government, but from the public, and at the present moment capitalists are not over anxious to come forward and put their money into undertakings no matter how probable might be their success.

Acetylene Corrosion.—With the increasing use of acetylene gas the risks of its corrosive effect on pipes and metal containers should be better known. Tests have shown that moist acetylene, as generated, attacked zinc, lead, brass and nickel to a slight extent; iron was affected at about six to seven times the rate; phosphor-bronze about twice as much as iron; but copper suffered more than any other metal tested. Copper was quickly changed into a soft, porous black mass. Tin, aluminium, bronze, german silver, and solder were practically unaffected. Thus it would appear that copper and brass or other copper alloys should not be used as piping for acetylene gas supplies, and that iron should be well tinned rather than galvanised or nickel-plated.—*Manchester Courier.*

(*Continued on page 801.*)

ADMIRAL SIR HENRY JACKSON, K.C.B., F.R.S., M.I.E.E.

THE announcement that Admiral Sir Henry B. Jackson has been appointed First Sea Lord of the Board of Admiralty, in succession to Lord Fisher, is of particular interest to our readers, on account of the fact that he is a member of the Institution of Electrical Engineers, and has attained to a high place in the scientific world, being one of the very few naval officers who have been honoured with the highest distinction that science can bestow—the Fellowship of the Royal Society. The new First Sea Lord is comparatively unknown to the general public, but electrical men cannot fail to be aware of the important position which he occupied when, as Captain Jackson, he was engaged in developing the applications of wireless telegraphy to naval operations, and in adapting the apparatus to the conditions met with on board ship.

As a matter of fact, Sir Henry Jackson's connection with wireless telegraphy goes back a great deal further than is generally known, for as long ago as 1891, shortly after his promotion to commander of H.M.S. *Edinburgh* in the Mediterranean, his thoughts were occupied with the problem of communication between warships by means of Hertzian waves: we may point out that Prof. Lodge's first public demonstration of the transmission of signals by this agency was performed at Oxford in 1894, and Mr. Marconi carried out his demonstrations in conjunction with the Post Office in 1897, so that the claim of Commander Jackson to be one of the earliest investigators in this region cannot be disputed. Continuing the work in his spare time, he succeeded in effecting communication over short distances in 1895, when he was commander of the torpedo training ship *Defiance*, at Devonport; his experiments were known to the Admiralty, but were treated as confidential matters. In 1896 he made the acquaintance of Mr. Marconi, and it is said that the two men collaborated in the development of their inventions, which were destined to exercise so vast an influence upon naval strategy.

Elliott & Fry]

ADMIRAL SIR H. B. JACKSON.

Sir Henry was placed in charge of the wireless equipment of the Navy, and, as Captain Jackson, continued in the control of this important department until, in 1906, he was promoted to the rank of Rear-Admiral. During this period he was successively in command of the torpedo depôt-ship *Vulcan*, Assistant Director of Torpedoes at the Admiralty, Commander of the battleship *Cæsar*, Captain of the torpedo-school ship *Vernon* at Portsmouth, and, finally, Third Sea Lord and Controller of the Navy.

Sir Henry received the Order K.C.V.O. in 1906, and remained at the Admiralty until October, 1908, after which he was in command of the Cruiser Squadron in the Mediterranean for two years. He next represented the Admiralty at the International Conference on Aerial Navigation at Paris in 1910, and a few months later was appointed to command the new Royal Naval War College at Portsmouth. Whilst holding this office he commanded the Seventh Squadron in the Naval manœuvres of 1912. In the following year he became Chief of the War Staff at the Admiralty, a post which he occupied practically up to the commencement of the war; had peace prevailed, he would probably have become Commander-in-Chief in the Mediterranean.

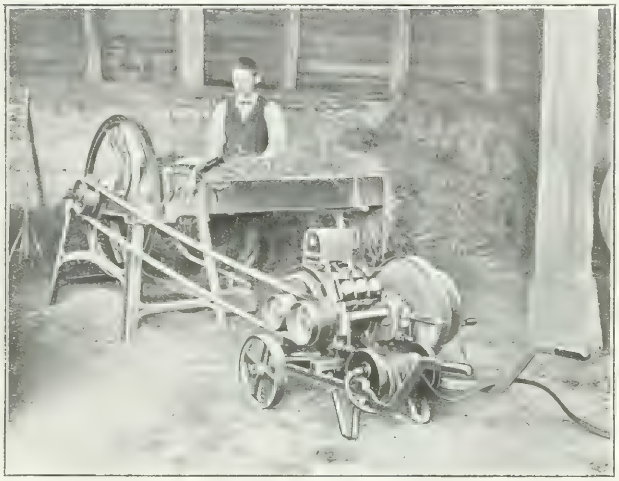
In 1901 Captain Jackson, as he was then known, was elected a Fellow of the Royal Society on account of his researches into electrical physics, and in 1902 a paper entitled "On some Phenomena affecting the Transmission of Electric Waves over the Surface of Sea and Earth" was published over his signature in the *Proceedings* of the Royal Society; in this paper he described a series of experiments which he had carried out on wireless communication between ships equipped with his own apparatus, with a view to ascertaining the screening effect of mountains and hills intervening between the stations, and the effect of atmospheric changes on the intensity and range of signals. Sir Henry was the first to observe that signals ceased to arrive when high land intervened between two ships, one of which was close to the land in question.

From the brief particulars given above, it will be seen that Sir Henry Jackson is by no means merely an electrician, or an engineer, or a sailor: he is an admirable combination of all three, and is regarded by the Navy as one of the most accomplished officers in that distinguished service. The diversified appointments that he has held, together with years of study of the modern problems of strategy and tactics, and a unique insight into the priceless services that science can perform in the defence of our Empire, render him one of the most able of the many brilliant naval officers of the present day, and should inspire confidence not only in the Navy—which knows him well—but also in the general public, which knows him hardly at all.

ELECTRICITY IN FARMING.—I.

From time to time attention has been drawn in our columns and elsewhere to the subject of electricity supply for agricultural purposes, more particularly to the developments which have taken place on the Continent and in America, where considerable results on a practical scale have been achieved.

That these results are encouraging and worth following up can be gathered from the data which has been published, but naturally there are difficulties, and it is not surprising that the limitations of such work should form a subject for discussion in the States. What concerns us most, however, is whether in view of the results obtained abroad there is not scope for similar developments in this country.



Oerlikon Three-phase Truck Motor driving Chaff Cutter.

A paper by Mr. J. L. White, of the Oregon Power Co., which throws some light on the difficulties encountered in Pacific Coast farming districts, points out that the farmer is of the "show me" class, and therefore must be convinced of the economical and practical value of electricity in performing his work before he will spend any great amount of money for its adoption.

This is the real difficulty, and it is probably more pronounced in this country, the supply authorities in farming centres being themselves unconvinced; we only know of one chief engineer who has had sufficient prescience to make a business of supplying local farmers, by means of cheap pole lines, but the question is being considered in several directions.

Wagon Motor driving Thrashing Machine.

The author goes on to point out that it will not pay to make long and costly transmission line extensions solely for the purpose of serving a scattered farm load, although it is equally true that a farming load will pay as a by-product when such extensions already exist or are being made to take care of other classes of business.

The stumbling block is the capital investment, and this has been met in several ways; in some cases the farmers have financed distribution systems, purchasing energy and retailing it amongst themselves, or they have paid the whole or part of the cost of the line, or have guaranteed a minimum income to the authority carrying out the work, this guarantee being such that the cost of the line is returned in from one to three years.

In some cases the consumer contributing a proportion of the capital cost has this returned to him if he succeeds in inducing others farmers on his line to take a supply.

Any attempt to deal with farming supply evidently resolves itself into a question of cost of service, and a short article from an American source gives the cost of a mile of rural service line, using poles 200 ft. apart, as follows:—

	Unit price.	*Item cost.*
27 poles (25 ft. high with 5-in. top)	$1.15	$31.05
10,560 ft. No. 8 copper wire	0.16	126.40
27 telephone cross-arms ...	0.13	3.51
27 through bolts	0·05	1.35
54 locust pins	0.013	0.70
54 insulators (porcelain) ...	0.03	1.62
54 square galvanised washers	0.009	0.50
Guy anchors (average) ...	—	5.00
Labour and hauling ...	—	7.200
Total field expense for material and labour ...	–	$242.23

This includes nothing for supervision, tools, insurance, interest, &c., and the all-in cost is about $300 (£60) per mile, but the company's initial investment is only one-third of this amount, as the farmers deposit the remainder, subject to its being refunded later in the form of electrical energy. The company requires a minimum of four consumers a mile before commencing operations, and at least £7·2 a year is required from them to cover interest and depreciation charges on the mile of line.

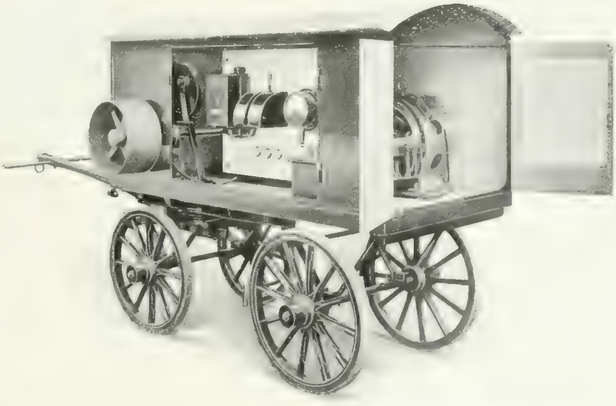
The company's farmer customers in a comparatively limited area now number 214; of these 23 have been connected in a year, and the average income from each of them for the first year was £3·5, which was regarded as satisfactory if not profitable, although the supply company's financial charges are also on a reduced scale in the development stage.

Portable Motor driving Churn.

A writer in a recent issue of the *General Electric Review* gave some statistics as to the electricity used by American and German farmers, which showed that 150 American farms in the central west, averaged 190 acres each, and had an average electrical installation of 35 per cent. lighting and 65 per cent. power. The revenue derived from them was £10·2 per farm, or about 13½d. per acre per year.

The statistics include some dairy farms, which are large users of electric power, and the charge for current varied between 2d. and 5d. per unit.

Corresponding German figures for an average 63-acre farm show that lighting and small power applications give a return of about 11d. per acre per year, but these gave only 20 per cent. of the revenue derived, the other 80 per cent., consisting of thrashing, ploughing and traction, bring up the total yearly revenue per farm to over £16. The prices charged are about 5d. per unit for lighting and 2½d. or less per unit for power.



Oerlikon Portable Driving Motor and Switchgear, Mounted on Wagon

The writer points out that the average farm load—presumably in America—has an excellent diversity factor, and that the peak load comes during the summer months, and is essentially a day load, with the exception of a small amount of lighting. On strictly country lines an appreciable lighting peak is noticed in summer between 4.30 and 5.30 a.m., and in winter between 5 and 7 a.m., while very little lighting is used in the evening.

The amount of power likely to be required per farm appears to vary within wide limits; three cattle breeders, for instance, head the list with an average of 17½ kw. per farm, and use 30 units per kw. installed per month.

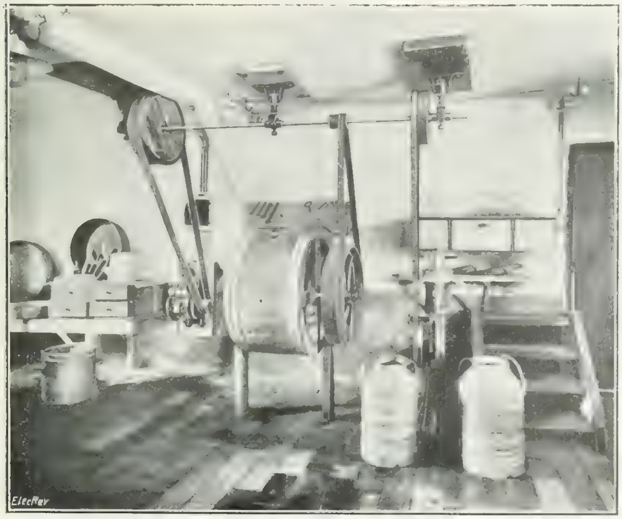
Two classes of dairy farms average 7 and 10½ kw., and use 31 and 9½ units per kw. per month respectively—the former high figure being due to the use of cold storage and milking machines and cream separators.

An average small motor and lighting farm requires some 2·6 kw. of plant, and uses 15·8 units per kw. installed per month: while the market gardener averages some 2 kw. of plant and 19 units per kw. per month, principally for pumping operations.

The writer's concluding advice, that if such farm lines can be built now to give only a small return, they should be constructed in order to forestall the isolated plant, which is hard to displace if once installed, is equally applicable to this country, where small petrol and oil engines are being adopted in large numbers by farmers.

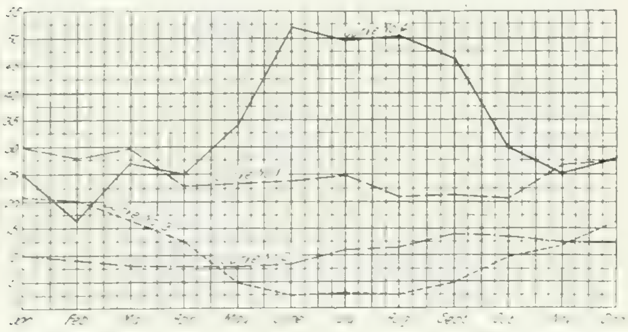
The question naturally occurs as to whether such data as that given is applicable to farming in this country; in fact, whether the average British farm can be compared to an average American farm of the class referred to by the writer.

In point of size, it is interesting to note that a *Times* article on British farming of a year or two back stated that the greater part of the land of the



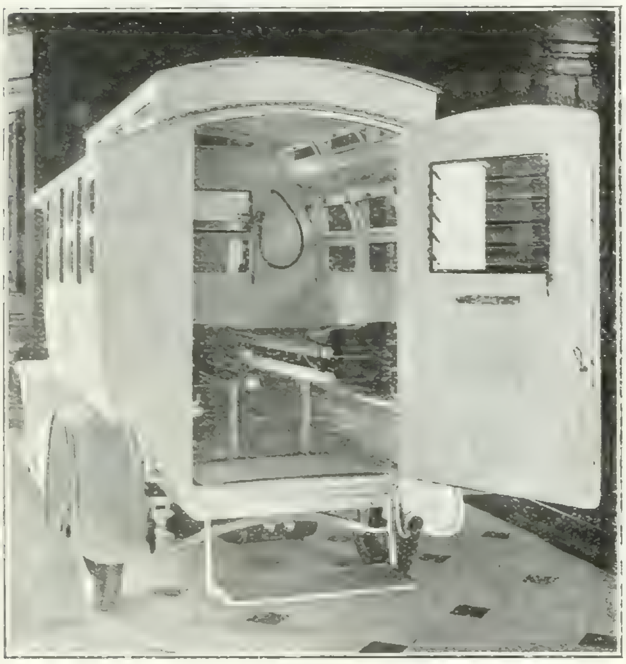
Fixed Motor driving Dairy Machinery.

country is held by men occupying single farms of from 150 to 500 acres, which compares sufficiently well with the average of 190 acres given for the American farms. The article proceeded to point out that America and the Colonies, so often quoted as examples of modern farming, had nothing to teach us, from which we may infer that our farming community is sufficiently progressive to adopt electric light and power if it is brought within its reach on competitive terms, especially in view of the necessity nowadays of economising in manual labour.



Curve 1, lighting, irrigation, and general farming: Curve 2, lighting: Curve 3, huskers, shredders and feed grinders: Curve 4, pumping and refrigeration.

CURVES SHOWING COMPARATIVE CURRENT CONSUMPTION OF FOUR PRINCIPAL TYPES OF AMERICAN FARM LOADS.



INTERIOR OF ELECTRIC AMBULANCE FOR DURBAN (see p. 799).

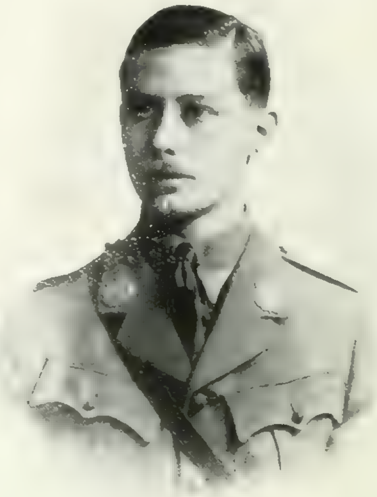
The position of the farmer in regard to motive power on the land was indicated by one of them in an article in the *World's Work*, who thought there would be a great opening in the future for it, and pointed out that farmers said they would have farm motors if they were cheaper, while the manufacturers replied that they could easily make them cheaper if more were bought.

The oil-engine builders are fully alive to the possibilities of farm business, and some of their booklets demonstrating the farm uses of the oil-engine should convey a hint to electrical people in this country, who do not appear to have studied the problem.

On the Continent electrical firms have designed special equipment to meet the requirements of the agriculturalist, and through the courtesy of the Oerlikon Co. we are able to illustrate some Swiss farming applications in which it will be noted that portable types of apparatus are employed. These are constructed with either direct or alternating-current motors, in the smaller powers on two-wheeled hand trolleys, while heavier motors are mounted on four-wheeled trucks.

A typical outfit of the smaller class includes a motor geared to a second motion shaft having different sized pulleys at either end, in addition to a pulley on the high-speed motor shaft.

The gear ratio of the spindles is usually 5 to 1, and the arrangement gives pulley sizes and speeds to suit most requirements. A starter and fuses are mounted on the motor frame and coupled to a cable drum on the trolley, carrying some 10 m. of cable fitted with a suitable end connector for coupling to the supply mains.



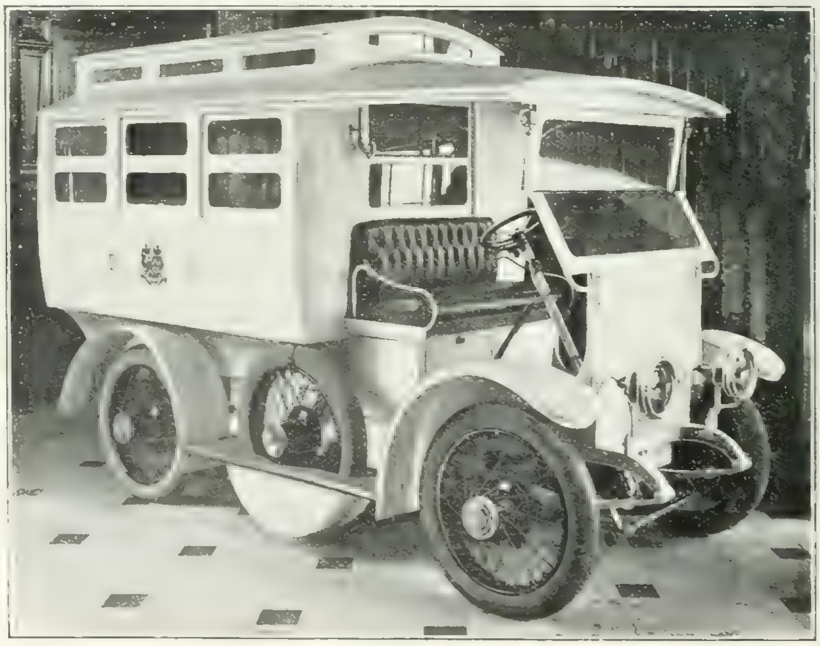
THE LATE HARRY GUSTAV BYNG
SEC. LT. 2ND BORDER REGIMENT (see p. 799.)

A portable 4-H.P. three-phase motor equipment of this kind would cost about £30; no fixing is required for driving purposes, the weight of the apparatus being sufficient to retain it in position.

Larger apparatus, of more elaborate design but similar in principle, is utilised for driving thrashing machinery.

In this case the motor, switches, cable, drum, &c., with 100 m. of cable, are carried in a sheet-iron van, from the sides of which the driving pulleys project.

The simple squirrel cage motor is favoured for this class



ELECTRIC AMBULANCE SUPPLIED TO DURBAN CORPORATION, SOUTH AFRICA (see p. 799) of work, and by the use of star-delta starters, and fast and loose pulleys for the larger motors, line disturbances at starting can be avoided.

An American instance of the use of similar apparatus was described in the *Electrical World*; in this case the farmers in a district combined to purchase an electric set for thrashing purposes, consisting of a 2,200/220-volt transformer, 30-H.P. single-phase motor and switches, mounted on a steel-frame truck, at one end of which a temporary ladder pole is placed to carry the 2,200-volt lines. This outfit cost some £200, and it is reported that the farmers' league saved 25 per cent. by using it in place of steam tackle.

In this country farms in the vicinity of towns, where manual labour costs probably 20 per cent. more than in the more remote districts, should present little difficulty to the tactful electric supplier, especially if portable apparatus such as that referred to can be hired out on similar terms to those with which the farmers are familiar for other plant.

THE LATE HARRY GUSTAV BYNG.

The war has robbed the electrical industry of one of its most promising sons by the loss of Second Lieut. Harry Gustav Byng. He was the third son of the late Gustav Byng (founder and late chairman of the General Electric Co., Ltd.) and Mrs. Byng, of 32, Bryanston Square, W. He was born in July, 1889, and educated at Harrow, where he was captain of the school gymnasium eight, monitor and head of his house, for which he played both cricket and football; he also played for the Harrow Association football team. After leaving Harrow he joined Faraday House, and was awarded the silver medal in his year. He then completed his education at Harvard University, where he distinguished himself by passing all his examinations with honours. He enjoyed extraordinary popularity, both socially and as a good sportsman. He was captain of the Harvard Association Football XI. When leaving Harvard he joined an exploring expedition into the lesser-known parts of Canada, and after a short return home joined the General Electric Co., of Schenectady, as a pupil. He distinguished himself in the test room and was on the fair road to success, when his duty towards his family called him back in order to take part in the work of the General Electric Co., Ltd. He settled in Warwickshire so as to live near the works at Witton, and was on the point of assuming a position of responsibility when war broke out. His sense of duty to his country made him join His Majesty's Forces during the first week. He trained with the Artists Rifles and went to France with them at the end of September, returning home on March 21st on five days' leave, during which time he married Miss Evelyn Curtis, of Boston and Beverley Farms, Mass., U.S.A. Immediately after he was gazetted 2nd Lieutenant of the Second Border Regiment and fell in battle on May 16th, near Festubert, in France, whilst leading his platoon. His Commanding Officer wrote:—

> Mr. Byng was wounded whilst most gallantly leading his platoon in action on May 16th. He was universally popular in the regiment. He had done very good work reconnoitring the enemy's trenches, and his loss is very great to the battalion.

The Adjutant of his regiment wrote:—

> He was shot whilst leading his men, and fell actually on the enemy's trenches. He lay quite uncomplaining, and would not allow any of his men to carry him back, because of the danger to their lives.

Those who knew the late Mr. Byng will remember him as a young man of exceptional promise and charm. His death comes as a great personal loss to his family, to whom we tender our deep sympathy, and to his many friends in electrical and other circles.

CARTER ELECTRIC AMBULANCE FOR DURBAN.

We illustrate on page 798 an electrical motor ambulance recently supplied by Messrs. Carters, the ambulance specialists, of New Cavendish Street, W., for the Corporation of Durban, South Africa. While the makers have proceeded on definite and well-known lines in regard to the chassis, the mounting of the vehicle and the design of body with the interior accommodation are quite new and offer many advantages. The chassis is of a type identical with two of those now in use in the City of London, fitted with a Greenwood & Batley 8-H.P. twin motor and Tudor Ky. B. 9 type battery; the controller gives six speeds forward, reverse, and electric brake, and, in addition, hand and foot brakes are provided. The chassis runs on Rudge-Whitworth steel detachable pneumatic-tired wheels. The body of the car is of teak throughout; the interior is lined with aluminium, and finished like the exterior in white Ripolin. Special ventilation is obtained by the adoption of a lantern roof with opening glass frames, window fasteners to the main window frames, and glass louvred windows in metal frames in the front end and the door. The car is intended for general use in Durban and provides accommodation for two invalids or injured; the stretchers are fitted with Carters' patent extension gear and a number of accessories are provided.

This is, we understand, the first electrical motor ambulance to be used in South Africa, and in view of its excellent features, it is quite safe to predict that other municipalities will follow the example set by Durban.

REVIEWS.

Polyphase Currents. By Alfred Still. Second edition, revised. London: Whittaker & Co. Price 6s. net.

The many friends of the first edition of this little book will be glad to see that its success has led to the issue of a new edition, which will, in its turn, make new friends.

The edition before us does not differ in essentials from its predecessor, but the contents have been to some extent rearranged and rewritten, while the diagrams have been mostly redrawn in order to make them agree with the International Convention regarding the direction of rotation of alternating vectors. The symbols have also been brought into agreement with the present standard conventions.

It is assumed that the reader has a fair knowledge of continuous currents, but that he comes to the study of the book without any knowledge of alternating currents. The book consists, in fact, of an introductory study of the principles of alternating currents, so far as this can be undertaken by the application of graphical methods depending on the use of the simple vector diagram.

Questions of construction and design are wisely left aside for treatment in books devoted to this side of the subject, while the author confines his discussion to the main underlying principles of the generation, transmission and conversion of alternating currents. The experimental aspect of the subject is also left almost entirely on one side for treatment elsewhere. The author's treatment is simple, clear and effective, while he displays high qualities as a teacher and evidence of painstaking thoroughness in his work. Throughout, the method of analysis is non-mathematical and based almost entirely on graphical constructions; but in several directions (for instance, in dealing with unbalanced loads) the author shows how the simple vector diagram may be extended beyond the limits of application usually assigned to it in elementary text-books.

It will be gathered from what has been said that the book is not a general text-book, but rather an introduction to the study of alternating currents confined to one aspect of that subject. Within these modest limits the book is quite excellent, and can be cordially commended to the student.

Polyphase induction motors come within the scope of treatment, and the simpler forms of circle diagrams are clearly given, although these are not developed into the forms which are usual in commercial practice. Some space is occupied in explaining the principle of the polyphase compensated motor provided with a commutator. It seems a pity that the author did not extend this treatment to include some of the better known forms of single-phase motor having a commutator. Perhaps this would have taken him too far—at all events, he has omitted all discussion of single-phase motors, whether with or without commutators.

Frequency converters, rotary converters and motor-converters are treated in a simple and interesting way in a chapter which begins by showing the development of the asynchronous generator from the polyphase induction motor.

Electric Bells, Alarms and Signalling Systems. By H. G. White. London: Rentell & Co. Price 1s. 6d. net.

As indicated by its title, this book deals chiefly with electric bell, alarm and signalling applications and systems. Circuits for every bell and indicator application of any importance are represented by clear diagrams; but mechanical details of apparatus are described no more than is necessary to explain their use. By adhering rigidly to this very reasonable limitation of scope, the author is able to give in small compass an exceptionally useful treatment of his subject, and this work should certainly be in the hands of every practical man engaged in bell and indicator work or interested in their installation, as well as every student of the subject. Bells and indicators are not so simple as they seem, particularly in respect of their connection for special purposes, and endless trouble is frequently occasioned by neglecting to study this subject properly.

Chapter I is devoted to simple bell circuits and includes useful notes on selection of bell resistance, transformers and reductors for high-voltage circuits. Chapter II deals with indicator systems and is exceptionally useful; a study of the information and diagrams presented should go far to remove the vagaries and troubles so frequently experienced in indicator installations. A comprehensive treatment of the general principles of fire-alarm systems and of open and closed circuit burglar alarms is presented in Chapter III, the connections of private alarms and public call systems being included. Fault localising and points to be observed in wiring form the subject matter of a short but very valuable chapter, and, by including a chapter on mine signalling systems, the author has greatly increased the value of the book while extending the range of its readers. The bearing of Home Office Regulations on this branch of signalling is kept well to the fore. The work is indexed thoroughly and constitutes excellent value for money.

SOME NOTES ON SHUNT REGULATING RESISTANCES.

By THOMAS CARTER.

(Concluded from page 755.)

III. *A Special Grading for Ordinary Regulators.*—While in very many cases of shunt regulation by the ordinary method, the standard connections for which are shown in fig. 6, the successive steps of resistance can be determined to suit some specified condition of regulation without reference to anything else, it is necessary in an increasing number of cases to consider the question of sparking between contacts as the resistance is introduced into circuit. The use of motors with increasingly great speed ranges on high-voltage circuits means that, with more volts to be absorbed in the regulator, the volts between contacts tend to increase in consequence of modern practice. The point at which sparking begins varies with many conditions, such as the amount of current dealt with, the shape of the contacts and their material, and the nature of the sliding contact. Once more experience alone indicates the correct conditions. It may be permissible to allow more volts between contacts at the low-current end of a regulator than at the high-current end; but, at any rate, as a starting point, it is useful to get out the grading for equal volts between contacts. The conditions upon which this depends will now be investigated.

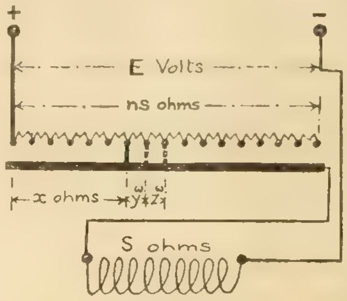


FIG. 6.

The exciting voltage, E, has across it the field winding, whose resistance is s ohms, and a part x, of the regulator, whose total resistance is $n\,s$ ohms. Suppose the resistances of the next two sections to be introduced to be y ohms and z ohms respectively. Also let e be the voltage between contacts on introducing any step of resistance, e being constant. Then—

$$e/\mathrm{E} = z/(s + x + y + z) = y/(s + x + y).$$

Hence, by the ordinary rules of ratios,

$$e/\mathrm{E} = (z - y)/\{(s + x + y + z) - (s + x + y)\} = (z - y)/z = 1 - y/z, \text{ or } y/z = 1 - e/\mathrm{E}.$$

Thus if e is constant y/z must be constant, and therefore also $(s + x + y)/(s + x + y + z)$, which from the above is equal to y/z, must also be constant and equal to $1 - e/\mathrm{E}$. That is to say, the resistance must be graded so that the successive totals between terminals, of field plus regulator resistance, form a geometric series. Let r be the ratio of this series. Let the ratio of maximum to minimum shunt current, determined experimentally as in Section II, be p. Then clearly $p = n + 1$, since the maximum shunt current is E/s and the minimum is $\mathrm{E}/s\,(n + 1) = \mathrm{E}/p$ by definition. The value of n is, therefore, in this case also experimental.

The first term of the series is s, and the last is $s\,(n + 1)$. Let there be t terms, or steps of resistance. Then—

$$r = \{s\,(n + 1)/s\}^{\frac{1}{t}} = (n + 1)^{\frac{1}{t}} = p^{\frac{1}{t}}.$$

It has already been shown that $e/\mathrm{E} = 1 - y/z$. Now $y/z = (s + x + y)/(s + x + y + z) = 1/r$, and hence $e/\mathrm{E} = 1 - 1/r = 1 - 1/p^{\frac{1}{t}} = (p^{\frac{1}{t}} - 1)/p^{\frac{1}{t}}$, or $\mathrm{E}/e = p^{\frac{1}{t}}/(p^{\frac{1}{t}} - 1)$, which can be put into the form $(\mathrm{E}/e - 1)(p^{\frac{1}{t}} - 1) = 1$, which is a rectangular hyperbola with asymptotes $\mathrm{E}/e = 1$ and $p^{\frac{1}{t}} = 1$. A simpler form of the same expression is obtained thus:

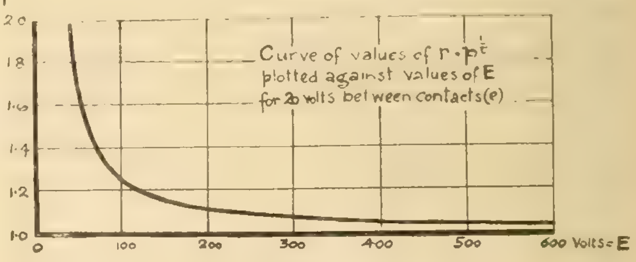


FIG. 7.

$$1/p^{\frac{1}{t}} = 1 - e/\mathrm{E} = (\mathrm{E} - e)/\mathrm{E}, \text{ or } p^{\frac{1}{t}} = \mathrm{E}/(\mathrm{E} - e) = r.$$

This gives a relation between p, which is determined by the design of the machine and the conditions to be fulfilled; t, the number of steps in the regulator, which is to be determined; E, the exciting voltage, which is known; and e, which is fixed from experience.

Consider now a definite case on general lines. Take e as 20 volts. Then a curve can be plotted, as shown in fig. 7, showing the relation between the ratio r, or $p^{\frac{1}{t}}$, of the geometric series, and the line voltage E. The curve is plotted from the following values, derived from the expression $r = p^{\frac{1}{t}} = E/(E - e)$:—

E	40	70	100	200	300	400	500	600
$E - e$	20	50	80	180	280	380	480	580
$r = p^{\frac{1}{t}} = E/(E-e)$	2·00	1·40	1·25	1·11	1·072	1·052	1·042	1·035

Other curves could be plotted on the same chart for different values of e, and these would at once give the ratio of the geometric series necessary, at any value of E, to limit e to any desired amount. It is clear, then, that for a given value of E, the value of $p^{\frac{1}{t}}$ is constant for a definite value of e. It now remains to investigate the relation between t and p as p increases in value. As an example, do this for a 500-volt circuit, for which it has already been shown that for $e = 20$, $r = p^{\frac{1}{t}}$ must have the value 1·042. If $p^{\frac{1}{t}} =$ 1·042, then clearly $t = \log p/\log 1{\cdot}042$, and the following relation is obtained :—

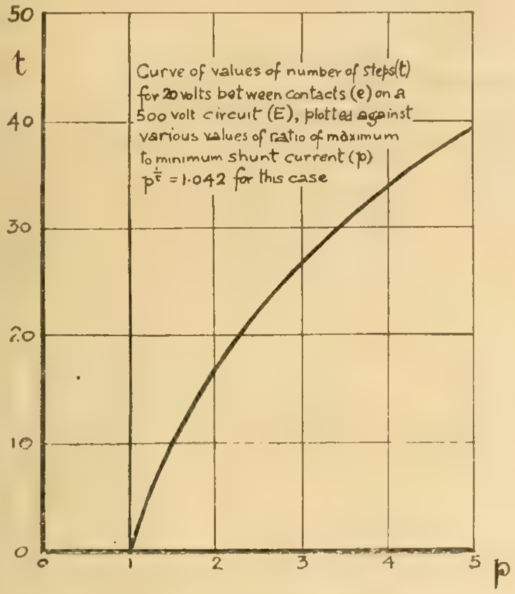


FIG. 8

p ...	1·0	1·25	1·5	1·75	2·0	2·5	3·0	3·5	4·0	4·5	5·0
t ...	0	5·4	9·9	13·6	16·8	22·3	26·7	30·4	33·6	36·7	39·0

The curve shown in fig. 8 gives the relation between p and t graphically, and shows how, for a 500-volt circuit, the number of steps of resistance required to limit the volts between contacts to 20 increases as the ratio of maximum to minimum shunt currents increases. A set of curves like this would enable the number of steps necessary for any given case to be read off at once. Or, if the dangerous point is not frequently reached, the value of t for any specified condition is readily calculable from the simple expression $p^{\frac{1}{t}} = E/(E - e)$, which, solved generally for t, becomes $t = \log p/\log E/(E - e)$.

The case considered in this section is one which can be most conveniently dealt with by a set of symbols in the shape of a formula rather than by a set of curves; the curves have been illustrated, however, to show the general shape assumed by the variables entering into the calculation, and there might be cases where a set of curves on the lines indicated would be useful in no small degree.

It is scarcely necessary to mention that in all problems connected with geometric series, in which the extraction of a root such as, say, the 36th or the 50th, is involved, the use of a log-o-log scale on a slide rule is of the greatest possible value as a time saver. There are several of these on the market; the writer has his own favourite, while others, no doubt, prefer other types. But the principle embodied in such slide rules enormously increases their range of usefulness.

In the setting-out of the calculation of a resistance with geometric grading, successive totals between terminals are obtained as the terms of the series, beginning with s and ending with $(n + 1)\,s = p\,s$. Successive steps are then obviously obtained as the differences between the successive totals so found, and the current capacities at each step are found by dividing E by the total between terminals up to and including the step considered.

NOTES.

(*Continued from page 794.*)

Fatalities.—In the Stirling Sheriff Court last week Sheriff Moffat and a jury held an inquiry into the death of John Stirling, coal-cutting machineman, Haggs, who was fatally injured in No. 3 Broomrigg Pit, Dennyloanhead, belonging to the Banknock Coal Co., on April 19th. David Todd, certificated colliery manager, Dennyloanhead, and William McCallum, chief electrical engineer to the Banknock Coal Co., were warned that, in view of possible future proceedings, they need not answer questions which might appear to prejudice them. Sheriff Moffat, in addressing the jury at the close of the inquiry, said it was quite apparent from the medical evidence that all the appearances were consistent with death resulting from electric shock, and there was quite clear evidence that at the time of the accident deceased was grasping a highly-charged electric coal-cutting machine which was in a defective condition. The chief electrician (McCallum), who was a most reliable witness, said the machine was defective owing to the non-use of the bolt, which caused the connection of the cable not to be tight. This, in turn, brought about the leakage of electricity into the frame of the machine, and naturally was the cause of death. The fact that the coal-cutter became alive might also be due to the defective state of the leads through the body of the machine. He did not think any fault or negligence could be attached to Mr. David Todd, the manager. He was not an electrician and did not examine the machine. Then it was quite apparent it was not Mr. McCallum's duty personally to examine the coal-cutter, as he stood more or less in the light of an adviser to the company. It was unfortunate that McCann, who was the electrical engineer at the pit, had been absent from the inquiry, and that the principal person who had had the supervision of the machine had not had an opportunity to give evidence. In the circumstances it would not be proper to say that any particular individual was at fault, but they could say that the coal-cutter itself was faulty. The jury returned a verdict that the accident occurred through the faulty condition of the machine, caused by want of proper insulation. The jury added a rider to the effect that there seemed to have been some negligence, but they did not feel called upon to lay the blame of that negligence at the door of any particular person.

A boy of seven received a fatal electric shock on May 27th while trespassing on Volk's electric railway at Brighton. The inquest was adjourned for expert evidence.

Newfoundland.—Mr. T. L. Wilson, formerly of Ottawa, has made registration at St. John's, Newfoundland, of a company with a capital of $20,000,000, to develop electrical energy in that Colony for the manufacture of nitrogenous fertilisers from the nitrogen of the atmosphere.

Penalty for Exporting Carbons.—At East Ham on Wednesday, according to the *Standard*, Messrs. Duncan Macneill and Co., Winchester House, Old Broad Street, E.C., were fined £5 and £3, together with £10 10s. costs, on two informations for failing to comply with the provisions of the Customs and Inland Revenue Act, and failing to comply with the orders of the Customs Consolidation Act. Mr. Cecil Simpson, who prosecuted for the Customs and Excise, said the first offence was that the defendants sent to the Royal Albert Dock two cases of searchlight carbons which were supplied by an electrical company. The goods were prohibited for export by Royal proclamation. The second offence was for not making a proper entry with the Customs before shipment. The goods were to be used by a navigation company on rivers in India. Mr. Basil Watson, for the defence, admitted the charges, and said the goods were only valued at £25. An apology was offered.

Cab-Signalling Needed. — Lieutenant-Colonel von Donop, in his report to the Board of Trade on the derailment of a Midland Railway express passenger train from York to Sheffield at Chaloner Whin Junction, York, on the North-Eastern Railway on March 28th, states that it was another instance of an accident mainly due to a driver not noticing that his distant signal was at danger.

Electrical Trade in Hong-Kong.—We learn that the opportunity for the introduction of cheaper grades of electrical supplies in the Hong-Kong field growing out of the closing of the trade to German manufacturers as a result of the war, is being taken advantage of by Japanese manufacturers, and many lines of electrical goods are going into the market from that country. There are three well-equipped factories for such goods in Japan, according to Hong-Kong importers concerned in this trade, and all of them have carried on an active campaign in behalf of their goods, which include practically all lines of ordinary electrical supplies, aside from electrical machinery, and the finer grades of electrical apparatus.—*E*[illegible]

Educational. — Northampton Polytechnic Institute (London).—A free scholarship, of the value of £30, open to all comers, is being offered to students of optics, in which the chances have been greatly enlarged by the shutting-off of alien supplies due to the war. Particulars can be had from the hon. secretary and treasurer, Mr. Henry F. Purser, 35, Charles Street, Hatton Garden, London, E.C.

Institution and Lecture Notes.—Junior Institution of Engineers.—A lecture was recently given on Diesel engines, by Mr. W. A. Tookey.

Institution of Electrical Engineers.—The report of the Committee of the Newcastle Local Section, presented at the annual general meeting on May 17th, shows a decrease in membership, mainly in the Students' Section, the total now being 261. The growing importance of the Tees-side sub-section is clearly shown in the report. The following were nominated and have been duly elected as officers and committee for next Session:—Chairman, Mr. P. V. Hunter; vice-chairmen, Messrs. H. W. Clothier and A. H. Marshall; Committee, Messrs. E. Fawssett, G. L. Porter, W. F. T. Pinkney, H. S. Ellis, C. Turnbull, W. G. Guns, T. Carter, M. G. S. Swallow, C. S. Vesey Brown, R. W. Gregory, J. R. Beard, G. L. Drury, H. Henderson, Dr. W. M. Thornton, Messrs. F. O. Hunt, A. P. Pyne, J. R. M. Elliott, and W. Cross; Hon. Treasurer, Mr. C. Vernier; Hon. Secretary, Mr. J. R. Andrews.

Volunteer Notes.—3rd Batt. (Old Boys) Central London Regiment (Volunteers).—This is a voluntary organisation, consisting of Old Public School and 'Varsity men and their friends, and is affiliated to the Central Association of Volunteer Training Corps. Drills take place every evening in Regent's Park and other centres, and a week-end camp is held at Wembley Park, N.W. An O.T.C. Class is also held at Lord's Cricket Ground, N.W., for men desirous of obtaining commissions. Over 350 have already obtained them through the Corps' instructions. A large number of electrical men are members of the Corps. Men wishing to join the Corps should send in their applications immediately to the Hon. Secretary, 205, Oxford Street, W.

Battalion Orders by Colonel S. G. Grant (Officer Commanding).—Week-End Parades.

Saturday:—The Battalion will parade at Baker Street Metropolitan Station at 2.30 p.m. "C" Company, under the command of Captain R. J. C. Eastwood, will proceed direct to Wembley Park and take up a defensive position to meet an attack coming from the south-easterly direction. "A," "B" and "D" Companies, under the command of Mr. H. O. King, will detrain at Neasden and attack the camp at Wembley. Route to be followed will be communicated later.

Sunday:—	7 a.m.	Reveille.
	10 a.m.	Church Parade.
	10.20 a.m.	Companies' Parade.
	2.15 p.m.	Battalion Parade.

The Quartermaster has made arrangements for serving tea to friends of members, on Sunday next. Price 6d. each. Tea will be served between 4 o'clock and 5.30 p.m. in the marquee set aside for the purpose.

A. G. Joiner, *Captain and Adjutant.*

Late Legal.—Adnil Electric Co., Ltd., *v.* British Traders' Association.—By a majority the Court of Appeal on Wednesday dismissed an appeal by the Adnil Electric Co., Ltd., from orders by Mr. Justice Ridley staying actions brought by them against the British Traders' Association for money had and received, and against Andcole & Turner, Ltd., for goods supplied. It appeared that in 1909 the plaintiff company was formed to take over the business previously carried on by Marples & Leach, Ltd. The shareholders were mainly German, and Mr. Marples and Mr. Leach were appointed joint managers. Solicitors were also appointed. The British Traders' Association were a debt collecting agency who obtained judgment against a debtor in the name of the plaintiff company. In respect of that judgment this action was brought. The action against Andcole and Turner was for goods supplied. The question was whether the solicitors acting for the company had authority to bring the action. They had been instructed by Mr. Marples and Mr. Leach, but since the war broke out had received no particular instructions from the directors. There were three directors—a Dutchman and a German, both resident in Germany, and an Englishman who was interned there. Mr. Gore Browne, K.C., for the company, submitted that there was authority to bring the action. Lord Justice Swinfen Eady said he agreed with Mr. Justice Ridley in that the evidence did not satisfy him that Marples & Leach had authority to bring those actions. Lord Justice Phillimore assented. Lord Justice Bankes concurred with Lord Justice Swinfen Eady. The appeals were, therefore, dismissed.

City and South London Railway Co. *v.* H.M. Postmaster-General.—A special case stated in this action to determine questions as to the right of laying telegraph and telephone wires, was before Mr. Justice Neville in the Chancery Division on Wednesday. Mr. Harmann, representing the plaintiffs, stated that the matter was somewhat complicated, but there was a prospect of a settlement. Under these circumstances, he asked, with the consent of the defendants, that the case might stand over, with liberty to restore it to the list for hearing on seven days' notice. His Lordship allowed that course to be adopted, and the case stood over generally as arranged.

The King's Birthday Honours.—The List of Honours which appears just as we go to Press with the last pages of this issue, contains the following announcements that will interest our readers:—

Upon Sir Henry Norman a baronetcy is conferred.

The honour of knighthood is conferred upon Lieut.-Col. Wm. Forbes, general manager of the Brighton Railway; Edward Rigg, Esq., C.B., Superintendent of the Operative Department of the Royal Mint; and W. Slingo, Esq., Engineer-in-Chief of the General Post Office.

Mr. David Mitchell Stewart, Superintending Engineer, General Post Office, is appointed to the Imperial Service Order.

To all these gentlemen the Electrical Review tenders its congratulations. An account of the career of Mr. Slingo appeared in our pages at the time of his appointment to succeed Major O'Meara as Engineer-in-Chief (Elec. Rev., March 8th, 1912).

Fire Prevention.—The British Fire Prevention Committee has issued a "Warning" circular (No. 16) for factories and works engaged on Government and war emergency supplies, containing useful advice as to the precautions that should be taken to prevent the outbreak of fire, of which the risks are increased at times of high pressure and all-night working. Copies can be obtained free on application to the Committee at 8, Waterloo Place, Pall Mall, S.W.

Appointments Vacant.—Switchmen (30s.) for Newport electricity department; assistant electrical engineer (£150), for Government of Malta.

Electric Vehicle Costs.—In a recent issue, our contemporary, the *Commercial Motor*, gave some particulars of the electric vans employed by Messrs. J. Lyons & Co., Ltd., the well-known caterers. These comprise one G. V. and seven Edison vehicles, and for four weeks ended April 16th, for two ½-ton vehicles the average current cost per mile was ·45d. on a mileage of 222·3; for two 2-ton vehicles the average cost of energy per mile was ·73d. on 192·1 miles; for one 5-ton vehicle the average cost of current per mile was 1·3d. on a mileage of 195·2. One Edison ½-ton and one Edison 2-ton vehicles have each run over 7,000 miles between November, 1914, and May, 1915, while the other five Edisons, each covered between 3,000 and 5,000 miles in that time. While the initial outlay is greater, Messrs. Lyons find the working cost of the electric compares very favourably with their petrol vehicles, and they intend to extend their "electric" fleet.

Anti-Aircraft Appliances.—A County Council report mentions that a new motor "emergency tender" has been put into commission. This appliance carries a number of smoke helmets, and, in addition, is fitted with a dynamo, portable searchlights, and an electric blower for forcing air into places where dense smoke or poisonous gases exist. It is manned by specially selected firemen, who devote considerable time to maintaining the apparatus and training and practising therewith.—*Standard.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials. — The newly constituted Spenborough U.D.C. has decided to retain Mr. Albert Pickersgill as electrical engineer, at the same salary and on the same conditions as hitherto attached to the appointment.

Mr. E. Broad has been promoted to the position of shift engineer at the electricity works of the Heston and Isleworth U.D.C., taking the place of Mr. J. Fletcher, who has been appointed station superintendent at Worksop.

Derby Corporation E.L. Committee recommends that the salary of Mr. A. Thomson, charge engineer, be increased from £2 7s. per week to £130 per annum.

Tramway Officials.—Mr. W. Tuke Robson, late manager of the South Shields Corporation tramways, who proceeds to take up a similar appointment at Southampton, has been presented by the staff and employés with a framed photograph of the donors, and a wardrobe made from timber taken from the old man-of-war *Royal Albert*, which was broken up 25 years ago.

Halifax Tramways Committee has recommended the T.C. to increase the salary of Mr. J. D. Caird, traffic manager, from £350 to £375 per annum, with a further increase to £400 a year hence.

General.—As from June 1st, Mr. James Fleming, treasurer to the gas and the electricity departments of the Glasgow Corporation is retiring, and the Corporation has agreed that in future the finances of the two departments concerned shall be handed over to the control of the respective managers, Mr. W. W. Lackie, chief engineer and manager of the electricity department, and Mr. Alexander Wilson, engineer and manager of the gas department. This arrangement will put the electricity and gas departments of the Glasgow Corporation on the same self-contained footing as the Glasgow Tramways Department.

Mr. Needham, acting first assistant electrical engineer at Dover Admiralty Works, has been appointed first assistant electrical engineer at the Bermuda Dockyard. He is succeeded at Dover by Mr. J. W. Church, late of Malta.

The marriage took place at Askern (Yorks.) Parish Church, on May 24th, of MR. DAVID ROSSER, electrical engineer, late of Askern, now of South Wales, and Miss E. Silmer Richardson, sixth daughter of Mr. John Richardson, of Moss Road, Askern.

MR. HAROLD W. JACKSON, of the electric telegraph branch of the chief mechanical engineer's department, Lancashire and Yorkshire Railway station, Bolton, has obtained an appointment in the electrical department of the Cape to Cairo Railway, and last week he was made the recipient of numerous gifts from his late colleagues on the Lancashire and Yorkshire Railway. Mr. J. H. Runnett made the presentations.

MR. MARCONI has recently returned to this country from America, and he will almost immediately proceed to Italy to take control of the organisation of the wireless telegraph service of the country.

MR. A. S. MARKS has resigned his position with Messrs. Veritys, Ltd., to become London and South of England representative for Messrs. Ingram & Kemp and Messrs. Sperryn & Co., Ltd. All correspondence should be addressed to his headquarters at 26 and 27, Hatton Garden, E.C.

MR. G. STANLEY WHITE, of the firm of Messrs. George White and Co., Bristol, has been elected a director of the Bristol Tramways and Carriage Co, Ltd., in the place of the late Mr. Hugh G. Doggett. MR. SAMUEL WHITE relinquishes the position of managing director owing to ill-health, but remains on the board. MR. W. G. VERDON SMITH has been appointed managing director. MR. J. H. HOWELL, J.P., has been appointed a director of the Imperial Tramways Co., Ltd., in place of the late Mr. H. G. Doggett.

Obituary.—Amongst the victims in the Gretna Green railway disaster was MR. HERBERT HENRY FORD, manager of the crane department of Messrs. Arroll, of Glasgow. He was 45 years of age, and belonged to Bath, where he was at one time with Messrs. Stothert & Pitt.

MR. W. GORDON, traffic manager of Dublin United Tramways Co., was seized with illness while out riding his horse on May 27th. Mr. Gordon was apparently in his usual health on the Thursday morning last week when he set out on his tour of inspection of the depôts. He was on horseback and was attended by a groom. While passing through Herbert Park he suddenly swayed. The groom tried to prevent his falling, but he did not succeed, and the unfortunate gentleman reached the ground with a thud and expired immediately. Deceased, who was a native of London, had reached his 68th year. He had a wide experience in tramway management in England and on the Continent before his appointment to Dublin in 1899. Mr. Gordon was very popular with the various staffs and with the general public.

The secretary of the Dublin United Tramways Co., MR. R. S. TRESILIAN has also passed away very suddenly. He had arranged for a holiday in the South of Ireland, but his state of health necessitated an operation in hospital. When this had been performed, it was thought that he would go on satisfactorily. Two days later, however, he collapsed. Mr. Tresilian was just over 60 years of age.

Wills.—MR. F. W. LAWSON, a director of Fairbairn, Lawson, Combe Barbour, Ltd., left £128,033 gross and £106,796 net personalty.

The late DR. S. G. RAWSON, Principal of Battersea Polytechnic, and chairman of the Council of the Association of Technical Institutions, left £4,237.

The late MR. THOMAS BULLOUGH, a director of Howard and Bullough, Ltd., left £704,634 gross and £697,128 net personalty.

NEW COMPANIES REGISTERED.

Poulsen Wireless Telegraph Co., Ltd. (140,491). Registered May 28th, by Steadman, Van Praagh & Gaylor, 4, Suffolk Street, Pall Mall East, S.W. Capital, £450,000 in £1 shares. Objects: to carry on the business of electricians, manufacturers, generators, accumulators, suppliers and distributors of electricity and electrical energy for telegraphic, telephonic, lighting, heating and other purposes, telegraphists, telephonists, proprietors and managers of telegraph and telephone works, lines, systems, stations and exchanges, etc., and to adopt an agreement with the British & Overseas Engineering Syndicate, Ltd. The signatories (with one share each) are: F. S. Gaylor, 4, Suffolk Street, Pall Mall East, S.W., solicitor; A. W. Urquhart, 4, Suffolk Street, Pall Mall East, S.W., clerk; G. Humphries, 4, Suffolk Street, Pall Mall East, S.W., clerk; J. R. Gallort, 4, Suffolk Street, Pall Mall East, S.W., clerk; S. F. Layzell, 20, Ventnor Road, New Cross, S.E., clerk; W. B. Pearson, 4, Suffolk Street, Pall Mall East, S.W., solicitor's managing clerk; E. Holding, 17, Herbert Road, Wimbledon, S.W., clerk. Minimum cash subscription, seven shares. The first directors (to number not less than two or more than six) are: Sir Leigh Hoskyns, Bt., Cotefield, Banbury, Oxon; A. Davidson, 23, Upper Thames Street, E.C.; S. F. St. J. Steadman, 4, Suffolk Street, Pall Mall East, S.W.; L. S. Robertson, 28, Victoria Street, S.W.; V. Gandil, 11, Park Lane, W.; and C. Hage, Stockholmsgade 43, Copenhagen, Denmark. So long as C. Hage, or his personal representative, and the company called Det Kontinentale Syndikat for Poulsen Radio-Telegrafi Aktieselskab, and their original nominees or their personal representatives respectively, hold at least 100,000 shares, the said C. Hage and the said company and the survivor of them shall be entitled to two nominees on the board, and so long as they hold less than 100,000, but not less than 50,000 shares, they shall be entitled to one nominee on the board. Remuneration of directors, £200 each per annum (Chairman, £300), and £1,000 extra, divided between them, in any year when 10 per cent. dividend is paid (increasing to £2,000 if 20 per cent. or more is paid). Registered office: 4, Suffolk Street, Pall Mall East, S.W.

British Bachelet Ordnance Co., Ltd. (140,484).—Registered May 28th, by Ray, Jackman & Falck, 58, Margaret Street, W. Capital, £50,000 in £1 shares. Objects: to carry on the business of manufacturers of and dealers in ordnance of all kinds for naval or military use, machinery, engines, apparatus and accessories, ironmasters, steel makers and converters, colliery proprietors, coke manufacturers, miners, smelters, engineers, metal founders, electricians, electric, magnetic, galvanic and general engineers and contractors, generators and storers of electricity, etc., and to adopt an agreement with C. R. Howes, of 42, Piccadilly, W. The signatories (with one share each) are: H. G. Barrett, Mill Land, Clayton, Sussex, gentleman; T. W. Druitt, Carrig Cleena, Maidenhead, gentleman; F. W. Tagg, 10, Tressillian Road, Brockley, S.E., accountant; L. H. Falck, 58, Margaret Street, W., solicitor; B. A. Cole, Oaklands, Bolton Road, Harrow, clerk; H. Crosland, Woodhurst, Crawley, Sussex, gentleman; C. Vane, 54, Bernard Street, Russell Square, W.C., gentleman. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than seven) are to be appointed by the signatories. Qualification, £5. Remuneration, 10 per cent. of the profits available for distribution, divisible. Secretary: W. E. Newell. Registered office: 166, Piccadilly, W.

Semple and Co., Ltd. (9,402).—This company was registered in Edinburgh on May 28th, with a capital of £1,000 in £1 shares, to acquire the business of electrical and mechanical engineers carried on by Semple & Co., 170, Hope Street, Glasgow. The subscribers (with one share each) are: R. Semple, Jun., Braehead House, Johnstone, mechanical engineer; J. H. Ballantyne, 49, Polwarth Gardens, Glasgow, civil engineer. Private company. The number of directors is not to be less than two or more than seven. The first are R. Semple and J. H. Ballantyne. Qualification, 100 ordinary shares. Remuneration, £10 per annum. Registered office: 170, Hope Street, Glasgow.

Mico, Ltd. (140,440).—This company was registered on May 22nd, with a capital of £500 in £1 shares, to carry on the business of manufacturers of and dealers in accumulators, lamps, batteries, magnetos and electrical apparatus and fittings of all kinds, motor components and accessories, etc. The subscribers are: Mrs. W. H. Hawdon, Yetholm, Elmfield Gardens, Gosforth, 250 shares; J. W. Cook, 57, Norfolk Road, Byker, Newcastle-on-Tyne, accumulator maker, 5 shares; C. F. H. Foster, 24, Beaconsfield Road, Stoke, Coventry, magneto expert, 10 shares. Private company. The number of directors is not to be less than two or more than five. Mrs. W. H. Hawdon is permanent managing director. Solicitor: C. Crowther, 23, Abingdon Street, Westminster.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Cryselco, Ltd.—A memorandum of satisfaction in full on May 19th, 1915, of trust deed dated May 6th, 1910, securing £7,500 first and £7,500 second debenture stock, has been filed.

Trust deed, dated May 20th, 1915, to secure £10,000 debenture stock, charged on Kempston Ironworks, Kempston, Bedfordshire, and company's undertaking and property, present and future, including uncalled capital. Trustees: H. S. Deacon, Kempston, Bedfordshire, and A. Baker, Billiter House, Billiter Street, E.C.

Rawlings Bros., Ltd.—Issue, on May 20th, 1915, of £500 debentures, part of a series of which particulars have already been filed.

Midget Lamp Co., Ltd.—Particulars of £400 second and £1,000 third debentures, created April 8th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £400 and £500 respectively. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

James Keith and Blackman Co., Ltd.—Issue, on May 11th, 1915, of £1,000 debentures, part of a series of which particulars have already been filed. Memorandum of satisfaction in full of debentures, dated October 29th, 1901, and February 9th, 1914, securing £1,000 also notified.

Electrical Distribution of Yorkshire, Ltd. (84,972).—Capital, £50,000 in £1 shares. Return dated March 9th, 1915. 37,500 shares taken up, £36,737 10s. paid, being £762 10s. in arrear. Mortgages and charges: £5,000.

Bromley (Kent) Electric Light and Power Co., Ltd. (54,127).—Capital, £100,000 in £5 shares. Return dated April 26th, 1915. 15,000 shares taken up, £75,000 paid. Mortgages and charges: £60,000 4½ per cent. debenture stock.

City of London Electric Lighting Co., Ltd. (34,406).—Capital, £1,200,000 in £10 shares, 80,000 ordinary and 40,000 preferred. Return dated March 3th, 1915. 70,595 ordinary and 40,000 preferred shares taken up; £1,105,950 paid. Mortgages and charges: £800,000.

Telephone Co. of Egypt, Ltd. (17,824).—Capital £200,000, in 36,000 preferred and 4,000 deferred shares of £5 each. Return dated April 28th, 1915. All shares taken up. £5 per share called up on 24,000 preferred; £120,000 paid; £80,000 considered as paid on 12,000 preferred and 4,000 deferred. Mortgages and charges: £184,251.

Chelsea Electricity Supply Co., Ltd. (20,468).—Capital £400,000, in 74,000 ordinary and 6,000 preferred shares of £5 each. Return dated March 25th, 1915. 49,436 ordinary and 6,000 preferred shares taken up. £5 per share called up on 37,770 ordinary and 6,000 preferred; £218,850 paid; £58,330 considered as paid on 11,666 ordinary. Mortgages and charges: £175,000 debenture stock.

Northampton Electric Light and Power Co., Ltd. (28,640).—Capital, £150,000, in 10,000 A [illegible] 140,000 B [illegible] of £1 [illegible]. Return dated March 11th, 1915. 10,000 A [illegible] 78,000 B [illegible] 140[illegible] [illegible] preference [illegible] £10,000 [illegible]

CITY NOTES.

Anglo-Argentine Tramways Co., Ltd.

Mr. J. B. CONCANNON presided at the annual meeting held at Winchester House, E.C., on May 27th. He said it was hardly necessary for him to detail the reasons for the set-back which the accounts revealed. They were all familiar with the conditions which prevailed in the Argentine both before and since the war. Whilst the total receipts for the year under review as compared with those of [illegible] showed a decrease of £112,196, the net profits declined £21,[illegible] only, thanks to the reduction in working expenses, due mainly to the heavy expenditure upon maintenance in the years 1911, 1912 and 1913, which resulted in the permanent way, rolling stock, etc., being put in good order and thereby allowing a substantial reduction to be made under this head in 1914. On the other hand, the debenture charges and interest on temporary loans showed an increase of £12,237, after allowing for interest for works in course of construction charged to capital. The working of the first section of the subway lines had helped materially to reduce the loss from the surface lines during the past and current years. The work of constructing the second subway section had been suspended, the Municipal authorities having met them very handsomely in this respect by sanctioning the postponement of the commencement of the work for one year after the termination of the war. Their investments at cost showed a depreciation of £47,378 on the basis of the estimated market values of December 31st last. The reserve fund of £75,145 was available to meet this deficiency, but (following the precedent of kindred companies) they had not thought it advisable at present to take any action in the matter. During the continuance of the war it was impossible to estimate correctly the value of the investments. They would notice the item of £22,810 in the balance sheet under the heading of deposits with contractors abroad. This represented cash paid on account of cars, etc., ordered from Continental firms which had not been delivered, and pending the termination of the war the matter must be left in suspense. The gross decrease in traffic receipts for the four months ending April 30th last was £92,182, and the net profit showed a reduction of £13,287. Having regard to all the circumstances of the moment, they thought it prudent to carry forward the balance of £96,408 remaining at the credit of net revenue account after payment of all charges and preference dividend. As for the future, he would not attempt to prophesy. They all knew how dependent the Argentine was on good crops and stock-raising. The immediate outlook seemed favourable, as the wheat and maize crops promised to give better results than those of late years, notwithstanding the fact that they seemed to be somewhat prejudiced by the heavy rains which fell during the first three months of the current year; whilst the high freight rates which prevailed at present were a handicap. Still, the ruling prices of meat, wheat, etc., showed a handsome profit to producers. The prosperity of their company depended on the prosperity of the Argentine Republic, and they hoped that the remaining months of the year would show improvement. The company had contributed £300 to the Prince of Wales' Fund and £200 to the Belgian Relief Fund, and they were paying full salaries to four of their London staff who volunteered for the Field.

Mr. C. M. Rose seconded the motion, and the report was adopted without discussion.

United River Plate Telephone Co., Ltd.

The annual meeting was held on May 27th at Winchester House, E.C., Mr. George Franklin presiding. The Chairman, after referring with regret to the death of Mr. David Smith (managing director), said that notwithstanding the general conditions in Argentina, which had been affected by the war, the gross earnings and the net profit were substantially the same for the past two years. The gross earnings for 1914 amounted to £630,651, as compared with £611,657 in 1913, while the gross maintenance and other charges had amounted to £468,846, as against £447,604. The profit for the year was £161,805, as compared with £164,052—a decrease of £2,247, which, under the circumstances, might be considered satisfactory. Included in the expenses were the customary provisions for the maintenance and renewal of plant, on which £129,803 was expended last year, an increase of £23,965 over the previous year. The capital expenditure for the year had absorbed £186,065, of which £70,206 was on account of underground plant, as compared with £364,304 in 1913. On real estate they had expended £46,605 last year, as against £24,671 in 1913. That was following out their policy of substituting underground for overhead plant, and of purchasing land and buildings in which their exchanges were erected instead of having to rely upon tenancies. The reserve for renewal of plant now amounted to £512,535, and that, with the reserve fund account which, after this year's appropriation, would amount to £316,138—formed, in the opinion of the board, an adequate reserve for any wastage likely to occur on the capital expenditure in the Argentine, which now amounted to £2,390,820. The reduction in the capital expenditure last year reflected the policy of the board due to the outbreak of war, because, apart from the fact that the growth of the company's system did not require the extra outlay, they felt that, consistent with business prudence, it was necessary to limit capital expenditure at the present time to the smallest possible amount. The stock of materials stood at £165,474, a reduction during the year of £37,689—a satisfactory feature, as it was manifest that materials on the other side were liable to depreciation. The growth of the business as indicated in the number of subscribers showed, for the first time in the company's history, no increase during the year. That indicated the gravity of the crisis through which Argentina had passed, but it had enabled them to postpone with greater ease the provision of new buildings and the erection of exchanges. The stagnation was only temporary and due to abnormal causes, and while it was impossible to prophesy as to the future they must remember that so far America had escaped the most baneful consequences of the war. The Municipality of Buenos Aires had granted them a new concession on satisfactory terms, under which they were allowed to extend their underground system and put down subways. In Cordoba they now had an excellent automatic system established, and last January they put into service a 5,000-line automatic system at Rosario. During the coming year Argentina should, he thought, show a fair measure of prosperity, and that in its turn should be reflected in the company's business.

Sir F. Green seconded the motion which, after a short discussion, was adopted.

Lancashire Power Construction Co., Ltd.

In their report for the year ended March 31st, 1915, the directors say that during the period the company completed its contract with the Parliamentary Company for the extension of the power station and plant. The balance of profit due thereon, amounting to £1,864, has been brought into the account. The trading profit of the Lancashire Electric Power Co. for 1914 amounted to £29,961, plus interest on hire-purchase plants, etc., amounting to £511, making £30,471, compared with £23,526 for 1913. The balance brought forward from 1913 was £419. Debenture interest has absorbed £4,500, reserve fund £10,000, a dividend of 3 per cent. £12,969, leaving £3,422 to be carried forward. The following figures indicate the development of the company's business:—

	1912.	1913.	1914.
Units generated	23 110,807	28,191,442	32,157,185
Max. load in kw	6,730	9,720	10,210
H.P. connected	16,400	23,900	27,018
Receipts	£42,773	£54,515	£65,433
Expenditure	£28,156	£31,730	£35,472
Profit on trading	£14,617	£22,785	£29,961

It will be observed that, while the dividend and the amount set aside for reserve have been maintained on the same basis as for 1913, the amount carried forward has been increased by £3,000. The revenue account of the Lancashire Power Construction Co., Ltd., shows that the total receipts for the year ended March 31st, 1915, amount to £19,344, and after deducting the expenditure, £17,110, the available balance of £2,224 is to be carried to reserve account.

Annual meeting, June 10th.

Electric Construction Co., Ltd.

Mr. P. E. Beechcroft presided at Winchester House, E.C., on May 27th, at the annual meeting. He said that the forecast he made at the last general meeting had been justified, and they were able to submit results that day with which he was sure they were satisfied. The gross profit on manufacturing and contracting amounted to £71,999, an increase of 4.2 per cent. This increase might appear somewhat small, but he would remind them that since 1911 they had recorded substantial improvements year by year from manufacturing and contracting, as the following figures proved:—1910-11, £47,800; 1911-12, £53,700; 1912-13, £62,600; 1913-14, for ten months £57,500=per annum, £69,000; 1914-15, £72,000. In five years, therefore, they had increased their gross profit by more than 50 per cent., and, given ordinarily good times, they did not think they had reached their maximum. The comparatively lower rate of increase last year, however, was affected by the exceptional conditions under which they (in common with all manufacturers) had had to carry on operations. Since the outbreak of war they had suffered from a scarcity of labour, no less than 30 per cent. of their workmen of eligible age having joined the Forces. Great delay had occurred also in obtaining delivery of certain classes of raw material, while the demand for prompt delivery of their products had been insistent, necessitating a considerable amount of overtime. Concurrently, the prices of raw materials (which were almost exclusively manufactured articles) had risen steadily since war was declared, but as they had a considerable amount of orders booked on the old basis they were unable to obtain the benefit of higher prices for their products until the financial year was well advanced. It must not be assumed that the receipt of Government or war orders necessarily meant larger additional profits out of proportion to those accruing to ordinary business; such was not so, at least in their case. Orders had been entrusted to them directly by the Government and by Government contractors which had to be executed under very great pressure, necessitating a good deal of overtime, and he desired to express the appreciation of the directors for the admirable manner in which these orders had been executed. Work had been carried out uncomplainingly, and he thanked all, from the managing director downwards, for their indefatigable zeal and for the manner in which they had met the demand upon their time and energies. Towards the end of the financial year they, in conjunction with other engineering establishments in Wolverhampton, granted an increase in wages of 3s. per week to skilled men and a correspondingly lower increase to unskilled. Recognising also the hardship of the increased cost of living, a war bonus had been granted to members of the staff whose wages were less than 55s. per week—a concession which had been much appreciated. These concessions were not felt to any material extent in their manufacturing profit last year, but he mentioned them in order that they might appreciate their effect during the year now current. General charges had increased at the rate of 7·4 per cent. per annum, but the increase had been counteracted by lower cost of maintenance of plant and buildings. The total expenditure, therefore, showed no increase, and the whole improvement of £3,000 in gross profit was available for distribution. Having given the comparative gross profit for the past five years, he gave the net profits for the same period:—1910-11, £15,000; 1911-12, £20,300; 1912-13, £27,500; 1913-14, for ten months, £27,000=per annum £32,400; 1914-15, £35,500. These showed that since the increased demand for electrical machinery set in a very large proportion of the increased gross profit had become available for distribution. In other words, the increase in standing charges on the bigger volume of business had been inappreciable. The past year had to some extent benefited in this respect by the extension which had been made to their main factory, and which had materially reduced the cost of handling, in addition to enlarging the output facilities. It might have occurred to some of them that the Board had been ultra-conservative in recommending a dividend of only 6 per cent. on the ordinary shares. In normal times they would have been justified in recommending a larger dividend, but they came to the conclusion that, having regard to all the uncertainties produced by the deplorable war which the nation was now waging, they would be consulting the best interests of the shareholders if they only paid the same rate as last year. The only item in the balance sheet calling for comment was "shares in other companies." This asset was almost entirely represented by their holding in the Electrical Power Storage Co., Ltd., and it had now been written down to what was considered to be the realisable value. An extraordinary general meeting of that company was to be held on June 3rd to consider and, if thought fit, to pass a special resolution for amalgamation with Pritchetts & Gold, Ltd. If the provisional scheme of amalgamation was approved by both companies, the manufacturing operations of the Electrical Power Storage Co. would be transferred to Dagenham, and the economies which would be effected thereby would enable a good dividend to be earned upon the reduced value of the shares. He admitted that they had dealt with the item drastically, but they were now in the happy position of being able to say that every item in the balance sheet stood (subject to what he said last year about the properties, patents and goodwill) at its realisable value or less, every item of a doubtful character having been fully reserved or written down. To enable them to write down the shares in other companies, they had had to transfer £39,403 from general reserve, but they were restoring the sum of £17,403 from last year's profits, making the amount to the credit of general reserve fund £36,000. If they continued to make substantial contributions to general reserve, though not necessarily to the same extent as last year, the item of goodwill in two or three years would be extinguished entirely, and this, in his opinion, should be the aim of every industrial concern. He would again direct their attention to the strong financial position which they enjoyed. Their entire liabilities, apart from debenture stock, were only £22,232, whereas their realisable assets amounted to £173,964, and they had, in addition, £17,983 in cash. From the point of view of the debenture holders and the preference shareholders, he might also point out that, after providing for depreciation, the debenture interest last year was covered six times over, and the dividend on the preference shares almost nine times—a position which he did not think was realised having regard to the market price of these securities. Having referred to the death of Mr. W. Bullock, a director who had acted as manager for 13 years at Wolverhampton; the election of Mr. David Willock, the secretary, to the board; and the appointment of Mr. W. M. Furniss as manager at Wolverhampton, the Chairman said that it was always dangerous to prophesy, but all the indications at present pointed to a busy and successful year.

Mr. J. GRAY (Managing Director) seconded the motion, and the report was adopted without discussion.

Replying to a resolution re-electing him as a director, the CHAIRMAN said the essential qualities required by a manufacturing business were indefatigable energy and conservative optimism. The first was possessed by their employés at Wolverhampton, and he believed that he himself was a conservative optimist. He believed there was a great future in store for the company.

Prospectuses.—*South Metropolitan Electric Light and Power Co., Ltd.*—This company has been offering to holders of its shares and debenture stock a further £25,000 of 4½ per cent. first mortgage debenture stock at £95 per cent. and 25,000 6 per cent. cumulative second preference shares of £1 each at par. A commission of £1 per cent. is payable on the debenture stock and of 1s. per share on the preference shares, making the net cost to the subscriber £94 for the debentures and 19s. for the preference shares. The debentures are repayable at par in 1931. The prospectus states that the dividend on the preference shares is covered more than three times over. The money is required to meet the continuous increase in the business.

The Cornwall Electric Power Co. is offering for subscription £60,000 5 per cent. debenture stock at 95 per cent.

Shropshire, Worcestershire and Staffordshire Electric Power Co.—The report states (according to the *Financier*) that the net revenue for 1914 amounted to £25,366. After deducting expenses, including £250 written off cost of electric lighting orders, the directors propose to add to reserve £4,500, to pay a dividend at the rate of 3 per cent. per annum and to carry forward £899.

Banbury and District Electric Supply Co., Ltd.—The report adopted at the annual meeting held on Monday at Electrical Federation Building showed that the number of consumers had increased from 312 to 353, but the number of units sold decreased from 607,447 to 547,439, due to the effect of the war on the business of the district. The revenue was £4,255, and the working expenses were £2,448. After paying debenture interest, putting £600 to renewals, £104 to sinking fund for redemption of debentures, and paying 2½ per cent. on the ordinary shares, £319 is to be carried forward.

Worcester Electric Traction Co., Ltd.—The report submitted at the annual meeting held at Electrical Federation Offices, Kingsway, on Monday, showed that the revenue was £18,525 for 1914, as compared with £18,071 for 1913. After deducting expenses chargeable to revenue, including £1,738 for renewals, £4,432 remains. After putting £1,000 to reserve, and paying 3½ per cent. on the ordinary shares, £293 is to be carried forward. The company has sold its motor-omnibus interests to the Worcestershire Motor Transport Co., Ltd., and now holds 8,238 £1 shares out of 19,347 shares issued.

Petters, Ltd.—Dividend on the ordinary shares for 1914, at the rate of 5 per cent. per annum, as compared with 10 per cent. for 1913. £2,000 is carried to reserve, and £5,000 to meet war losses.

Brazilian Traction, Light and Power Co., Ltd.—A dividend of 1½ per cent. for the three months ending June 30th, 1915, on the 6 per cent. cumulative preference shares, is announced.

Ruston, Proctor & Co., Ltd. — Dividend on the ordinary shares for 1914 7 per cent. per annum, carrying to special reserve for contingencies arising out of the war £25,000, and carrying forward £13,353.

Canadian General Electric Co., Ltd.—A quarterly dividend of 1¾ per cent. for the three months to the 30th inst. on the common stock is announced.

Stock Exchange Notice.—The Committee has ordered the following to be officially quoted:—

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Further issue of 60,179 ordinary shares of £1 each, fully paid, Nos. 737,501 to 797,679; and 224,832 [illegible] per cent. preference shares of £1 each, fully paid, Nos. 687,501 to 912,332.

Mackay Companies.—The regular quarterly dividend on the common shares of 1¼ per cent. is announced.

STOCKS AND SHARES.

TUESDAY, [illegible]

BUSINESS in the Stock Exchange continues to [illegible] quietly. Chief among the themes of discussion [illegible] of the early part of the week, which took place in the "outlying districts" of London. Although these visitations are becoming sufficiently frequent to make members [illegible] somewhat *blasé*, a very different effect has been the [illegible] given to recruiting and to underwriting policies. Investment [illegible] are somewhat heavy. A substantial [illegible] of the War Loan is expected to be made before long, and, pending its arrival, investors in gilt-edged stocks are [illegible] hands. It is still remarkable, however, to observe the difficulty that exists in obtaining such first-class shares as those, for instance, of the good electricity [illegible]

An interesting newcomer of the week [illegible] South Metropolitan Electric Light and Power Company [illegible]. This takes the shape of £25,000 4½ per cent. first mortgage debenture stock offered at 95 and 25,000 [illegible] per cent. [illegible] preference shares at £1. As no part of the issue is underwritten, applicants for the debenture stock [illegible] per cent. [illegible], and the preference shares [illegible] per share [illegible], making the net cost 94 for the [illegible] per share for the preference. The prospectus [illegible] interest on the debenture stock and the dividend on the preference shares to be [illegible] the profits of the past two years. The stock is repayable at par [illegible] or earlier at the company's option [illegible]

The existing [illegible] 7 per cent. preference at [illegible] been [illegible] Stock Exchange [illegible] London [illegible] have taken [illegible] to [illegible]

Electric Construction [illegible] the preference at 1. Babcock & Wilcox are 1s. easier at 2¼, and Callender's shed part of their rise of last week. The manufacturing group as a whole [illegible]

Amongst Home Railway stocks [illegible] tendency is again marked. Underground Electric issues [illegible] the income bonds at 76 being ¾ down, while the [illegible] shares are a few pence lower. Central London ordinary has failed to maintain the strong front hitherto presented; there is a little stock on offer, and the price has fallen 3 to 77. The 4 per cent. guaranteed preferred ordinary remains at 80, and the deferred is about the same price as the ordinary stock. East London changes hands infrequently on the basis of 4¼, and a bargain has been lately marked in the 4 per cent. "A" debenture stock at 90. Metropolitan Surplus Land is in some demand around 54½, and the company's ordinary stock at 29 is one of the few to show an improvement on the week. Various rumours are afloat with reference to the probability that some of the Home Railway companies will be requiring to make fresh issues of capital before the end of the current six months, and two or three of the steam lines have already approached their stockholders with this object.

The unsettlement produced by the tramway strike acts as a depressing factor upon prices. London United Tramways 4 per cent. debenture stock is 50, and no transactions have been recorded in the issues of the Metropolitan Electric Tramways since the middle of last month. Potteries preference were done at 10s. 6d. a few days ago.

Anglo-Argentine Trams are a better market, on the consideration that the passing of the ordinary dividend is really a bull point for the pre-ordinary descriptions, inasmuch as it enables the company to carry forward a largely increased sum to the new year. The first preference shares have recovered to 4⅜, and the 4 per cent. first debenture stock is 1½ better at 83. Brazilian Tractions dropped to 49 on a shrinkage in the Rio exchange to the round shilling, but there was a subsequent recovery to 50 on the declaration by the company of its usual quarterly dividend on the preferred shares.

That affairs in Mexico are no better is made evident by a circular just issued by the Board of Trade, in which stress is laid upon the huge quantity of paper money now in circulation, some of which there seems every reason to fear will be absolutely valueless when peace comes. "Much of this paper," says the British Vice-Consul at Guaymas, "has been printed and lithographed on such poor paper that it is wearing out, and will disappear or be unredeemable. Moreover, a great deal of counterfeit is in circulation, as well as bank issues without the sanction of such banks." Mexico Tramways common shares changed hands at 30 on Monday, and the second mortgage bonds at 31 two days earlier. In Mexican Light and Power issues the market has come to something like a full-stop for the time being. Auckland Tramways 5 per cent. debenture stock has been done at 101, and Bombay Electrics are firm on the excellent report.

Telegraph and Telephones tend to the duller side, and there are falls in Anglo-American Telegraph preferred, Eastern Extensions, Eastern ordinary and preference, Globe preference, Western ordinary, and West India and Panama. There is no particular pressure to sell, and the dulness arises from the lack of buyers to take what small amount of stock executors of deceased accounts would like to place. Great Northerns rose £1 to 31, and New York Telephone bonds have started to recover. Marconi shares keep very firm, the ordinary being a shade better at 34s., while Canadians are 5s. and Americans 10s.

The Canadian General Electric Company has declared its regular quarterly dividend of 1¾ per cent. on the common stock, which has had the effect of stiffening the price to 92½; while for the preferred there are still buyers in the neighbourhood of 108. Stock and shares in companies connected with Canada have been somewhat dull on the whole, in sympathy with the weakness of American securities engendered by the renewal of the impression that, unless Germany provides the United States with a much more satisfactory answer to President Wilson's demands than that already formulated, America may find herself face to face with the prospect of war. The Consolidated Gas, Electric Light & Power Company, of Baltimore, is another which has declared its regular dividend of 1¾ per cent. on the common stock.

Reuter's Telegram Company's report breathes the hope that the State will recognise the sacrifices entailed upon the undertaking by reason of the war, which brought about Government interference with the business. Reuter's Bank passed its dividend, so that the £15,000 provided from this source last year is missing in the current report. The net profits of £5,900 are about one-sixth of those for 1913; and the company, as already notified, has passed its own dividend. The occasion has been taken, however, of writing off the goodwill account and making substantial allowance for depreciation of investments, including the holding in Reuter's Bank shares. The nominal quotation for the Telegram Company's shares is 4½, but there is next to nothing doing in them, and to get a bid for the shares is naturally difficult.

The Rubber market shows a good deal of firmness, in consequence of good reports recently issued by some of the companies whose shares stand at low prices. These reports came as a pleasant surprise to the market, and, as a favourable influence, served to counteract a trifling decline in the price of the raw stuff. The Armament group is somewhat harder than it was last week. Northern Stock Exchanges, however, are doing so little in their popular shares that London is not disposed to initiate fresh activity in them. The Copper group is supported on the one hand by the firmness of the Paris Bourse, and inclined on the other hand to reflect the dulness apparent in most American securities for the reason already mentioned. The net result of these conflicting currents is that business has shrunk to an exceedingly low ebb.

SHARE LIST OF ELECTRICAL COMPANIES.

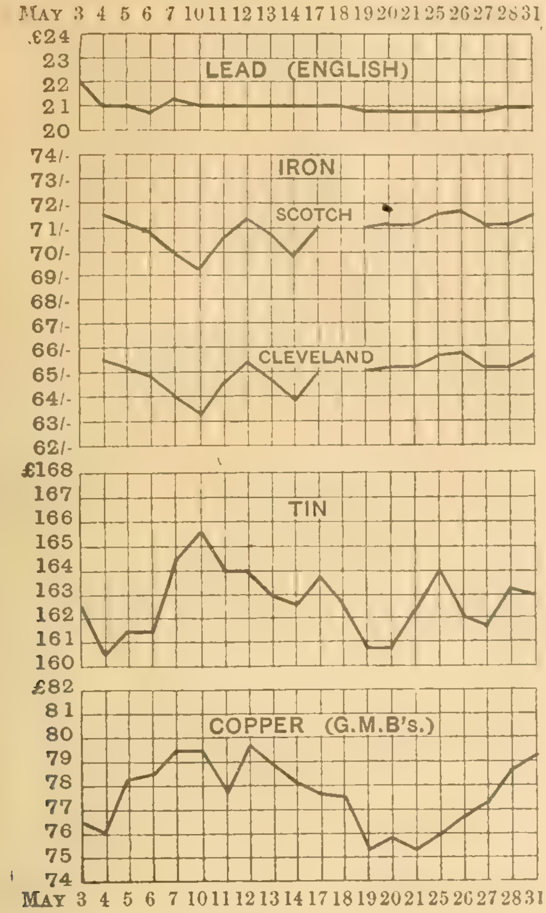
	Dividend, 1914.	Price June 1, 1915.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.				
Brompton Ordinary	10	8¼	—	£6 1 3
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	6	4½	—	5 11 1
do. do. do. 4½ Pref. ..	4½	4⅛	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	[illegible]	14¼	—	6 6 4
do. do. 6 per cent. Pref. ..	6	12¼	—	4 18 0
do. do. 5 Deb.	5	112	—	4 9 3
do. do. 4½ Deb.	4½	96	—2	4 13 10
County of London	7	11⅜	— ⅛	6 3 1
do. do. 6 per cent. Pref. ..	6	11½	—	5 4 4
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	95 xd	—	4 14 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1¼	— ¼	8 0 0
do. do. 6 per cent. Pref. ..	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	3½	3⅛	—	5 12 5
do. 4½ per cent. Pref. ..	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	75	—	4 13 4
St. James' and Pall Mall	10	7½	— ½	6 13 4
do. do. do. 7 per cent. Pref.	7	6⅜	—	5 9 10
do. do. do. 3½ Deb.	3½	75	—	4 13 4
South London	5	8	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7½	—	6 0 0
do. 4½ Pref.	4½	4⅞	—	4 12 4
TELEGRAPHS AND TELEPHONES.				
Anglo-Am. Tel. Pref.	6	105	— ½	5 14 4
do. Def.	1½	22½	— ⅛	6 13 4
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8½	—	5 17 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	13	— ¼	*6 1 3
do. 4 Deb.	4	92	—	4 7 0
Eastern Tel. Ord...	7	133	—1	*6 0 4
do. 3½ Pref.	3½	75	+1	4 13 4
do. 4 Deb.	4	92	—	4 7 0
Globe Tel. and T. Ord.	[illegible]	11	—	*6 4 9
do. Pref.	6	11¾	— ⅛	5 2 2
Gt. Northern Tel.	22	31	+1	7 2 0
Indo-European	65/-	54	—	6 0 4
Marconi	20	1 23/32	+ ⅛	11 17 0
New York Tel. 4½..	4½	97	+ ¼	4 13 0
Oriental Telephone Ord.	10	2	—	5 0 0
do. Pref.	6	1 3/16	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 3
United R. Plate Tel.	[illegible]	6⅛ xd	—	*7 7 0
do. Pref.	6	6	—	5 0 0
West India and Pan.	1	1¼	— 1/32	8 0 0
Western Telegraph	7	13½	— ¼	*5 18 5
do. 4 Deb.	4	91	—	4 6 6
HOME RAILS.				
Central London, Ord. Assented ..	4	77	— 3	5 4 0
Metropolitan	1¼	29	+ ½	4 7 2
do. District	Nil	16¾	—	Nil
Underground Electric Ordinary ..	Nil	1⅝	—	Nil
do. do. "A"	Nil	5/8	— 3d.	Nil
do. do. Income ..	6	76½	—2¼	*9 2 0
FOREIGN TRAMS, &c.				
Anglo-Arg. Trams, First Pref. ..	5½	4⅜	— ⅛	6 5 9
do. 2nd Pref.	5½	3¾	—	7 6 8
do. 4 Deb.	4	83	+1½	4 16 3
do. 4½ Deb.	4½	87	—1	5 3 6
do. 5 Deb.	5	87xd		5 15 0
Brazil Tractions	6	50	—2	12 0 0
Bombay Electric Pref.	6	10⅜	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	35	—	Nil
do. 5 per cent. Bonds ..	—	58	—	Nil
do. 6 per cent. Bonds ..	—	32	—3	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	39	—	Nil
do. 1st Bonds	—	48	—1	—
Adelaide Sup. 6 per cent. Pref. ..	6	5 5/16	—	5 13 0
do. 5 Deb.	5	108	—	4 17 1
MANUFACTURING COMPANIES.				
Babcock & Wilcox	14	2½	—1/-	5 12 0
British Aluminium Ord.	5	21/-	—	4 15 8
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	11¼	—	6 13 4
do. Pref.	6	6⅛	—	5 0 0
British Westinghouse Pref.	7½	1 3/16	—	7 15 0
do. 4 Deb...	4	72	—	5 11 1
do. 6 p. lien	6	101	+	5 19 0
Callenders	15	12¼	½	6 2 5
do. 5 Pref...	5	5	—	5 0 0
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	8½	—	4 12 6
Edison & Swan, £3 pd.	Nil	12/9	—	Nil
do. do. fully paid	Nil	1⅞	—	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5% Deb.	5	60	—	8 6 8
Electric Construction	6	13/- xd	—	9 4 8
do. do. Pref.	7	1 xd	—	7 0 0
Gen. Elec. Pref.	6	10 3/16	—	5 17 8
Henleys	20	14½	—	*3 0 4
do. 4½ Pref.	4½	4⅞	—	4 12 4
do. 4½ Deb.	4½	97	—	4 13 9
India-Rubber	5	9	—	5 11 1
Telegraph Con.	20	87	—	6 9 10

* Allowance made for dividends being paid free of income-tax.

Hong-Kong Tramway Co., Ltd. — After charging £6,530 for depreciation and providing for debenture interest, and including £7,479 brought forward, the net profits for 1914 were £17,022. A dividend of 10 per cent. is proposed, writing £2,000 off properties, and leaving £6,897 to be carried forward.—*Financier.*

METAL MARKET.

Fluctuations in May.



The Glasgow Iron Market was closed on May 3rd and 18th.

Russian Electrical Industry: German Control.—A Petrograd paper quotes from an address delivered by V. A. Kieselieff to the Technical Society, Petrograd, on the organisation of the German electrotechnical industry, and the possible results for the Russian electrotechnical industry. He observed that in 1903 there were seven large electrical concerns in Germany which were both producers and consumers of electrical energy. Taking advantage of the support of the banking houses, which promptly recognised the importance of this branch of industry, these concerns made rapid progress. However, after the crisis of 1904-5 the larger concerns absorbed the smaller ones, so that there remained two—the Siemens-Schuckert and the General Electricity Co. With the advantage of their power of extreme specialisation, the great extent of their production and their immense resources, these two companies cover nearly the whole world with a system of electrotechnical concerns which they finance and control. Thus the General Electricity Co. is interested in several electrotechnical concerns, the nominal capital of which reaches the colossal figure of 2,000,000,000 marks. Not content with their *rôle* as producers of electrical energy, these companies soon get into their hands the production of all manner of electrical equipment, and rapidly destroy all competition in respect thereto. At the present moment these two companies, as a fact, hold in their hands the entire electrotechnical industry of Russia. In some form or other they control all branches of production of installation materials in Russia. Some houses that have been nominally considered to be Swiss, Belgian, or French, are upheld really by German capital for the most part. But how is the electrotechnical industry of Russia to extricate itself from this abnormal situation? The lecturer said that the proposition of many to increase the Customs tariff would not serve at all to increase the Russian production, but would rather strengthen still further the German concerns operating in Russia. He considered that the only way out was the formation of a great financial organisation—an "Electrobank"—with plenty of money, which would enable the young Russian electrotechnical industry to compete with German capital. Such a bank with entire absence of risk, as the electrotechnical industry was essentially progressive, judged by German experience, would attract much money, and make it possible for the Russian electrotechnical industry to emerge from German control. The meeting generally agreed with the lecturer, but some of the audience held that the lack of experienced workmen in the country, and the unsatisfactory position of this industry in the schools, necessitated the adoption of corresponding measures for the rectification of these drawbacks.

ELECTRIC POWER IN INDIA.*

By H. R. SPEYER, A.M.I.E.E.

([illegible] 77[illegible].)

The fact of many of the pioneering electric power installations in India not proving so successful as anticipated has in many cases turned the owners of mills, factories and collieries against the use of electric power for industrial purposes, and although to-day this feeling has to a great extent been overcome, it is still a matter of considerable difficulty to convince owners and others that, apart from the saving in capital outlay and running expenses, inherent advantages appertain to the electrical drive which are not possible of achievement with steam.

In textile mills the steady and uniform speed results without doubt in a better quality texture, and the output over the same running hours is materially increased to an extent depending upon the careful lay-out of the machinery, but unfortunately in very few cases, if any, are manufacturers prepared to guarantee these results. Although they are convinced in their own mind that such is the case, it is rarely that one is able to induce manufacturers to convert their beliefs into written guaranteed percentages, which is really the only basis on which it is possible for laymen to base the value of a conversion from steam, which may have done well for 25 years, to electric power. The approximate coal consumption of the mills and factories in India in 1911 was 1,460,000 tons, and the approximate horse-power available for electrification was 250,000 I.H.P.

The lay-out of a mill or factory to operate successfully in India cannot be designed to the best advantage at home, for in each case local conditions and the topographical position of the site must be taken into consideration. Experience has shown that many drives, which have proved eminently successful at home, have not given the best results in India. During the rainy season the average textile mill, after having been shut down on the Saturday afternoon, requires approximately double the amount of power to get under way on the following Monday morning, owing to the abnormal humidity causing the rope drives to tighten during the interval. It is, therefore, advisable when designing an electric drive with either ropes or belts to allow for the starting gear having an overload capacity of 80 to 100 per cent. Experience has shown that whilst in the majority of cases three-phase induction motors are quite capable of dealing with this temporary overload the capacity of the starting gear has been quite inadequate.

The advisability or otherwise, viewed from the manufacturers' point of view, of taking a supply of electrical energy from a public company in preference to generating current on the premises, is being keenly contested at the present moment in one of the largest industrial centres of India.

There is, however, little doubt that for small outputs up to 1,000 H.P. it is far more economical for consumers to take a supply from a local company; but in the case of 15,000 H.P. or more for a 10-12-hour daily load throughout the year, manufacturers realise that with equal facilities for an adequate supply of water for condensing purposes and equal rates for coal, they are in a position to generate electric power as cheaply as a public supply company.

It appears a matter of difficulty to convince manufacturers of the fact that the current supplied by the company represents effective power, whereas in generating power on the premises the difference of cost between indicated and actual horse-power—in which must be included such losses as may be occasioned in the boiler and engine house as well as in the main transmission drives—has to be borne by the mill-owner.

In India during nine months of the year a steady power load due to fans is maintained throughout the 24 hours. The peak lighting load is superposed on the fan load, but the resultant station load-factor (defined as the ratio between the mean and the maximum load) may average as high as 65 per cent. It, therefore, becomes a matter of very serious consideration as to whether a very material advantage is to be gained by an Indian public supply company catering for heavy mill loads which will again be superposed on the fan and lighting peak-loads.

It must be remembered that the revenue per unit obtained from the two latter loads is far in excess of the price which it is possible to charge the mills and factories for a supply in bulk.

If care is not taken to limit the sale of power for such purposes, the earning capacity per kilowatt installed in the station may easily be decreased to a greater extent than it is possible to reduce the standing charges per unit generated, by the introduction of such loads.

The diversity factor obtained with a fan and lighting load is of great advantage to the station, whereas a big power load overlapping the evening peak of the lighting and fan loads may prove the reverse of remunerative, unless the charge for such a power load is saddled with a proportionate charge of the capital expended on general distribution. It would therefore seem necessary for a standing charge to be levied in addition to a rate per unit metered; but such a method of charging appears inexplicable to the mill-owner, and in many cases it is owing to controversy on this point that mill-owners have installed their own plant. It appears, however, that this basis of charging must be enforced in order to safeguard the interests of the supply companies, as it may happen that through a shortage of raw materials or the excess of produc-

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* From the *Journal* of the Institution of Electrical Engineers (Abstract).

TABLE II.—ELECTRICAL POWER STATIONS AND PLANTS IN INDIA (WORKING AND IN COURSE OF ERECTION, JUNE, 1913).

Ahmedabad Cotton Mill	Ahmedabad
Akola and Mid. India Gin Factory	Akola
Anglo-Indian Jute Mill	Calcutta
Apollo Cotton Mill	Bombay
Assam Oil Mill	Assam
Baroda State Plant	Baroda
Bengal Iron & Steel Works	Barakur
Bengal Nagpur Ry. Works	Calcutta
Bengal & North-West Ry.	Lahore
Birkmyre Brothers' Jute Factory	Calcutta
Bikanir City Flour Mill	Bikanir
Bikanir City Oil Mill	,,
Bikanir State Plant	,,
Bombay, Baroda & Cen. India Rly. Works	Bombay
Bombay Cotton Mill	,,
Bombay Electric Tramway and Power Co.	,,
Bombay Flour Mill	,,
Bombay Municipal Sewage Works	,,
Bombay United Mills	,,
Buckingham Mills	Madras
Budge Budge Mills	Calcutta
Burma Railway	Rangoon
Burma Oil Co.'s Depôt	Calcutta
Bombay Telephone Co.	Bombay
Calcutta Electric Supply Co.	Cossipore
Calcutta Ordnance Dept.	,,
Calcutta Real Property Co.	Calcutta
Calcutta Telegraph Dept.	,,
Calcutta Elec. Supply Corp.	,,
Cauvery Falls Works	Mysore
Cawnpore Harness Factory	Cawnpore
Caxton Printing Works	Bombay
Central Jute Press	Calcutta
Civil Engineering College	Sibpur
Colaba Land Cotton Mill	Bombay
Colombo Tramway Co.	Ceylon
Cossipore Gun and Shell Factory	Cossipore
Crescent Cotton Mill	Bombay
Crown Cotton Mill	,,
Currimbhoy Cotton Mill	Bombay
Cordite Water-Power Station	Nilghiris
David Cotton Mill	Bombay
Dawn Cotton Mill	,,
Delhi Tramway Co.	Delhi
Dum Dum Ammunition Factory	Dum Dum
East India Coal Co.	Calcutta
East Indian Rly. Works	,,
E. Pabaney Cotton Mill	Bombay
E. D. Sassoon Cotton Mill	,,
Elphinstone Cotton Mill	,,
Empress Cotton Mill	Nagpur
Fazalbhoy Cotton Mill	Bombay
Finlay Cotton Mill	,,
Fort William Flour Mill	Calcutta
Great Indian Peninsular Railway Works	Bombay
Godak Water Falls	Belgaum
Gold Mohur Cotton Mills	Bombay
Government Public Works Department	Ootacamund
Government Press	Madras
Government Printing Press	Yeravda
Government Secretariat	Calcutta
Gwalior State Plant	Gwalior
Gwalior State Railway	Gwalior
H.M. Mint	Calcutta
Hindoosthan Cotton Mill	,,
India Jute Mill	,,
Indian Bleaching and Print Works	Bombay
Indore State Installation	Indore
Industrial School	Lucknow
Jacob Sassoon Cotton Mill	Bombay
Jamadaba Colliery	Jamadaba
Jamshed Cotton Mill	Bombay
Jubilee Cotton Mill	,,
Kolar Goldfields Plant	Mysore
Madhawji Dharamsey Cotton Mill	Bombay
Madras Elec. Supply Corp.	Madras
Madras Portland Cement Works	,,
Madras Telegraph Dept.	,,
Madras Corps. Plant	Madras
Mahmedbhoy Cotton Mill	Bombay
Mathematical Institution	Calcutta
Monarch Flour Mill	,,
Madras Electric Tramways	Madras
Munnar Hydro-elec. Works	South India
Mussorie Hydro-elec. Plant	Mussorie
Nepal State Hydro-electric Works	Nepal
New City Flour Mill	Calcutta
New City of Bombay Cotton Mill	Bombay
New Kaleewarar Cotton Mill	Coimbatore
North-Western Ry. Works	Lahore
Noondydroog Mines	Mysore
Ocean Jute Press	Calcutta
Oudh & Rohilkhand Rly.	Oudh
Patiala State Plant	Patiala
Phœnix Cotton Mill	Bombay
Pondicherry Elec. Inst.	Pondicherry
Quetta Residency Station	Quetta
Quetta Staff College	,,
Rangoon Elec. Tramway	Rangoon
Ranigunj Colliery	Ranigunj
Ripon Cotton Mill	Bombay
Sarah Bridge Plant	Sarah
Sun Jute Press	Calcutta
Swan Cotton Mill	Bombay
Suraj Jute Press	Calcutta
Sorab Cotton Mill	Bombay
Srinagar Hydro-elec. Works	Kashmir
Shri Buldeo Cotton Mills	Hathras
Simla Hydro-elec. Works	Simla
Sun Cotton Mill	Bombay
South Indian Railway	Nagapatam
Taj Mahal Hotel	Bombay
Tata Swadeshi Mill	,,
Tata Hydro-elec. Works	Lonavla
Tata Iron & Steel Works	Kalimati
Thomason Eng. College	Roorkee
Tibutil Gold Mines	Anantpur
The Times Press	Bombay
Upper Swat Canal	Malakand
Victoria Jute Press	Calcutta
Western India Cotton Mill	Bombay

tion over demand, a number of mills may be shut down two or three days per week over many months of the year.

Detailed data concerning the principal power supply companies in India have been tabulated in Table I.

The largest private generating stations in India are given in Table II.

A number of the Indian State-owned railways have now under consideration important projects for the electrification of inter-urban and main lines, and it is quite likely that many such schemes will mature in the near future.

In conclusion, it may be said that the more important manufacturing centres of India to-day are fully alive to the advantages appertaining to the installation of electric plant, but if British manufacturers are desirous of obtaining a fair percentage of this trade it is essential that they should send out to the country their best men, and should endeavour to standardise a special line of machinery suitable for the unfavourable climatic conditions and unskilled treatment to which the machinery is subjected.

Mill-owners, agents and laymen in general must on their part be prepared to lay aside pre-concerted ideas on the electric drive, and endeavour to grasp simple technical facts, whilst engineers must, on the other hand, be prepared to broaden their outlook to embrace not only technical points but elementary commercial factors. In this way the electrical industry in India will prosper to the advantage of both the mill-owner and British electrical manufacturers.

LOAD FACTOR, OUTPUT AND COST.

BY C. ASHMORE BAKER, A.M.I.E.E.

(*Continued from page 777.*)

A STUDY of the various items which go to make up the total cost of production indicates that the variations from the mean are frequently so great as to render superfluous any closer approximation than a straight line law connecting the logs of load factor output and cost. In the matters of total working expenses and average price charged, however, the extremes do not vary to such a wide extent from the means, and the author has been tempted in the case of these items to push the approximation a stage further.

If we divide our undertakings into three groups, namely :—

(*a*) Those whose load factors are less than 16 per cent.

(*b*) Those whose load factors are 16 per cent. or under 20 per cent., and

(*c*) Those whose load factors are 20 per cent. or over.

And if for each of these groups we find and plot the K.E. relation as already described, we shall obtain the three dark lines A, B and C, fig. 5. It will be observed that if these lines were projected towards the right they would cross, which means (if the logs of K and E were actually related by a straight-line law) that for very large values of K the cost per unit for high load factors would be greater than the cost per unit for low load factors, which is obviously absurd. It is probable, therefore, that instead of being a straight line, the graphic relation between log E and log K is a curve slightly sagging downwards.

If we work out the relation between log log K and log log E for the group of larger towns, as before, we obtain the relation :—

$$\log\log \epsilon = \cdot 347 - (\log\log K \times 0{\cdot}711) \quad \ldots \quad (5)$$

where ϵ is the value of E, corresponding with the mean value of λ for the undertakings in question.

Taking as correct the equation connecting λ and ρ already obtained, namely, equation (3), where $\rho = 11{\cdot}8/\lambda\ 0{\cdot}831$, E becomes

$$\rho\ \lambda\ \epsilon \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

Similarly for the relation between output, load factor and price :—

$$\log\log p = 0{\cdot}289 - (\log\log K \times 1{\cdot}75) \quad \ldots \quad (7)$$

where p = the average price corresponding with the mean value of λ for the undertakings in question.

$$\text{In this case } \log \rho = 1{\cdot}34 - (\log \lambda \times 1{\cdot}027) \ldots \quad (8)$$

so that the average price charged per unit (of total supply) =

$$P = p \times 21{\cdot}6/\lambda\ 1{\cdot}027 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

Diagram 6 has been prepared from equation 6. The dotted curve in fig. 3 is also derived from equation 6, the full curve being worked out from equation 4 ; in these two curves the mean variation of λ with K has been taken into account as satisfying the equation $\lambda = 9 \times K^{0\cdot096}$.

Fig. 6 should be useful in enabling fairly accurate comparisons to be made between undertakings having wide differences in output and load factor.

The usual method of taking into account the influence of load factor consists in dividing the total cost of production into "standing" and "running" charges. From the foregoing equations or from their corresponding diagrams we can ascertain what should be the average working cost for a station of any size and for any load factor under any heading.

Fig. 7 gives a series of curves so calculated for the item E, "total working expenses" for undertakings of various sizes. The equivalents of these curves in practice are usually taken to be straight lines, and they probably would be approximately such for any given undertaking.

It will be noticed that for values of λ above 10 per cent., they are very flat, and might, between reasonable limits, be replaced by straight lines without serious error. Straight lines have, in fact, been drawn through points calculated to cut the curves at the ordinates representing λ = 10 per cent. and 30 per cent. respectively. These lines projected back to zero will give us fairly closely the respective standing and running components of working cost for undertakings of the sizes they represent.

The point of intersection with the zero ordinate is the total standing cost per kilowatt exclusive of capital charges, and the slope of the line (that is, the difference between the standing and the total cost at any point divided by the number of units corresponding to the load factor for that point) represents the additional running cost per unit.

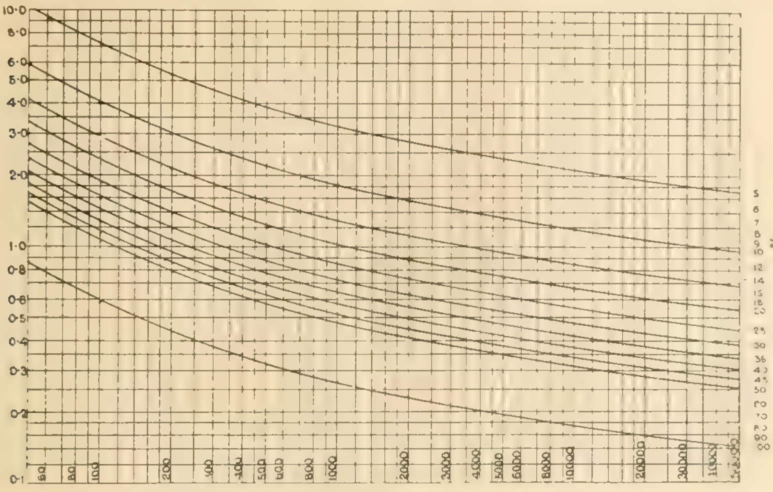

FIG. 6.—TOTAL WORKING EXPENSES PER UNIT SOLD.

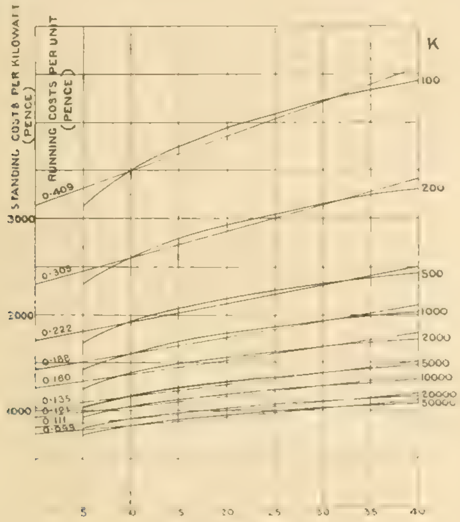

FIG. 7.

It will be noticed that both the standing costs per kilowatt and the running costs per unit vary with the maximum load. These variations are shown in fig. 8, in which the lower curve represents running costs per unit and refers to the left-hand scale. It will be noticed that even in quite small undertakings the running cost should not exceed one-third of a penny per unit. The middle curve represents standing charges in pounds per kilowatt per annum, and refers to the right-hand scale. The upper scale represents the lower curve plus interest and sinking fund at 7½ per cent. on the capital expenditure calculated from curve A, fig. 12.

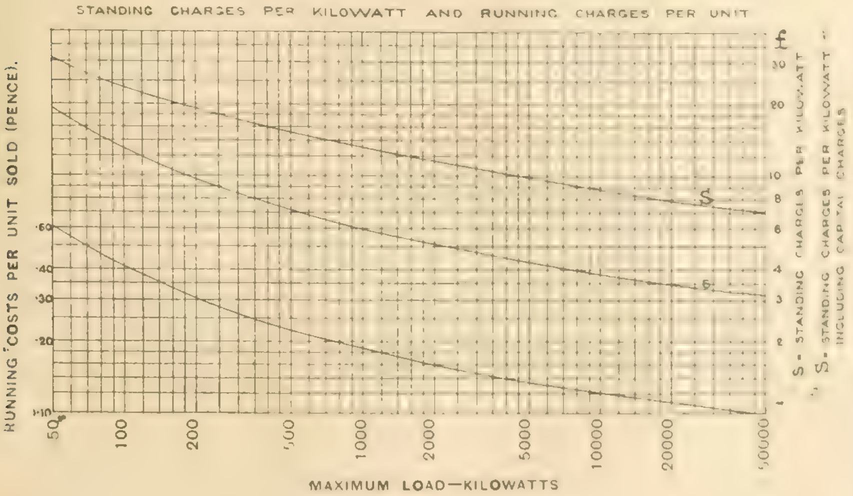

FIG. 8.

USE OF THE EQUATIONS IN PRACTICE. INFLUENCE OF LOCALITY.

With a view to applying the standard of comparison afforded by the foregoing equations to various classes of undertakings for the purpose of ascertaining the influence of locality on the cost of production, I have divided the municipal undertakings hitherto considered as a single class into three separate classes, namely :—

(*a*) 31 Undertakings situated within the area known as Greater London, and as defined by the Metropolitan Police area.

(*b*) 71 Undertakings situated in or near the various coalfields.

(*c*) 105 Undertakings situated in other provincial towns scattered throughout the British Isles.

The method of comparison is as follows :—

For each class separately an equation was determined connecting the maximum load K with the various items of cost. The relation between K and λ for the class was also determined (fig. 9).

Thus it was possible to plot for each class of undertaking a curve correlating K and each item of cost, and on the same diagram to plot the corresponding standard curve for the same ranges of K and λ.

Here then we have a direct means of comparison size for size, and load factor for load factor, of our three classes of undertaking, with the general averages for municipalities throughout the country.

Taking first the London group, we might reasonably expect to find higher working costs under every head of expenditure.

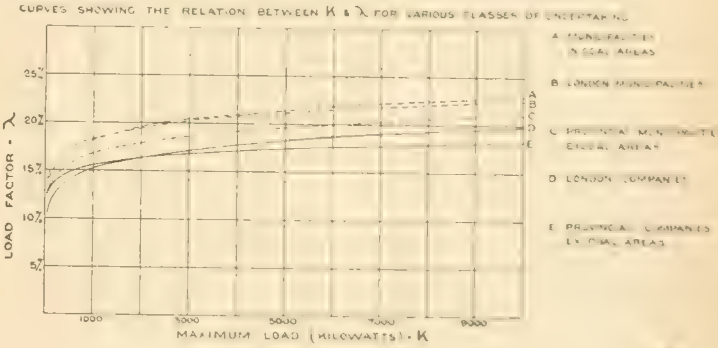

FIG. 9.

This, however, is noticeably true only for the items "Fuel" and "Management" (which are about 25 per cent. and 50 per cent. respectively in excess of the standard), and "Rent, rates and taxes," of which more hereafter.

The other items are in fairly close agreement with the standard curves.

In fig. 10 is given the diagram comparing the total working costs for London municipalities with the standards, the former being shown in full and the latter in dotted lines.

As regards the coal area towns it is not an easy matter without a personal knowledge of each town to decide whether it should be considered as being in a coal area or not, and my classification must, therefore, be considered as purely arbitrary. An interesting hint is given us in fig. 11 however.

Here it will be seen that, although the coal cost per unit is considerably lower than the general average for the smaller undertakings, this advantage vanishes when we come to the larger towns, Manchester, Glasgow, Birmingham, &c., from which we may conclude that if we want to obtain the full benefit of cheap coal our power houses must be situated above the workings, not merely among them.

Even a short railway journey such as that from the mining suburb into the big town puts up the cost of fuel considerably.

Except as regards the rates and taxes, the remaining items of cost, contrary to commonly held ideas on the subject, do not show any marked divergence from the normal. Generally speaking, they are somewhat lower, owing doubtless to the somewhat lower cost and lower standard of living in coal areas, particularly in the smaller towns.

With regard to the curves for the ordinary provincial towns, little need be said except that they are, as was to be expected, markedly similar to the general average.

The curves relating to "rent, rates and taxes" for the various groups of local authorities, as also for those of companies, are marked chiefly by anomaly.

Thus in the case of London local authorities the rate per unit under this head increases as the load increases, and therefore as the average price charged decreases. In the case of the coal area towns also this is true, but to a less extent. In the case of the ordinary provincial municipalities this item decreases with increased load and with the average price charged. In the case of companies working in ordinary provincial towns the rent, rates and taxes item also decreases with the average price, but to a greater extent than in the case of the corresponding municipalities, so that the average charge under this head is in this case *less* for the companies than for local authorities.

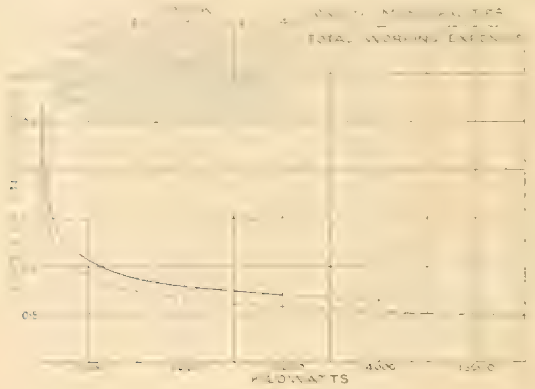

FIG. 10.

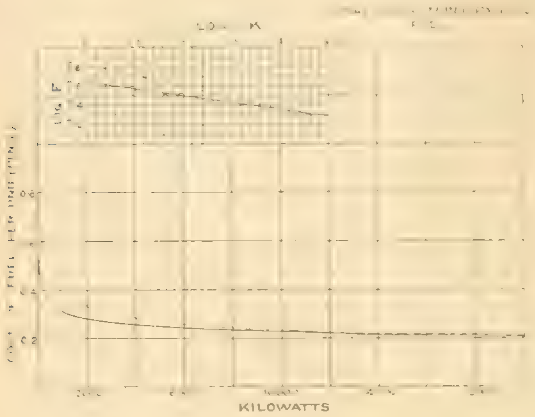

FIG. 11.

With London companies again the "rates, &c." per unit rise with the size of the undertaking as in the case of the municipalities, but the average cost per unit to companies is nearly double that paid by London municipalities.

The whole question is in fact extremely complicated and interesting, and well worth further study, but whether this investigation is properly the function of engineering science or that of the Society for Psychical Research, I do not as yet feel competent to express an opinion.

(*To be continued.*)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electrical Tide Gauge.

MESSRS. GENT & CO., LTD., of Faraday Works, Leicester, have recently completed an interesting application of their water level indicating apparatus for the purpose of registering the state of tide during the night, in conjunction with certain dredging operations now being undertaken by Messrs. Topham Jones and Railton.

The apparatus, which is fixed on a timber dolphin about half a mile from the shore, consists of a 25-volt Walker Horrocks automatic electric lighting plant driven by a petrol engine, and having accumulators of 240 ampere-hour capacity for supplying the current to five differently coloured Anchor type lamps.

The mechanism, which is operated by a float fixed in a standpipe under the dolphin, consists of a number of switches operated by a lever which is geared to a chain connected with the float, and as the tide rises and falls every 6 in. difference in level causes the switches to operate, and cut in different groups of lamps in accordance with a prearranged code. Different combinations of red, green and white lamps indicate differences in level from zero to 19 ft. 6 in., and with a spring tide the change of lights takes place approximately every five minutes.

The plant is entirely automatic in working, being self-starting self-regulating, and self-stopping; occasional oiling and replenishing of fuel only are required. If the engine fails to start, a warning is given by a red light at the side of the engine-house, but the cells will supply light for about four days after this warning has been given. A time switch is used in the circuit to cut off the current during the day time.

Railway Carriage Lighting.

In view of the great amount of attention that the subject of the correct illumination of railway carriages has recently been receiving at the hands of the illuminating engineers of railway companies and others, the accompanying illustration is of interest.

This railway carriage is one of a large number built by the Metropolitan Carriage, Wagon and Finance Co., Ltd., at Saltley, Birmingham, for the Central Argentine Railway. The overall dimensions of the carriage are approximately 66 ft. × 9 ft. It is divided into two compartments, each 25 ft. × 9 ft., and in each compartment are installed four 12-in. Holophane Reflector bowls (each equipped with two 40-watt lamps) down the centre of the coach, whilst on either side there are four Holophane Pines, No. 3,150, with 40-watt lamps.

HOLOPHANE LIGHTING IN A RAILWAY CARRIAGE.

The power provided in this case is very liberal, enabling an illumination intensity of 6 ft.-candles to be obtained uniformly over the whole reading plane. Notwithstanding that the illumination intensity is so high, excellent diffusion and evenness are obtained from the use of the Holophane glassware, whilst glare and shadows are obviated. The carriage has a lively and pleasing appearance when illuminated, and the handsome furnishings are shown up to advantage.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Cab Signalling.

I notice in your issue of May 21st an article by Mr. W. H. Dammond, of Nottingham, with reference to "cab signalling." He still calls the Railophone a "toy," and adds that it is a "very frivolous waste of time" to test a toy.

Mr. Dammond reminds me of a child whose toy is always better than anybody else's, and who never gives credit to the work involved in designing toys. He condemns the Railophone without knowing anything about it, and judges in a very autocratic manner what is right and what is wrong. After he has run everything down in a wholesale fashion, he thinks it fitting to ask Mr. Acfield to explain some important details of the Railophone. Then, before finishing his illogical outburst, he groups the wireless inductive (Faradic) system of the Railophone with the radio-active (Hertzian) wave system, and declares them both "decidedly wrong." I do not think he would know the real difference between these two systems, and so he comes to the following conclusion :—"The wireless impulse tries as hard to go to the wrong locomotive as it does to go to the right one, but the same is not true with the ramp system."

I agree with him as far as a purely wireless or Hertzian system and his ramp are concerned, especially when a ramp is bodily torn up by a passing train, as happened last year, when the ramp made no attempt to go to a wrong train.

I do, however, not at all agree with him about his argument, viz., that the same happens with the Railophone. First of all, the Railophone is a true positive safety system and the ramp is the reverse. Secondly, with the Railophone, continuous control of the trains is assured and a positive clear signal is obtained on the train, which, by the arrangement of the primary circuit, is converted into a positive danger signal. Those who have studied the inductive researches and tests I have carried out, and all those who are conversant with the laws of induction, know that the governing factor of a Railophone plant is the "mutual" induction between the two circuits. Such mutual induction depends on the dispositions and dimensions of the primary or stationary circuit, both being of a rectangular shape and parallel. Now in the calculation of a mutual inductance, the net inductive force creating a current in the secondary depends on the logarithmic value of the respective distances between the limbs of the primary and the secondary circuits.

Such value in a Railophone plant of correct design is the $\log_{10} 2$, so that we can write:—

$$M = k \times \log_{10} 2$$

for the safety zones, and :—

$$M = k \times \log_{10} 1$$

for the danger zones.

As $\log_{10} 1 = 0$, we have proof of the soundness of a Railophonic induction plant.

I may mention for the information of your readers, that with a Railophone plant the value for the constant k is approximately $k = \cdot000555$.

As, I believe, I have previously promised you to furnish the technical Press with all the details of my research work, now extending over five years, I shall be pleased to give your readers full particulars and diagrams, as soon as time and circumstances permit, and if the railway companies desire me to do so.

In the meantime, I am glad to have succeeded in amusing Mr. Dammond with the "Toy on the Midland."

H. V. Kramer.

Edgbaston, *May 25th*, 1915.

About a year ago I was in a signal-box at a place near Orleans, where a wreck like the one at Gretna cannot occur; but, of course, such dangerous and primitive makeshifts as lever collars are not relied upon for safety there.

Elsewhere in France and at thousands of places in the United States and Canada I have seen at work what I saw near Orleans, viz., electrical apparatus which yields a far higher degree of safety than can possibly be attained by such a crude mechanical device as a lever collar.

If a signalman is to blame for not making the prescribed use of a device that no railway ought to be allowed to employ, then the Board of Trade is even more culpable for sanctioning the employment of such a death-dealing anachronism. One engineering expert has rightly said: "The lever collar is merely a patch on the signalling system." He would have been justified in adding that it is a patch which obscures the dangers of, but does not mend, a system that is thoroughly bad.

The assertion that "it will be a long time before the signalman can be replaced, even to a limited extent" is one that ceased to be true at least a quarter of a century ago. On more than 25,000 miles of steam railway track, the signalman has been completely replaced in the matter of guarding against wrecks like that at Gretna; and on more than 10 per cent. of this mileage his elimination from this matter was effected as long as 10 years ago. Electrical equipment has relieved the signalman of cares which cannot safely or justly devolve upon the "human element"; and, as a result, the signalman has, in these cases, been free to concentrate his attention on those responsibilities with which he can legitimately be charged. On all this vast mileage, the extinction of wrecks of the Gretna species has synchronised with this "replacing" of the signalman.

Every mile of English high-speed express routes ought to have been track-circuited at least 10 years ago. That this has not been done is a matter for which the Board of Trade deserves the severest kind of condemnation. One does not need to go farther back than Colchester to find a Board of Trade Inspector actually sanctioning the employment of lever collars. If the Board's inspectors had, during all these years, been performing their duty of making proper preventive recommendations and of condemning dangerous signalling methods, it is quite certain that such primitive and clumsy death-traps as lever collars, release keys for block instruments, and the rotary lock-and-block, would have disappeared from British railways, and that electrical methods of proved efficiency would be universal thereon. In that case the worst collision in British history would have been prevented.

During the last six years fatal wrecks of the Gretna class have been second in number only to those of the Aisgill species. The existence of a preventive for wrecks of each kind has been well known, for 30 years as to the former and for four years as to the latter kind, both preventives being electrical. These expedients are the track circuit for the Gretna class, and visual and audible three-indication cab signals of the ramp type for the Aisgill class. In the last six years the Board of Trade Inspectors have occasionally made proper preventive recommendations as to the former, but have not once done so regarding the latter class of fatal railway wrecks.

Wm. H. Dammond.

Nottingham, *May 30th*, 1915.

Karachi (India) Tramways (Petrol).

With regard to the reference made in a recent issue of the Electrical Review to the Karachi tramway extensions, I should like to point out that the Karachi tramways, which belong to my company, though serving a population of over 140,000, are not an "electric" undertaking, but are entirely operated by "Simplex" self-contained petrol cars.

The extensions now under construction are to provide a tramway service to the new Goa-Portuguese settlements known as Cincinatus Town, and will be worked by self-propelled cars similar to those on the other parts of our system. In fact, were it not for this economic type of traction requiring but a small capital outlay compared with electric installations, it would not have been possible for the company to have entertained these extensions, going, as they do, to a sparsely-populated, but growing, district.

Geo. Gale,

Secretary, [illegible]

London, E.C., *May 29th*, 1915.

LEGAL.

Merchandise Marks Act Prosecution.

At the Mansion House Police Court, on the 27th ult., the British Thomson-Houston Co., Ltd., of Mazda House, E.C., were summoned before Ald. Sir John Knill, for unlawfully applying and selling an electrophone to which a false trade description had been applied, in contravention of the Merchandise Marks Act, 1887. Mr. J. Hunter Gray appeared for the company, who pleaded not guilty to the summonses.

Mr. Bodkin, who prosecuted, said the proceedings were at the instance of a Mr. Hammer, the owner of certain patents and registered designs in connection with electrophones, a contrivance which by the aid of an electric battery would help deaf people to hear. Mr. Hammer, counsel went on to say, was connected in 1912 and 1913 with a London company for representing an American company called the Stolz Electrophone Co., of Chicago, and being connected with that company and the owner of patents, an arrangement was come to between that company and the British Thomson-Houston Co., Ltd., to manufacture electrophones according to a description of patent of which Mr. Hammer was the owner. After much correspondence, an order was placed with the British Thomson-Houston Co. to manufacture a large number of electrophones for the Stolz London company, the former company taking a collateral guarantee for payment. Four thousand electrophones were to be manufactured. A sample instrument was submitted for the approval of the patentee, and the order was to be executed according to this model, by the defendant company. For the purpose of turning out these instruments a large quantity of tools of a special kind had to be made by the defendants. From the correspondence it appeared, said Mr. Bodkin, that the goods were not to be manufactured at the company's works at Rugby, but were to be made in Berlin.

Mr. Gray: I object to this. The company never had works at Berlin.

Mr. Bodkin: I am only speaking from my instructions, and I have here a letter in which occurs the sentence, "We will write from our Berlin factory, &c."

Mr. Gray: That is wrong. We have no Berlin factory. I have not seen that letter.

Mr. Bodkin: This is only one of several letters which confirm the same thing. In the correspondence, Mr. Bodkin said, a question was raised as to how these goods, manufactured, as it was understood, in Berlin, ought to be marked in order to comply with the Merchandise Marks Act, for there would be a breach of that statute if they were marked "Made in London," when in fact they were manufactured abroad. In order to conform to the law, the words "Made in Germany" were stamped upon the completed articles supplied by the defendant company. These instruments embodied [illegible] was necessary, in order to preserve the rights of the owner of the designs, to stamp the articles with a registered number. With regard to the 4,000 order the Stolz London company went into liquidation, and the guarantee for the payment to the defendant company for the instruments by Mr. Holt became worthless. The result was that the defendants having manufactured a good number of [illegible] Germany," they had [illegible] payment was not made, which Mr. Hammer gave, was that the articles, between 150 and 200 of the first consignment sent, were not in accordance with the Merchandise Marks Act as regarded the mark applied to them. Mr. Bodkin, in explanation, produced an electrophone in Court for the inspection of the magistrate. On the top of the transmitter, he pointed out, there was a sort of metal loop, adapted to hook on to the coat of a person using the instrument. This was screwed to the back of the instrument [illegible] prevent any meddling and putting the instrument out of gear. It was contended on the part of the prosecution that, as this metal hook covered up the words "Made in Germany," this article was not marked in accordance with the Act. This covering up of the words mentioned was the reason for the refusal to pay for goods manufactured in this way. On the back of the instrument there was a line which read, "Registered design, No. ——," but, said Mr. Bodkin, the instrument could not be possibly defined, because the registered number had been deliberately defaced; while on those goods supplied by the defendants on which the words "Made in Germany" were concealed, the registered number was plainly visible. The Stolz London company having gone into liquidation, and the order for the manufacture of these instruments having come to an end, Mr. Hammer eventually discovered that the defendants were selling electrophones of the British Thomson-Houston Co., and for the purpose of ascertaining what sort of instrument it was that they were selling, Mr. Peters, clerk in the office of the solicitors prosecuting, purchased one. On the front the name Stolz was omitted; on the back a metal hook covered up the words "Made in Germany," and the number had been defaced. Upon examination, Mr. Hammer found that the instrument was an exactly similar thing to his own patent, and accordingly the present proceedings were brought. In November last defendant company sent out a circular, headed "The British Thomson-Houston Electrophone," and represented to the public that they had produced a reliable instrument with all the latest improvements embodied in it. It did not convey, said Mr. Bodkin, that these goods were the subject of another person's patent. It was suggested that this company, in order not to suffer a bad debt, had adopted this registered design and patent as their own, and had advertised the sale of the instrument, as if they were the owners of it. On no part of the instrument purchased appeared the description British-Thomson Houston Co., as the manufacturers, but there was the name on the original goods, and also a serial number indicating that they were the manufacturers. This, however, was obliterated in respect of the goods the defendants were advertising for sale. Evidence was called in support of the summons, and the further hearing was adjourned.

INSTITUTION OF ELECTRICAL ENGINEERS.

The annual general meeting was held on Thursday last week. The President, Sir John Snell, referring to the result of the ballot for members of Council, expressed a wish that the members themselves would nominate candidates in addition to the names suggested by the Council, so that that body should be made as thoroughly representative as possible. In connection with the work done for the War Office in selecting men for commissions in the Army, he stated that not one of the nominations the Institution had made had been turned down; and some of the officers had already received promotion. The President drew attention to the paragraph in the Report which related to the formation of a special Committee, and remarking that the Council had been criticised for its inability to take effective action in industrial matters, he pointed out that the British Electrical and Allied Manufacturers' Association had been consulted, and fully concurred in the decision arrived at, that nothing could be done to foster British trade during the war; things would solve themselves in due course. In the matter of the duration of loans for engineering works, the President was associated with the Presidents of the Institutions of Civil and Mechanical Engineers in making representations to the Local Government Board. He made a strong appeal to the members to support their Benevolent Fund, on which calls were certain to be made as the outcome of the war.

On the motion that the Report be adopted, Mr. Ll. B. Atkinson asked that the names of members of I.E E. Committees should be published, and suggested that the Benevolent Fund, which was quite unworthy of that Institution, had not been brought before the notice of the members as it should have been.

Mr. W. M. Mordey said that the contributions to the Fund amounted to an average of only 6d. a member; it was urgently necessary that the fund should be increased, and he thought that large numbers of small contributions were especially desirable. Mr. Rawlings agreed, suggesting a maximum of 5s., and Mr. Raphael proposed that a large committee should be formed, to invite contributions from friends and from manufacturing firms.

Replying to these and other points that were raised, the President said they would receive careful consideration. The reduction of membership was partly due to the examinations, but the class of candidate that was coming forward was distinctly higher than formerly. Part of the reduction was the result of the troubled times they were passing through.

Introducing the Statement of Accounts, the hon. treasurer, Mr. Robt. Hammond, said that with the reduced membership they had to record a reduced net income—£1,200 less than last year: but the latter was an abnormal year. The assets at cost were £114,929, and their liabilities £43,359, leaving a margin of £71,569, which showed an improvement of £2,046.

The Report and Accounts were adopted *nem. con.*, and the usual votes of thanks to the hon. solicitors and the hon. auditors were recorded.

The ballot for five "ordinary members of Council" resulted in the election of Prof. T. Mather and Messrs. W. A. Chamen, H. Dickinson, H. F. Proctor and G. S Ram. The remaining vacancies were filled as shown in the Electrical Review, of April 2nd, page 477.

NEW PATENTS APPLIED FOR, 1915.

NOT YET PUBLISHED.

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

7,358. "R[illegible]." Ges. f. Drahtl. Telegraphie m.b.H. May 17th. (Addition to 7,342/15.) (Convention date, May 30th, 1914, Germany.) (Complete.)

7,366. "Electric transmission for automobile vehicles." Daimler Co., Ltd., F. W. Lanchester & A. E. W. [illegible]. May 17th.

7,367. "Wireless signalling systems." British Thomson-Houston Co., Ltd. May 17th. (General Electric Co., United States.)

7,373. "Sound-receiver for thermic telephones." Naamlooze Vennootschap [illegible]. May 17th. (Convention date, April 16th, 1915, Germany.) (Complete.)

7,374. "[illegible]." [illegible]. May 17th. (Convention date, May 15th, 1914, United States.) (Complete.)

7,443. "[illegible]." [illegible]. May 18th.

7,467. "[illegible]." [illegible]. May 18th. [illegible]

7,481. "M[illegible]." [illegible] Wall. May 19th.

7,486. "[illegible]." [illegible]. May 19th.

7,492. "Electric soldering-irons." M. J. Railing & H. Ide. May 19th.

7,498. "[illegible]." H. S[illegible]. May 19th.

7,510. "Devices for adjustably suspending electric and other lamps, electroliers, gas pendants, and other articles." W. H. Sturge. May 19th. (Complete.)

7,517. "[illegible]." [illegible]. May 19th.

7,522. "Insulated materials applicable to articles of wearing-apparel." W. J. B. Westlake. May 19th.

7,546. "Electric accumulators or storage batteries for use in electric battery lamps." S. D. Smith. May 19th.

7,554. "Combined electric switches and plugs." A. H. Railing, C. C. Garrard & A. E. S[illegible]. May 20th.

7,574. "Electrical switches." L. Cadenel. May 20th. (Addition to 7151/15.) (Complete.)

7,575. "Liquid [illegible]." British Westinghouse Electric & Manufacturing Co., Ltd. May 20th. (Convention date, [illegible], 1914, United States.) (Complete.)

7,576. "[illegible]." [illegible]. May 20th.

7,584. "Apparatus for or relative to receiving, transmitting, and recording vibrations." E. Roe. May 20th.

7,607. "Armouring for simple-core electric cables for alternating currents." A. Rosselli. May 20th. (Complete.)

7,622. "Electric lamps as applied for advertising purposes." W. C. Jeans & Jeans, Ltd. May 21st.

7,638. "Control of electric motors." C. F. Brindley. May 21st.

7,641. "Means for maintaining uniformity of speed of a series of co-related motors." J. R. Happer. May 21st.

7,647. "Junction boxes and the like for electric wiring installations." G. S. Boothroyd & Callender's Cable & Construction Co., Ltd. May 21st.

7,661. "Fuse length indicators." G. E. Mappin. May 21st.

7,673. "Electric torch and compass in a stick or umbrella or the like." K. S. [illegible]. May 21st.

7,675. "Manufacture of electric cables." W. F. Smith. May 22nd. (Convention date, May 23rd, 1914, United States.) (Complete.)

7,685. "Sparking-plug for internal-combustion engines." J. Knight & J. H. Foster. May 22nd.

7,704. "Telephone systems." Relay Automatic Telephone Co., Ltd. & [illegible]. May 22nd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1914.

5,294. Telegraphy. W. Judd, A. Fraser, R. I. Wood, & Eastern Telegraph Co. March 2nd. (Cognate application 20,274/14.)

7,298. Electric Lamp Sockets. R. B. Benjamin. March 23rd. (April 11th, 1913.)

10,822. Operations on Alternating-current Distributing Systems. A. G. Collis and Crompton & Co., Ltd. May 2nd.

10,872. Bearings or Wearing-surfaces. British Thomson-Houston Co. (General Electric Co.). May 2nd.

10,938. Electrical Control and Operation of Railway Points and the like. A. F. Alexander (Union Switch & Signal Co.). May 4th.

11,083. Transport of Electric Searchlights or Projectors. Soc. Anon. Des Automobiles & Cycles Peugeot. May 5th. (May 6th, 1913.)

11,116. Electrical Reactance Coils. P. [illegible]. May 5th.

11,399. Dynamo-electric Machines. Crompton & Co. & N. [illegible]. May 8th.

11,599. Portable Electric Safety Lamps for use in Mines or other places. L. [illegible]. May 11th.

12,189. Means for Giving a Series of Electric Flashes of Light from a Bicycle or the like when in Motion. C. H. Hulbert. May 18th.

12,913. Electric Impulse Producing Mechanisms. J. A. Kropp. May 26th. (July 29th, 1913.)

13,538. Electric Welding and Fusion Deposition of Metals. A. P. S[illegible]. June 3rd.

13,706. Centrifugal Governors for Internal-combustion Engines of Vehicles having Electric Power Transmission Mechanism. Geb. Sulzer (firm of). June 5th. (September 16th, 1913.)

14,159. Electric Fuses. A. H. Railing & C. C. Garrard. June 12th.

14,861. Manufacture and Construction of Commutators for Dynamo-electric Machines. A. H. Midgley & C. A. Vandervell. June 20th.

16,363. Electric Lamp Holders or other Coupling Members. G. St. J. D[illegible]. [illegible]

16,703. Secondary Galvanic Batteries. O. O. [illegible]. July 10th.

17,396. Gas Valves and Electric Switches. A. E. [illegible]. July 22nd.

19,147. Boxes or Containers for Electric Batteries chiefly designed for use on Automobile Vehicles and the like Positions. F. H. [illegible] & [illegible]. August 28th.

20,168. Electric Lighting and Battery Charging Systems for Automobiles and analogous purposes. F. G. Brettell (Apple Elecrtic Co.). September 25th. ([illegible] application on 10,251/14, April 25th.)

21,271. Electric Motor Control Systems. C. W. [illegible]. October 20th.

22,149. Magneto-electric Machines for Ignition Systems. C. L. Mason. November 6th. (November 6th, 1914.)

23,5[illegible]. Combined Incandescent Electric Lamp and Reflector. C. P. Lawson. December [illegible].

THE

ELECTRICAL REVIEW.

VOL. LXXVII. JUNE 11, 1915. No. 1,959.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: June 11, 1915. [No. 1,959.

Page
Increasing the Output ... 813
Electricity in Farming ... 814
Responsibilities of Directors ... 814
Copper ... 815
Copper Wire Manufacturers and the Contraband Problem ... 815
Men who Stay at Home ... 815
Battery-Bell Signalling Systems in Mines ... 816
Wireless Call Devices, by L. B. Turner (*illus.*) ... 817
Röntgen Society ... 818
A Glasgow Hospital (*illus.*) ... 819
Scientific and Technical Commissioners, by W. P. Digby ... 819
New Electrical Devices, Fittings and Plant (*illus.*) ... 820
War Items ... 821
Reviews ... 823
Legal ... 824
Business Notes ... 824
Notes ... 830
City Notes ... 833
Stocks and Shares ... 835
Electric Tramway and Railway Traffic Returns ... 835
Share List of Electrical Companies ... 836
Market Quotations ... 836
Electricity in Farming.—II. (*illus.*) ... 837
The New Turbine Plant of the Interborough Co., New York (*illus.*) ... 840
Load Factor, Output and Cost, by C. Ashmore Baker (*illus.*) (*concluded*) ... 841
Correspondence—
  Munitions of War ... 843
  Automatic-Lift Accidents ... 843
  Cable Shortage ... 843
  Appointments Vacant ... 843
  Cab Signalling ... 843
  Overseas Trade—Nothing Done ... 844
New Patents Applied for, 1915 ... 844
Abstracts of Published Specifications ... 844
Contractors' Column ... Advertisement page xviii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
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LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto I 307.
SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

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INCREASING THE OUTPUT.

FOR more than 20 years past the pages of our own and other journals concerned with engineering industry have published criticisms of the disposition of Labour to limit output. Organised Labour blatantly claimed the right to say how many hours' work a man should do in a day, to define when and where a particular class of worker should end his operations and another class begin, and to limit the efficiency of the individual worker and the capacity of the equipment with which he did his work. Employers fought such tendencies again and again and were attacked because they were Capitalists. That there were rights and wrongs on both sides we never failed to acknowledge, but we have unhesitatingly and consistently tried to show that the restrictive and limiting tendency was harmful to both Capital and Labour, and was altogether opposed to the best interest of British engineering industry.

At the time of the engineering strike of 1897 it was stated that funds which were raised to assist strikers and their families in their fight against British industrial leaders included subscriptions from Germany, whose manufacturers received contracts purely because closed English factories were unable to handle them. We have no desire at this date to set muddy water in motion, but we cannot help remembering such incidents when we observe the tendency that has been so often and so loudly denounced as hampering our great industries, singled out for attack by the Minister of Munitions, because in the present time of crisis it is imperative that we secure the maximum output of everything that is essential for the successful conduct of the war. Mr. Lloyd George addressing Manchester engineers last week said that Labour must be directed and controlled by the State to that one vital end. He showed that regulations, customs, and practices imposed by Unions in times of peace were utterly inapplicable and out of place in the terrible urgency of war. Objections to working more than so many hours per day, because "my Trade Union won't allow it": or to increasing output because "my Trade Union won't allow me to do more than my share"; or the refusal to work beside an untrained man because it is "against my Union's regulations"—objections which have hampered national industry for years—are not to be permitted to stand in the way in these days. The Minister of Munitions and the Coalition Government may have to use their powers under the Defence of the Realm Act if men are blind to the interests of the Empire, or are not prepared to meet willingly their obligations to those who are holding the seas or fighting in one of the many battlefields on which bloody slaughter is proceeding in combat with "the most formidable antagonist that ever attacked human liberties."

At the end of Mr. Lloyd George's speech, representatives of the Manchester Engineering Employers' Federation and of the Amalgamated Society of Engineers, declared the readiness of Lancashire engineering employers and Trade Unions alike to support in every possible way the great national effort to increase the production of war material. It seems inconceivable that when the issues involved are such as to make even the man in the street exclaim: "Victory or Death!" there should be any holding back of effort in the factory.

The fight has to be a fight to the finish, or we may lose all that we cherish or hold dear, all the freedom and honour and liberty that our fathers have struggled and fought for. But in order to render that freedom and liberty inviolable for the generations that follow, surely both masters and men will see the necessity for obedience to those who as our national leaders are striving so to organise our works and our labour that there may be no doubt about the ultimate issue.

Mr. Lloyd George said that if he could for a moment make everybody realise the great issues, and grasp the great dangers of the struggle in which we are engaged, there would be but one cry from every home to the Government:—"Convince yourself as to what action is necessary; take it boldly, and we will see you through."

In our old Labour controversies we heard and said much about "Common Interests." Here, if never before, we have "common interests" at stake, and a recognition of that serious truth peremptorily demands universal whole-hearted, self-sacrificing, co-operation.

Electricity in Farming.

Elsewhere in this issue we publish a short account of the steps which have been taken to supply farmers on the outskirts of the city of Hereford with electric light and power; this is the continuation of a general article on the subject of "Electricity in Farming," which commenced in our last issue.

Living for the most part remote from the electrically-developed town areas, and beyond those influences which tend to keep the town-dweller on the alert for something new, there is probably no class of our population less familiar with the economic value of electricity than the farmer class, and yet all the available evidence goes to show that when once he has made the plunge, the farmer, whether in this country or abroad, becomes an enthusiastic user of electricity for both power and lighting, and, incidentally, a consumer of much greater value than the average consumer in any town, unless it be an industrial centre

Unfortunately, this is not generally appreciated by our central-station engineers—on whom the task of influencing the farmer in things electrical must devolve—and there is therefore every chance of this valuable field for electrical development being neglected, unless those most concerned can be led to interest themselves in the subject.

The results obtained by Mr. Kerr at Hereford are so striking, and present such an object lesson to other central-station engineers within reach of the farming community, that they cannot be ignored by the latter; especially is this the case with the small undertaking, whose rate of progress has been mainly dependent on the almost microscopical growth of a country town.

In the Hereford area the average farm consumer is worth £20 per annum to the electricity department, while the average revenue per consumer from all consumers is between £8 and £9, a figure which probably represents a good average for a non-industrial community of 20-25,000 inhabitants. If a profit can be shown on the latter, it seems obvious that the farm consumer, who can be reached with overhead lines costing about £110 per mile, is a most attractive proposition to the supply engineer.

We have emphasised elsewhere the necessity of showing the farmer the real thing—nothing can take the place of a practical demonstration—and given a good prospective farming area, it would no doubt save time and trouble to come to some agreement with one farmer for the use of his farm for demonstration purposes for a year, possibly in return for a free supply of energy during that period.

This would enable the engineer to test the feeling of his immediate neighbourhood, and to obtain valuable data as to the probable nature of the load, and, no doubt, would assist him in formulating an efficient scheme of supply to commence with.

But this is a digression; the prime necessity of the moment is to bring home to our supply engineers and agriculturalists the mutual advantages of introducing electrical methods on the farm.

There are in the British Isles over 45 million acres of land under cultivation, giving employment to a bigger percentage of the population than any other industry; surely it cannot for a moment be contended that this important section of our national economy is beyond the pale in matters electrical.

With the experience gained under the varied conditions obtaining in half-a-dozen European countries, some of them intensively cultivated, and in the sparsely populated districts of Canada and the States, favourable to the development of electrical methods on the farm, there is every incentive for us seriously to grapple with the problem, which so directly concerns both the electric supply and manufacturing interests of this country.

Responsibilities of Directors.

We have had occasion more than once to advert to the responsibilities which attach to the position of director of a limited company. It is not for nothing that a man allows his name to appear on a prospectus. He is generally paid fees or he acquires certain other advantages for so doing; but it cannot be made too plain that his name is not put on a prospectus for amusement. The law is thus stated in Lord Halsbury's "Laws of England," Vol. V, p. 366: "Directors may incur liability to persons who subscribe for the company's shares or debentures in reliance upon a prospectus which contains material misrepresentations of fact," but "a director is not liable for untrue representations made to the shareholders if he honestly believes the representations to be true, and has reasonable grounds for his belief. Thus, where a company is formed to take over an existing business which turns out to be ruinous, the directors will not be responsible for making the purchase unless the ruinous nature of the business is obvious on the same principle that protects an agent purchasing by authority of his principal." The liability of directors is well illustrated by a case recently decided in the Court of Appeal—Adams *v.* Thrift and Others. The defendants were directors of the Stolz Electrophone Co. (1913), Ltd., a company formed (according to the prospectus) "to take over (*inter alia*) as a going concern the business of the Stolz Electrophone Co. (London), Ltd., and the old-established business of the Homer Earphone Co., of New York." The prospectus stated that the business of the American company had been of a highly remunerative character; that the turnover had increased from £11,923 9s. 5d. in 1910 to £32,615 13s. 3d. in 1913, and that the London company were operating 175 branches and agencies in various parts of the world. It was alleged by the statement of claim, and found as a fact by Mr. Justice Eve, that there was no such company as the Homer Earphone Co. in existence. The learned Judge found that although the defendants personally believed that the statements in the prospectus were true they had no reasonable ground for the belief. One of these directors appealed. As regarded him the Judge had found that, although he knew that the electrophone was not a mere quack affair, and though he had the prospectus signed by three colleagues, this did not afford him a reasonable ground for relief. In giving judgment dismissing the appeal, the Master of the Rolls pointed out that the appellant director "did not ask from any human being information about the particular statements which had been proved to be untrue. He said that the promoter had told him that it was all right. The promoter was the last person in the world whose uncorroborated statement ought to be relied on by an intending director as a justification for his belief in statements in a prospectus."

From the rarity of the reports of cases of this kind in recent years, it may be presumed that as a rule directors are more cautious than they used to be; but it is manifest that if the directors in the case above mentioned had made the most perfunctory inquiry they would probably have found that the company in question did not exist.

Copper.

There has been a strong and sustained upward movement in the copper market since last writing, and the ultimate limits of the rise have hardly yet been attained, for the demand reported by producers and dealers continues to expand in an alarming fashion, and it is doubtful whether the full increase in production now in progress in America will do more than afford modified relief to the situation. The statistical position is, of course, a matter of considerable anxiety. There is every belief felt that the stocks in the United States have dwindled down to bed-rock figures, but there are no details available. On the other hand, the last European statistics were not good, the stocks of standard copper having increased 5,000 tons during the month, the total stocks in England and France by over 4,000 tons, and the European visible supply by about 2,600 tons during May. This, however, had no damping effect upon sentiment, which, indeed, improves steadily under the rising tendency of the share markets in the United States, accompanied by a large buying on account of the enormous orders for munitions which continue to be placed. There is not the least chance of any cutting down of the war demand on the part of the Allied Governments for many months at the very least, and, indeed, there is talk in America of munition orders being booked into 1917-18. All this tends to check any enthusiasm which might otherwise be felt regarding the termination of hostilities, but it implies at the same time a huge destructive consumption of copper. Whether the world's mines can turn out sufficient material to satisfy the demands of the Allies is becoming open to doubt, while the fact that there are possibilities of serious friction between America and Germany, has induced the United States Government to assume a much more interested air regarding her supplies of munitions.

If the United States comes in as a buyer of copper on anything like the scale necessary to play any part of importance in a world-wide conflict, copper prices must inevitably advance further, and by leaps and bounds. There is not the least doubt that the United States domestic demands have undergone a very wide expansion, which may be only the forerunner of still greater calls made upon her reserves and resources. There has been much more speculative interest in the London market, a good proportion of which has emanated from America, and there should be no illusion as to the strength of the position in which producers now find themselves. They are sold very far ahead, and are in an entirely independent position. A distinct feature is the enormous premium which Lake Superior copper demands over electrolytic, and which arises from the fact that the Allied Governments are, in many cases, insisting upon the use of the former. It is doubtful whether any good purpose is served by this rigid adhesion to time-honoured precedent. Other nations can get along well enough with electrolytic, but in some matters ultra-conservatism is still worshipped here as a fetish. Meanwhile all indications appear to point to a steadily higher level of values, though no doubt with fluctuations in the standard market.

Copper Wire Manufacturers and the Contraband Problem.

In view of the satisfactory inquiries for copper goods, particularly for copper wire for electrical purposes, being daily received by British manufacturers from Germany's chief European markets in Holland, Sweden, Spain, &c., it is becoming a matter for complaint with manufacturers in this country that there are unnecessary precautions and protracted delays for which the War Trade Department of the Board of Trade is responsible. As every manufacturer of contraband goods is aware, the sanction of the War Trade officials has to be obtained before shipment can be made to most, if not all, of the neutral countries adjacent to the German Empire, Austria, &c., and while all business men have long since realised the necessity for some strict supervision from the proper source in preventing war material of any form from entering the territory of our enemies, many are of the opinion that the tedious and circumlocutory manner in which the War Trade officials have been dealing with the subject is unwarrantable, and as restrictive to legitimate trading as it is absurd in theory. The procedures that have to be gone through by manufacturers before sanction for shipment is obtained are thought to be, as a rule, most unnecessary.

Instances have been mentioned where delays of as long as six weeks and two months have occurred before sanction has been obtained to ship goods to countries like Spain and Sweden, and this only after having passed through procedures involving several communications with the War Trade authorities, application for references from the Minister for Foreign Affairs, sworn declaration from the consumer before a notary and legalised by the British Consul, further communications with the Customs authorities in England, and other formalities necessitating loss of valuable time and money.

Men Who Stay at Home.

While we have every sympathy with the movement which aims at getting increased efficiency as a consequence of reorganisation and industrial mobilisation, there is a danger that the enthusiasm of the newspaper Press in this connection may have some other consequences which are not so desirable. We must not forget that it has been laid down for us that our forces have to be mobilised for three purposes:—

(1) Military or naval service; (2) the production of munitions of war, directly and indirectly; (3) the maintenance of our export trade.

We are just a little afraid that in discussing (1) and (2), which are undoubtedly the more immediate necessities of the situation, there is a disposition with those who give little thought to the industrial and financial phases of the matter, to consider the third of the foregoing purposes as being of practically no importance. Now whatever our age or fitness, we are all more or less engaged in heart-searching, trying to discover what we can individually do to help bring the war to a conclusion —and quite right too! But there can be no question that for maintaining even our present reduced flow of exports, which on national financial grounds is shown to be so indispensable, we shall require at home many men who, because they are engaged in mere trade matters and apparently not helping in the conduct of the war, are restless and discontented and unhappy, wondering whether they ought not to throw up what they are engaged upon and do that vague something which they cannot discover. If the present movement organises essential forces and influences lusty youths and factory workers to "play the game" and "do their bit," it will have achieved its purpose, but let us not overlook the fact that there are hundreds, and perhaps thousands, of works which are not required for making war material, and hundreds of thousands of males and females whose services will not be immediately, and perhaps not at all, directly required for fighting or for war factory service. These can be utilised partly in connection with the maintenance of export manufacturing, but they will require suitable staffs and heads to guide and control them. We trust that before long the Government may be able to give us a more definite leading in this matter.

In the meantime, there must be many among our readers who, while they cannot now adopt the original cry of "Business as Usual," will conscientiously feel that, considered from the point of view of national trade and finance, they must for a good many hours of the working week continue to follow their ordinary industrial and trading avocations though they never handle a rifle or anything that has to do with shells.

BATTERY-BELL SIGNALLING SYSTEMS IN MINES.

Home Office Report on the Danger of Ignition of Firedamp-Air Mixtures.

It will be remembered that one of the possible causes of the disastrous explosion at Senghenydd Colliery on October 14th, 1913, put forward at the inquiry, was an electric spark from the signalling wires, and certain tests were made by Dr. Wheeler with the signal bell and battery to prove that a firedamp-air mixture could be ignited. The results of the experiments then made, however, were not conclusive, and Dr. Wheeler has made a further series of experiments at the Home Office experimental station at Eskmeals; his report on these tests has recently been issued.

In his report on the experiments on signalling apparatus carried out for the purposes of the Senghenydd inquiry, he showed that with three Dania cells giving a current (on closed circuit) of 0·45 ampere under a pressure (on open circuit) of 4·5 volts, it was possible by short-circuiting the current in the signal wires to give a signal to produce a spark which would explode a mixture of air and methane when methane was present to the extent of 8·2 per cent. This was certainly a very disturbing observation, and in view of the fact that a large proportion of the electrical signalling apparatus in use in coal mines is affected by this conclusion, the Secretary of State requested Dr. Wheeler to carry out further experiments with the object of "obtaining a system of bare wire signalling which would be free from the danger of ignition of firedamp-air mixtures by the flash produced on breaking circuit at the signal wires." In his present report Dr. Wheeler says: "This object has been attained, inasmuch as it has been found possible to determine with considerable accuracy the limits of voltage, current and self-inductance of an electric circuit, derived from the primary batteries, that can cause ignition of the most sensitive firedamp-air mixture by the flash obtained on breaking the circuit; and at the same time it has been found possible to construct a bell which, while conforming with the requirements of safety as indicated by these limits, gives an adequate signal."

In the previous experiments made with a bell of the pattern used at Senghenydd Colliery it was found that the most sensitive mixtures contained between 7·3 and 9·4 per cent. of methane, and this conclusion has been confirmed by the present series of experiments, which showed that the most sensitive mixtures contained between 7·5 and 9·0 per cent. of methane, the amount of current required for ignition of all mixtures lying between these percentages being practically the same, namely, about 0·2 ampere. With mixtures containing less than 7·5 or more than 9·0 per cent. of methane, the difficulty of ignition rapidly increases, more markedly as the higher limit of inflammability is approached. These limits are 5·6 (lower) and 14·8 (higher) per cent., and the mixture that has methane and oxygen in combining proportions, for complete combustion to form carbon dioxide and steam, contains 9·45 per cent. of methane. In these experiments artificially-prepared pure methane (99·8 per cent. methane) and pure air (containing 20·8 per cent. of oxygen) were used; but as firedamp often contains a considerable proportion of nitrogen, and the air of mines may contain less than 20 per cent. of oxygen, it seemed desirable to determine the ignitability of mixtures of methane and air to which nitrogen had been added. A mixture of oxygen and nitrogen containing 19 per cent. of oxygen was therefore prepared, and a series of determinations was made of the currents required for ignition of various mixtures of methane with this "atmosphere." The voltage of the current and the inductance of the circuit were the same as in the previous experiments, and the result showed that rather more current (about 0·22) was required—presumably because of the defect of oxygen—while the limits of inflammability were 5·8 (lower) and 12·5 per cent. (higher), and the mixture containing methane and oxygen in combining proportions contained 8·65 per cent. of methane.

Provided, therefore, circumstances were to arise whereby a mixture of firedamp and air of these proportions was present during signalling operations, with a current of 0·2 ampere passing, ignition of the gas would take place at the "break" of the circuit; though such circumstances are probably remote, they are very possible, and, consequently, exceedingly dangerous, and it becomes a strict duty of mine owners and managers to remove this danger as far as human agency permits.

The danger is the "break-flash," and the strength or intensity of this depends largely upon the self-induction of the coils forming the bell magnets; in order to determine the effect of such inductance in signalling circuits, "a number of inductances of known magnitudes were made, consisting of coils of silk-covered copper wire wound in layers on cores of wood, so as to be of constant value at all currents. These were introduced into the circuit from a battery of dry cells, and the current at 90, 60, 30, or 15 volts required for ignition of different mixtures of methane and air by the break-flash determined." The results obtained with current at 90 volts were as follows:—

Self-induction of circuit.	Current required for ignition.			
	6·0 per cent. methane.	7·0 per cent. methane.	7·5 per cent. methane.	8·0 per cent. methane.
0·00815 henry	1·52 amp.	1·18 amp.	1·05 amp.	0·94 amp.
0·03175 ,,	0·84 ,,	0·52 ,,	0·46 ,,	0·42 ,,
0·06350 ,,	0·50 ,,	0·32 ,,	0·28 ,,	0·26 ,,
0·09510 ,,	0·40 ,,	0·23 ,,	0·20 ,,	0·19 ,,

From this "it will be seen that the amount of current required for the ignition of any of the mixtures increases rapidly so soon as the self-induction of the circuit falls below about 0·03 henry. Results of the same order were obtained with current at 60, 30 and 15 volts."

Dr. Wheeler found that the amount of current in a circuit—as might be expected—was of far greater importance than the voltage as regards the igniting power of the flash produced on breaking the circuit, and especially with highly inductive circuits. Thus, an 8 per cent. methane-air mixture was ignited by the break-flash with a current of from 0·24 to 0·25 ampere, at any voltage between 10 and 30, the self-induction of the circuit being 0·095 henry. The results up to 90 volts were as follows:—

Voltage.	Current required for ignition (8 per cent. mixture).
10	0·25 ampere
12·5	0·245 ,,
15	0·24 ,,
30	0·24 ,,
60	0·22 ,,
90	0·19 ,,

At 90 volts, which is well above the arcing pressure, rather less current, it will be noticed, is required for ignition, but, on the other hand, if the current is only 0·18 ampere, "hundreds of break-flashes can be made in the mixture without causing its ignition, whereas with 0·19 ampere ignition occurs at the first break-flash."

Summarising then (*a*) the most readily ignitable mixtures of methane and air contain between 7·5 and 9 per cent. of methane, and the susceptibility to ignition by sparks of the firedamps of different mines varies with the proportions of nitrogen they contain as an impurity with the methane which is the main constituent; (*b*) the self-induction of the circuit is of prime importance in determining whether the break-flash can ignite an explosive mixture, and below about 0·03 henry the current required for ignition rapidly increases; and (*c*) an increase in the voltage from 10 to 30 volts does not materially alter the amount of current required to ignite a particular mixture, while, on the other hand, an increase in the current of 0·01 ampere is often sufficient to determine the ignition of a mixture.

The solution of the problem then is to reduce the self-induction of the magnet coils of the bell so as to render the intensity of the spark harmless in any mixture, and experiments were carried out with signal bells of different types with perfectly satisfactory results.

(*To be continued.*)

WIRELESS CALL DEVICES.

By L. B. TURNER, M.A., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Post Office Electrical Engineers, London Centre).

In submarine telegraphy moderate power is transmitted, and much less, but still moderate, power is received. In telephony the power transmitted is ordinarily a small fraction of a watt, and only about one ten-thousandth of this may be received at the other end. In wireless telegraphy, unhampered by the limitation of input imposed by the microphone, and with a receiver of extraordinary sensitiveness, the ratio between the power received and the power transmitted may reach a degree of smallness quite unapproached in telephony. The following table shows, in a rough illustrative fashion, the orders of magnitude of the power transmitted and received in the several systems named :—

	Watts transmitted.	Watts received.	Ratio
Submarine telegraph	1	$10^{-[illegible]}$	10[illegible]
Telephone	10^{-2}	10[illegible]	10[illegible]
Wireless telegraph	$10^{-[illegible]}$	10[illegible]	10[illegible]

The primary difficulty in devising an effective wireless-call apparatus is the extreme smallness of the power available; for, obviously, if the device is to be of the fullest service, the calling range must be as great as the signalling range.

A secondary difficulty is the avoidance of false calls, that is, calls actuated by foreign wireless stations discharging their ordinary traffic, or by atmospherics.

The problem is, therefore, in the main, to provide apparatus capable of responding noisily to such stimulus as may be got from an antenna fed with about one-hundredth of a microwatt, but which will not respond to stray disturbances.

Excluding the coherer from consideration, no wireless call apparatus has yet, so far as I am aware, been put into commercial operation.

The available energy is so small, that no relay of the make-and-break type with solid metallic local-circuit contacts could be constructed to give reliable service. The ingenious jet relay of Dr. A. Orling, already employed in submarine cable telegraphy, could, however, be used. In this instrument a coil is carried by vertical phosphor-bronze suspensions in the field of a powerful magnet, as in an ordinary D'Arsonval galvanometer. A fine quartz fibre, called the deflector, is stretched as a stiff radial arm attached to the coil. Above this fibre is a vertical glass jet, through the fine orifice of which protrudes a second quartz fibre bearing with a light lateral pressure on the horizontal fibre. A fine stream of acidulated water runs through the orifice of the jet and along the vertical quartz fibre. At the end of the vertical fibre, a little below the deflector, the stream either just hits or just misses one of two platinum plates, thereby either making or not making contact between it and an electrode immersed in the column of acid. A very slight motion of the deflector carried by the coil produces a much magnified displacement of the stream of liquid where it passes the electrode. I have seen such an instrument relay hand-speed signals of .37 microampere. The coil had a resistance of 500 ohms, so that this corresponds to a steady-current power of 7×10^{-11} watt.

Of the amplifier type there is a diversity of patterns. Probably the most familiar is Mr. S. G. Brown's telephone amplifier, capable of responding to currents of telephonic frequency.

Another highly sensitive amplifier is that due to Mr. E. S. Heurtley. This device depends on the change of resistance produced in hot, thin platinum wire, when it is slightly displaced across the edge of a blast of cold air.

When the amplifier is used for submarine telegraphy, good readable slip may be obtained at slow speed with a deflecting power of 6×10^{-10} watt in the coil. The power in the siphon recorder would then be about 5×10^{-7} watt, giving a multiplication of nearly 1,000.

In all the relays above mentioned the change in the local current is effected by the displacement of some comparatively massive body. In the kathode-ray amplifier of Von Lieben and Reiss the moving body is molecular, or, rather, corpuscular.*

The kathode-ray amplifier is likely to play a very important rôle in the future. It can deal with the smallest powers, introduces no perceptible distortion, and is available for amplifying fluctuations of any rapidity up to the frequencies used in wireless telegraphy. The Marconi Company have developed a modified form of the Lieben-Reiss amplifier, which plays an important part in their high-speed reception.

With the exception of the last, the foregoing relays or amplifiers have been D.C. or low frequency instruments, suitable for use after the high-frequency current has been rectified by a crystal or other detector.

Any one of these extra-sensitive relaying instruments might replace the telephone of an ordinary receiver, and so, in conjunction with other instruments, convert signals which would have been a faint buzzing in the telephone into the ringing of a bell. But whereas the listening operator attends only to a message preceded by a certain sequence of dots and dashes, his call signal, the bell would not exercise this discrimination. It is necessary, therefore, to arrange that a signal of some special character shall be used for calling, and that the device shall respond only to signals of this character. Although much may be effected by the ordinary tuning methods, a call device requires a greater selectivity than can be thus obtained.

A simple form of call signal is a long dash, and the receiver may be constructed so that it will respond only to a dash of not less than a certain minimum duration, which would, of course, be chosen longer than any dash likely to be made in transmitting messages. This principle has been utilised in the P.O., and could be applied to any of the quick-acting relays.

The musical-note transmitter, now so widely used, introduces the possibility of a second line of defence against interference, by making use of musical resonance. The antenna and coupled circuits are already tuned to the high frequency, say 10^5 to 10^6 periods per second, giving selection by wave-length syntony; and with a musical note the telephone or other apparatus may be tuned to the spark-frequency, say, 200 to 1,000 periods per second, giving selection by note syntony. The Telefunken amplifier is constructed to make use of note syntony. This instrument consists of a bank of microphonic contact relays, each similar in arrangement to the Brown amplifier with granule contacts. But whereas in the Brown amplifier the electro-mechanical connection between the armature and the circuit energising the magnets is as close as possible, and the armature has a natural frequency greatly exceeding the frequency of the currents to be amplified, in the Telefunken amplifier the armatures are relatively loosely related to the energising circuits, and the natural frequency of each armature is mechanically adjusted to be equal to the spark-frequency (500 periods per second). It is claimed that with a bank of three such tuned amplifiers in cascade very great magnification and selection can be obtained.

But whether the transmitter is a musical one or not, it is possible to effect a syntony somewhat analogous to note syntony by transmitting dashes at small regular intervals. A scheme for a distress call device, depending for its selectiveness on this principle, has been suggested by Mr. W. S. Peake in a recent patent specification.

The essential point of the device is that the vibration of an armature under a succession of impulses is built up gradually, as in all cases of resonance; that is, the effect of successive impulses is cumulative, as it designedly is not in a Brown amplifier, an oscillograph or a telephone used for speech. Peake employs a transmitter sending alternate dashes and spaces at a definite frequency (between 10 and 40 per second), and the armature of the receiver is mechanically tuned to this frequency, as in the Telefunken amplifier. When the amplitude has grown sufficiently, contact is made and a bell rings.

The arrangement is mainly of interest in that it provides a probably adequate selectiveness by the use of a quite practicable apparatus which could be added to an existing ordinary station. It embodies nothing new in principle, for the resonance relay is a well-known device; it was used in an attempt to provide a call device on the Preece induction telegraph connecting the Skerries with the mainland. I think it would fail on the score of insensitiveness.

One further potential wireless call apparatus is the Marconi Company's quite recently developed device for the remote control of fog-signalling apparatus. This constitutes, I think, the nearest approach that has been made to a practical call device which can be left to itself. The result has been achieved by reverting to the coherer, but in a specially reliable, and consequently insensitive, condition. The coherer controls a relay of conventional type, whose local circuit energises the magnets acting upon a pendulum of balance-wheel form. Dashes are sent at equal intervals (automatically) from the calling station, and at each dash the coherer coheres, the relay tongue flicks over, and an impulse is given to the balance-wheel. The balance wheel has been mechanically tuned to the frequency of the transmitted dashes, which are [illegible] second, its amplitude, therefore, [illegible] stimuli, until a [illegible] by the [illegible] cups, and the fog-gun is thereby switched on or off. Apart from malicious interference the selectivity here is as perfect as could be desired, for however strongly an interfering signal affects the coherer, its effect on the balance-wheel is the same. There are various [illegible] refinements in this apparatus, and it is stated to have [illegible] left absolutely unattended [illegible]. Its unsuitability for P.O. work lies chiefly in its insensitivity.

At the P.O. wireless stations for ship [illegible] watch is kept day and night, the operator [illegible] telephone constantly, and is always ready for a message addressed to him. A call device, howsoever devoid of limitations and objectionable features, would be of little service at any of these stations. There is, however, a [illegible] for wireless communication between the mainland and small outlying islands, or between the separate islands of a group. The department already has ten stations in use for this sort of communication, and with a suitable call device, or even without, these short-range land-to-land stations will probably become quite numerous. At the existing stations the practice is for one of the pair to call the other once an hour, or at other defined intervals; and seeing that the operator usually has also to attend to the land line, sell stamps, pay out old-age pensions, and perform other functions, precise punctuality cannot be expected. Consequently such a method of working causes a good deal of annoyance and wastes much time. Furthermore, in some instances that have arisen, it is desired, for life-saving purposes, to have the telegraph available day and night. For this class of work there is pressing and immediate need of a wireless call device.

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* This device was fully described in the Electrical Review of May 1st, 1914.—Eds.

Owing to the short range—maybe ten miles or so—over which these stations are required to work, difficulties from interference from ships are in many cases not very great. There is, however, one condition which must be satisfied in a call apparatus for this work, and it is a hard one to meet; the instruments must require no skilled attention from day to day.

The apparatus shown has been constructed with a view to meeting this quite specialised want of the department.

The principal features of the device are as follows:—At frequent pre-arranged times—four times an hour in this apparatus—the clock switches in a crystal receiver of ordinary character, except that an extremely sensitive D'Arsonval galvanometer replaces the usual telephone. The receiver remains in circuit for a brief period only—about ⅛-minute in this apparatus. If the key of the calling station is held depressed throughout this period, the needle of the galvanometer is deflected into position between the jaws of a hit-or-miss device actuated by a local current. When the needle is in its undeflected position, the closing of the jaws is without effect, for the jaws are slightly staggered, like those of a bulldog; but if the needle is in place between them, it is gripped by the jaws, a local circuit is closed, a continuous-ringing bell relay actuated, and the bell rings. Any atmospherics or signals, whether of the appropriate wave-length or any other, and of whatever strength, are without effect unless they occur during the brief period of activity of the receiver. The probability of damage to crystals and of false calls is, therefore, reduced by the agency of the clock-switch in the ratio of 15 minutes to one-third minute, *i.e.*, 120 times, whereas the delay to a telegram caused by this system of working cannot exceed ¼ hour.

Despite this safeguard, it must happen that the crystal will be "knocked off," in the wireless jargon, by atmospherics some time or other. A second line of defence is, therefore, prepared by the provision of two crystal detectors, which are used alternately. An instrument called, for lack of a better name, the mercury toppler, in addition to other duties, switches over after each period, so that the other crystal detector shall come into use at the next period. If, therefore, one of the detectors has been knocked off and a call is, in consequence, unsuccessful at one period, it can still be made a quarter of an hour later. Communication then being established, the failure would be reported to the defective station, and the faulty detector be replaced by the spare provided.

Except during the few seconds of activity, the detector is disconnected from the receiving circuit and short-circuited on itself, and is immune from any electrical damage.

The galvanometer is shunted so as to be dead-beat; when unshunted it has a period of about 15 seconds. As now set, the minimum deflection to make a call is about 5°, and this is produced by a current of 40^{-1} microampere; 20^{-1} microampere is considered a safe working current. The galvanometer is not harmfully affected by rapid vibrations.

In the absence of a suitable quick-acting relay of extreme sensitiveness, it is necessary to accumulate the energy of the received signal over some considerable time before a sufficiently energetic response can be produced. In the call device dealt with in the last section, the accumulation takes place during the several seconds in which a slowly moving galvanometer coil is gradually deflected. It is also possible to accumulate the energy in an oscillating body, provided that the signal is intermittent and synchronises with the oscillation. This method of working enjoys a certain selectiveness which is not inherent in the other; it is the method adopted in the Peake device.

Whether the accumulator of energy be an oscillatory one or not, it must be capable of continuing the accumulation over a sufficiently long period.

In the second call device exhibited, Peake's reed vibrating at (say) 25 periods per second is replaced by the coil of a galvanometer oscillating at 10^{-1} period per second, *i.e.*, 250 times slower. Consequently, if the decrements of the coil and reed were equal, signals would continue to add energy to the coil 250 times as long as to the reed. The gain in ability to accumulate energy from the signal is more or less proportional to the lengthening of the period of the oscillating system.

In this second call device, the galvanometer coil takes the place of the telephone in an ordinary receiver, and a swing is gradually built up from the sending station by keeping the key depressed during every alternate five seconds. Since the detector is always in circuit, a Fleming valve is used instead of a crystal, as the valve, though less efficient, is not liable to be knocked off by atmospherics.

The moving coil is cast with wax into smooth cylindrical form to reduce air friction. It has a resistance of nearly 6,000 ohms; is suspended by a stout phosphor-bronze strip, and has a radial arm or tongue of fine platinum wire free to move between two fixed vertical platinum wires. The galvanometer constitutes a microwatt relay. The moment of inertia of the moving system (viz., 9.8 $\text{gm.}-\text{cm.}^2$) has been adjusted to give a period of just 10 seconds.

The tongue is kept in mid-position between the side-contacts by the torque of the suspension balancing the torque due to the polarising current of the valve. This polarising current, which may be 10 or 20 times the current due to the signal, is largely affected by variation of the filament current; and as the filament takes about half an ampere, the current in it must appreciably fall as the battery discharges. This might be a serious difficulty, but by use of the circuits shown in fig. 1, a fall in filament current is made to compensate for itself by producing a suitable rise in the polarising P.D. This arrangement has proved remarkably successful. A variation of ± 10 per cent. in the filament current produces no perceptible deflection of the pointer; whereas without the balancing circuits + 10 per cent. rings the bell and − 10 per cent. nearly does so.

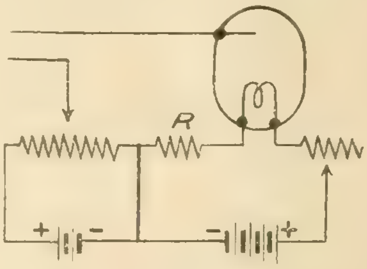


Fig. 1.

This call device possesses the merits of simplicity and robustness, and the present makeshift set will make a call with a signal of 0.063 microampere in about 2½ minutes, or with .14 microampere in about 1¼ minutes. The sensitivity could, I feel sure, be considerably improved. The objection to this device for P.O. short-range stations is that the valve has a continuous consumption of some 4 watts, which is a serious matter when dry cells supply the power. This objection might be overcome, and greater sensitiveness obtained by the use of a crystal detector, if a non-earthed antenna sufficiently free from atmospherics were employed.

RÖNTGEN SOCIETY.

At the meeting of the Röntgen Society on June 1st, the principal business was a discussion on the protection of the X-ray worker from the evil effects of the radiations with which he has to deal. The subject derived special importance, said the President, Sir A. P. Gould, in view of the extraordinary number of X-ray oufits which were being installed in military hospitals, both at home and abroad. These were often placed in charge of men having only scanty experience, who were called upon to work under circumstances of very great pressure, and the attention of manufacturers of X-ray apparatus and others should be called to the possibility of grave perils arising as a result of insufficiently protected equipments. Mr. Sidney Russ, D.Sc., said that he had been comparing the protective materials supplied with the installations of three manufacturers, who should be denominated X, Y, and Z. The lead rubber placed between the operator and the tube varied very greatly in different samples, as, for instance:—

	Thickness of lead rubber in mm.	Percentage of X-ray energy transmitted.
X	2·2	1·4
Y	1·54	4·9
"	3·07	1·1
Z	1·25	5·0
"	2·5	1·0
"	3·75	0·4
"	5·8	0·1

Lead glass, which was also used largely as a protective material, varied in a still more perplexing fashion, the absorptive power for the dangerous radiations bearing no relation to the thickness of the glass, but only to its density. Here, again, three manufacturers submitted samples, with the following result:—

	Thickness of lead glass in mm.	Percentage of X-ray energy transmitted.
X	3·63	2·9
Y	3·87	5·5
"	5·0	4·1
Z	3·25	4·3
"	3·65	3·4

As a dream of the future, Dr. Russ thought that before the radiologist began his work the atmosphere would be examined for ionised particles, just as drinking water had to be examined and sterilised. Mr. J. H. Gardiner, F.C.S., urged, with a view to guarding against secondary radiations, that X-ray tubes should be enclosed completely in a good thick case of thoroughly efficient and heavy lead glass. The protection of the tube in the plane of the anticathode was not sufficient, owing to the vagrant secondary radiations. The following resolution was carried: "That in view of the recent large increase in the number of X-ray installations, this Society considers it a matter of the greatest importance that the personal safety of the operators conducting the X-ray examinations should be secured by the universal adoption of stringent rules, and that the Council of the Society be requested to meet at an early date and take steps to secure this end."

At the annual business meeting, Mr. J. H. Gardiner was elected President, and Mr. W. Duddell a vice-president.

A GLASGOW HOSPITAL.

The Royal Hospital for Sick Children, Glasgow, which was opened by the King and Queen in July last year, is a large establishment equipped on the most modern lines, and possesses an exceptionally complete installation of electrical appliances. Electricity is supplied by the Glasgow Corporation Electricity Department, through duplicate cables to each of two main switchboards in the basement of the building; a duplicate supply is furnished to the operating theatre, under local control.

Artificial illumination is provided for by nearly 2,000 metallic-filament electric lamps. Thirteen lifts and the whole of the laundry, kitchen and other machinery are operated by electric motors, of which there are, in all, upwards of 40. Ventilation is effected entirely by electrically-driven fans. There is an extensive automatic intercommunication telephone system having 30 stations, in addition to the Post Office instruments, of which there are five with a central exchange.

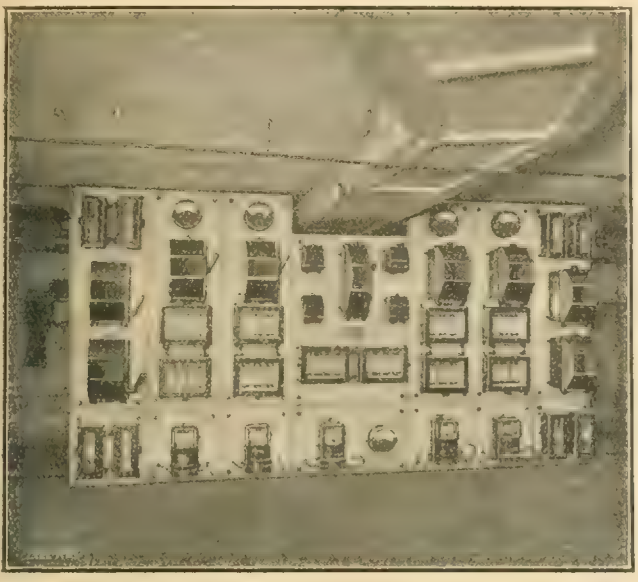


Fig. 1.—Switchboard in Main Building, showing Cable-carrying Structure.

The clocks throughout, about 30 in number, are electrically operated and controlled, as also are the several bell systems.

In addition to these ordinary utilitarian services there are the very extensive and varied uses of electricity in electro-surgery, Röntgen ray, high-frequency, and other special apparatus too numerous to mention in detail.

In the wards general illumination is obtained by central pendants, so shaded that the actual lamps are screened from the bed positions. One of these pendants, in each ward, is of the inverted type to serve as a night light. By the bedsides, brackets and special portable hand-lamps are provided for local use.

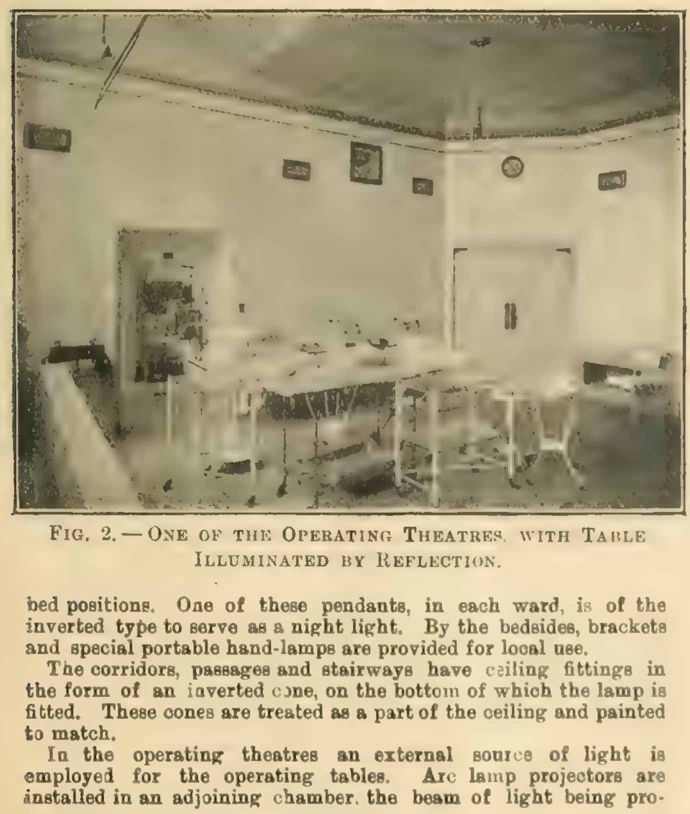


Fig. 2.—One of the Operating Theatres, with Table Illuminated by Reflection.

The corridors, passages and stairways have ceiling fittings in the form of an inverted cone, on the bottom of which the lamp is fitted. These cones are treated as a part of the ceiling and painted to match.

In the operating theatres an external source of light is employed for the operating tables. Arc lamp projectors are installed in an adjoining chamber, the beam of light being projected through a glazed aperture in the wall and on to the operating table by means of adjustable mirrors.

For the general illumination of the operating theatres special sunk fittings with flush glazed bronze covers have been employed. These frames fit into position by their own weight, and have no fixing studs or screws, but are nevertheless water-tight. The arrngements generally in the operating theatres are such that the walls may be washed down without risk or damage to any portion of the electrical fitments.

The whole of the internal electric light fittings are of plain smooth design to avoid so far as possible dust collection, and to render them easily cleaned.

The laundry equipment includes washing machines, hydro-extractors, ironing and finishing machines, and a large drying room above, served by an electric hoist. All the machines are electrically driven, some having the motors direct coupled, and others being driven by belts.

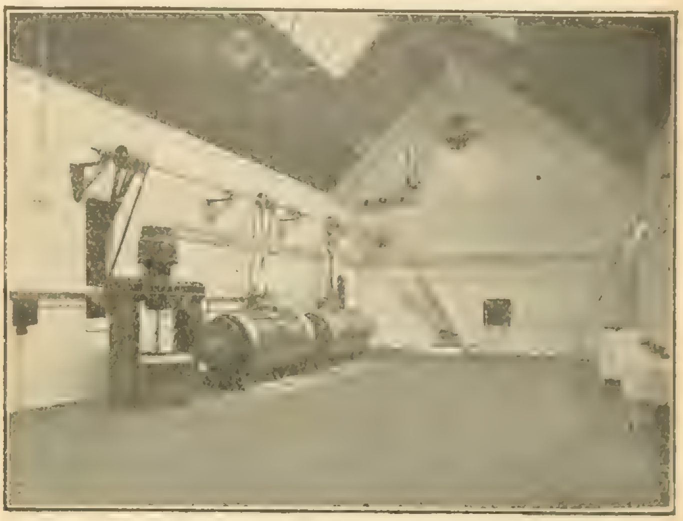


Fig. 3.—Washing House in Laundry.

We publish herewith some views of the plant, for which we are indebted to the consulting and advisory electrical engineers to the Board of Control, Messrs. James E. Sayers & Caldwell. The contractors for the electrical equipment generally were Messrs. Telford, Grier & MacKay; the electric clocks were supplied by the Magneta Time Co., Ltd.; the telephones by the Sterling Telephone and Electric Co., Ltd.; and the lifts by Messrs. Waygood-Otis, Ltd.

SCIENTIFIC AND TECHNICAL COMMISSIONERS.

By W. POLLARD DIGBY, Lieut. R.E. (T.), A.M.I.E.E.

(*From the Journal of the* Institution of Electrical Engineers. *Abstract.*)

Military victory *per se* is not the only duty before us; the military victory once attained, success in the ensuing commercial warfare must be the essential objective. The comparative incidence of the burden of taxation after the war will be heavier than anything we knew before Europe mobilised. Capital will be very scarce, and exports of capital in the form, say, of engineering machinery or railway plants to neutral markets will probably be on a greatly reduced scale.

The organisation of industry, particularly with reference to oversea markets, is as important as the organisation of the intelligence service of a field army, and the better the industrial organisation of any manufacturing nation, the sooner will be the recovery from the aftermath of the war.

External aids to trade have received consideration, but it is a very open question whether all that can be done, has been done. The Commercial Intelligence Branch of the Board of Trade is the medium of conveying a great deal of Consular information concerning prospective trade openings in the Colonies or in foreign countries. Trade Commissioners and Commercial Attachés have been appointed, and it is with no idea of belittling the useful work that they have done that the author urges the selection of an entirely new type of official representatives to perform the duties of Technical Commissioners.

Unless written by specialists, neither the reports of Commercial Attachés and Trade Commissioners, nor the Consular reports, can be reasonably expected to give details, say, of the successful types of competing foreign manufactures, the reasons of lower price, the reasons apart from price why British types are not successful, and the local conditions which may render typical British articles unsuitable. Such reports can only be adequately written by specially selected men situated in friendly countries, having behind them all the prestige of our diplomatic service. The men to be chosen for the duties must be of a high type. They must be recruited with as much care as the secretaries of our various

Embassies and Legations, but recruited differently. The modern side of a public school, and an engineering degree at Cambridge, Oxford, London, or Manchester, are by themselves wholly inadequate credentials for a Technical Commissionership. Industrial experience is as essential as the intervening years of sea service between leaving Osborne and a naval attacheship for officers in the Navy.

The Technical Commissioner should be a specialist. Specialists acquainted with the needs of distinct industries must naturally possess an all-round knowledge of those branches of applied science most closely related to their own special work, and should possess imagination. Much, very much more than is supposed, of German success in the past has been due to the possession of a scientific and commercial imagination. If we look back on the history of the evolution of any branch of science, or even of any piece of machinery, it is at once evident that at any stage the next advance might have been predicted by the intelligent putting-together of the then ascertained achievements and phenomena.

There must, therefore, be among the essential credentials of the technical commissioners evidence not only of practical experience and the power of succinct description, but of a logical imagination.

Visits of individual engineers abroad are directed mainly, if not entirely, to purchasing countries, not to competing manufacturing countries.

The author has yet to learn of an British firm maintaining an intelligence department in any foreign manufacturing city, concerned in no way with the sale of the firm's products, but with the sole duty of forwarding technical information to the firm's headquarters.

The technical commissioner must be essentially a worker: he must make long journeys from his headquarters, and on his return must give a great deal of attention to office work. His minutes will be lengthy and numerous. He will have to avoid giving too much of his time to the social side of life.

The professional status of a technical commissioner, say, in engineering, should be at least the equivalent of full membership of one or more of the institutions most closely concerned in his work, viz., the respective Institutions of Mechanical Engineers and of Electrical Engineers. Those concerned with mining machinery or metallurgical matters should belong, among other bodies, to the Institution of Mining and Metallurgy. The chemist, too, should possess equivalent qualifications. Before proceeding to take up his post, the newly appointed technical commissioner should have ample opportunity of conference with representatives of the industries concerned with his sphere of work, both as regards their selling and their technical departments and methods of manufacture. At stated intervals he should return to England to confer with those concerned in his work.

The technical commissioners should rank after, but be associated with, the present commercial attachés, assisting the latter by the preparation of the scientific and technical matter required for general reports. Prompt dissemination of the information, sometimes perhaps in the shape of secret and confidential publications, will of course be requisite.

An engineering commissioner for any particular branch of the industry would report on types of plant in use, study its operation, and send home recommendations thereon. He would join the engineering Institutions of the country in which his duties lay, attending annual meetings, congresses or conventions, and abstracting promptly important information in the technical papers.

It would be easy to multiply instances of possible useful activity, but any manufacturer knows the technical information which he would like to have, and which could be furnished by a technical commissioner of the right type.

We shall be indeed a short-sighted race, if, when military war again gives place to the commercial warfare waged by manufacturing countries for foodstuffs and luxuries, we do not strain every nerve to apply system to our methods. We must remember that the added burdens not only of direct taxation but of reduced numbers of food-getters will render commercial success more vital to our welfare than in the past. It is well within the bounds of feasibility that German industrialism may make a rapid recovery. Her factories and equipment are uninjured. Only raw materials and markets are needed for industrial production to be resumed.

Just as the important, and in some respects almost dominating position, which Germany held in the neutral markets of the world before the war was in part due to the thorough and systematic methods of her commercial engineering departments, so her innate genius of organisation and co-ordination, her capability of concentration of purpose, and her logical industrial imagination, will guide and steady her progress towards a recovery of her previous position. To this she will be relentlessly spurred by the grimmest of necessities, that of food earning.

Mere exhibitions of German articles in London, with particulars of the wholesale and retail prices, though good in their way, will not suffice. We need representatives with technical experience and foresight studying conditions in the markets which we seek to supply. We can either leave this to sporadic industrial enterprise (generally an unsatisfactory quality, and undoubtedly expensive and inefficient), or make it a matter of national organisation, and as definite a branch of official activity as the duties of the Development Commissioners.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Roto-Drum Pumps.

The Worthington Pump Co., Ltd., of India House, Kingsway W.C., have developed a rotary dry vacuum pump or blower suitabl for direct coupling to an electric motor, as shown in fig. 1. Th pump operates on the familiar principle of the rotating eccentric drum fitted with sliding steel plates which act as pistons; the plates do not rub on the inside of the cylinder, but are carried by hardened and ground steel running rings, which "float," so that no rubbing friction is set up. The shaft is carried on ball bearings, and all friction is reduced to the minimum. The casing is provided with a water jacket. The pump illustrated is capable of handling 20,000 cb. ft. of free air per hour at 700 R.P.M., and is very compact for the output. Ten sizes are made.

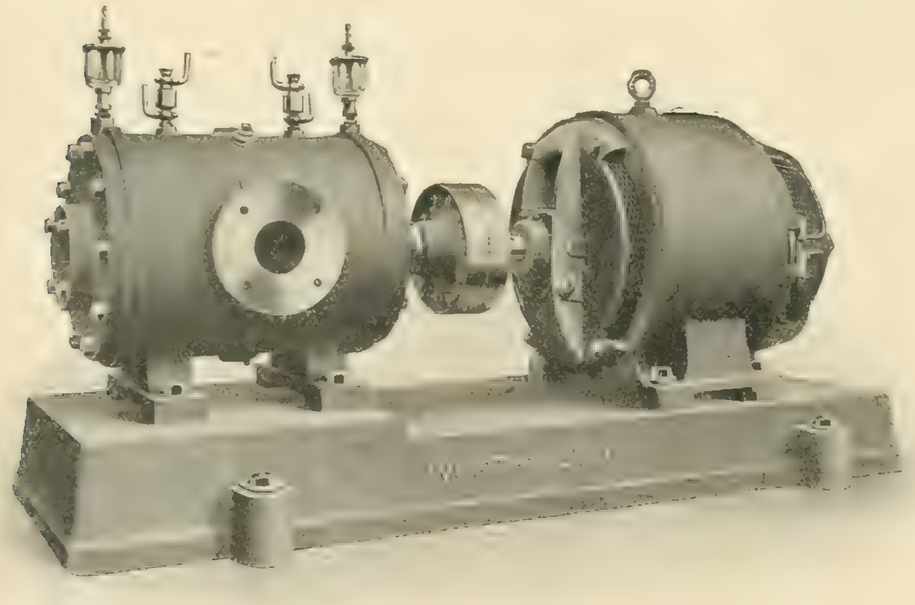


Fig. 1.—Worthington Roto-drum Pump coupled to Motor.

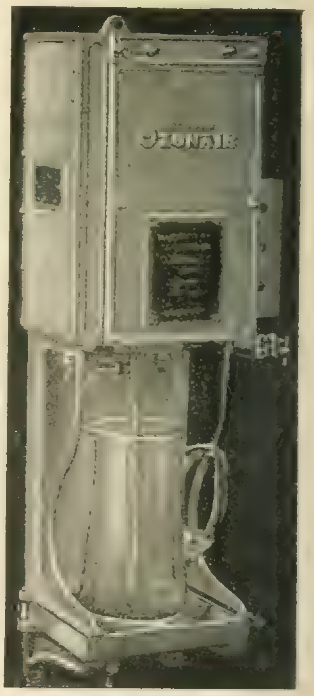


Fig. 2.—Ozonair Domestic Water Steriliser.

Ozonair Water Steriliser.

Messrs. Ozonair, Ltd., of 96, Victoria Street, S.W., have devised a water steriliser of small dimensions for domestic use, which we illustrate in fig. 2. It consists of a metal frame which is fixed to the wall, and comprises a case containing the ozone-producing apparatus above a bracket and swivelling tray to carry the receptacle for the sterilised water. The apparatus is quite automatic in action; on placing the jug in position and turning on the water tap, which is provided as part of the device, the ozone generator is set in operation. The steriliser is made for any type of supply and any voltage, and works on any water pressure from 12 to 50 lb. per sq. in.; the metal work is neatly finished in aluminium. Closing the tap stops the generator. The advantages of ozone for sterilisation are well known to our readers, and the system has been used for public supply abroad for many years, but a small British-made domestic plant has not hitherto been available.

"Witton" Multiple Switch Starters.

The General Electric Co., Ltd., of Witton, have recently supplied a number of multiple switch starters, comprising a mistake-proof starting switch cutting out sections of the resistance in the ordinary way and interlocked electrically with a circuit breaker.

In starting up a motor controlled by a "Witton" multiple switch starter, the circuit breaker is first closed, and the switch cutting out the first step in the resistance is then inserted. But should an attempt be made to insert either the switch that short circuits the resistance or an intermediate switch on the starter, the attempt is frustrated by an interlocking bar. This bar is automatically moved along by the switches as they successively close, and precludes the closing of any of the other switches out of their proper sequence. Further, should the circuit breaker trip due to an overload on the motor and an attempt be made to replace it—which would mean short-circuiting the supply—a special trip coil on the circuit breaker is energised through contacts which are shorted when any or all the switches on the starter are closed. The action of this trip coil locks the circuit breaker mechanism and prevents the breaker being closed.

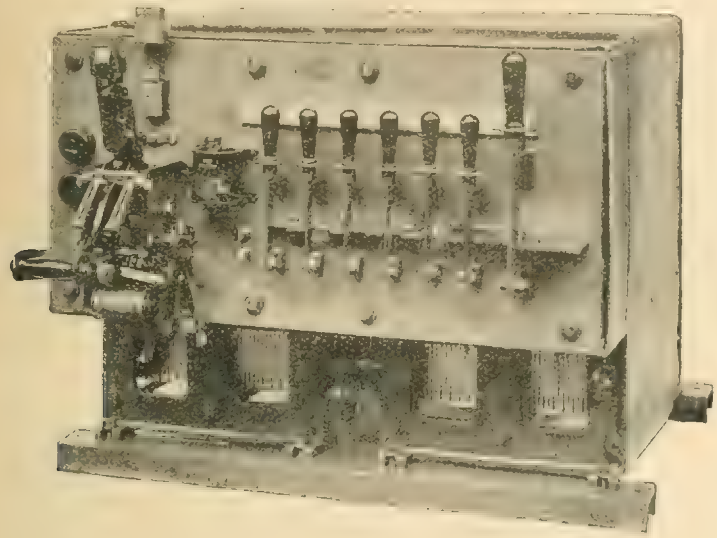


Fig. 3.—"Witton" 100-h.p. Multiple-Switch Starter.

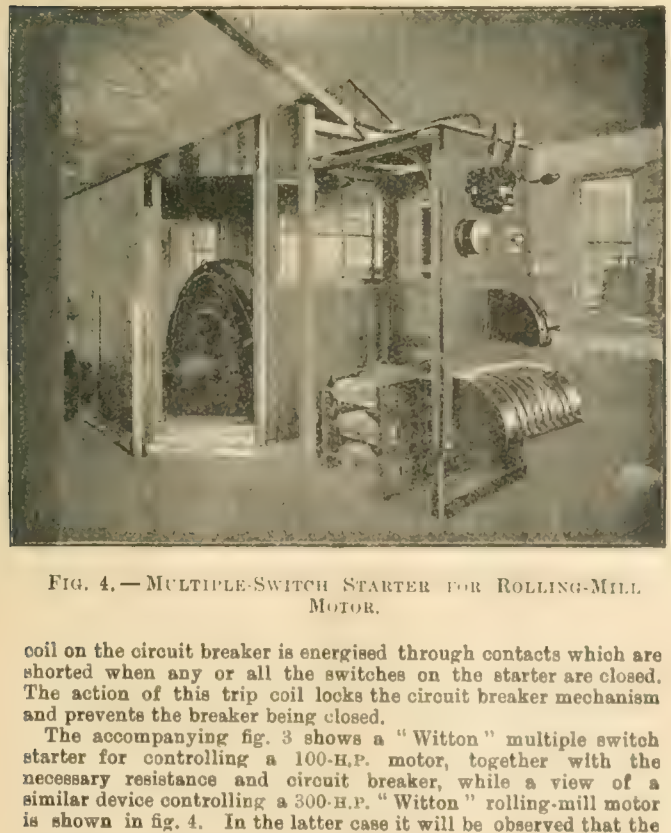


Fig. 4.—Multiple-Switch Starter for Rolling-Mill Motor.

The accompanying fig. 3 shows a "Witton" multiple switch starter for controlling a 100-h.p. motor, together with the necessary resistance and circuit breaker, while a view of a similar device controlling a 300-h.p. "Witton" rolling-mill motor is shown in fig. 4. In the latter case it will be observed that the switches are provided with a suitable cover.

Renewing Tungsten Lamps.

There is a good deal more useful material in a burnt-out tungsten lamp than in a carbon-filament lamp, and naturally attempts to make use of it have not been wanting. Mr. Hedley Field, of the Allies Electric Lamp Co., Ltd., Montgomery Street, Hammersmith, W., has just shown us a sample of such a lamp, in which the filament has been renewed, without using any fresh material other than the new filament. In this company's process, the bulb is cut off at the shoulder, the glass is cleaned, and the new filament is mounted; a glass tube is then fused on to the pip of the bulb, the latter is joined at the original cut, and the lamp is exhausted and sealed in the usual way. The company has been at work for about a year, and has applied the process to lamps of all sizes, from 8 to 400 c.p., for voltages up to 250 volts; the same efficiency is claimed as for new lamps, and the life of a renewed lamp is guaranteed to be not less than 1,000 hours. The appearance of the lamp is practically unchanged, and the operation can be repeated several times.

WAR ITEMS.

Openings in Italy.—From the British Chamber of Commerce for Italy at Genoa we have received further lists of openings for British articles in Italian markets, from which we extract the following. Some of these firms formerly did business with German and Austrian houses, and now seek British connections:—

No. 680. Agent at Turin wishes to hear from manufacturers of machine tools. T.A.R.

No. 682. Agent in North Italy would take up agencies for scientific instruments. E.G.B.

No. 684. Electrotechnical engineer at Turin would represent British manufacturer of electric material and apparatus. T.B.G.

No. 636. Agent at Naples would represent manufacturers or shippers of steel, tools, machinery. N.G.B.

No. 696. Agent at Genoa representing British firms in other similar lines, has openings for electric lamps and apparatus. G C.D.O.

No. 712. Firm at Florence would sell on commission in Tuscany, or merchant, machinery. F.O.G.

No. 718. Agent at Turin inquires for leather belting. T.G.B.

No. 726. Engineer at Turin has openings for iron and steel, rain-water pipes, water-meters, steel tubes, anti-rust paint. T.P.F.

No. 729.—Rome agent would take up electric lamps. R.O.B.

No. 738. Agent at Genoa would sell on commission or merchant—copper, bronze, brass, zinc, aluminium, nickel, iron in pigs, electrical sheets of steel, for all Italy. G.E.A.R.

No. 739. Commission agent at Genoa has openings for anchors, warping machines, steering gear, thermotanks, steam and electric winches. B.

No. 764. Engineer at Rome wishes to represent important manufacturer of electrical material, motors, pumps, lifting machinery. R.A.F.

No. 775. Commission agent at Genoa wishes to hear from manufacturer of electric pianos. G.F.D.B.

No. 782. Commission agent at Bologna wishes to represent manufacturer of machinery for paper mills, spinning mills, wool, cotton, linen, hemp, jute, workshops, files, linen and cotton yarns. B.C.F.

No. 790. Manufacturers at Bordighera would take up mechanical and electrical specialities. B.W.B.

"Munitions—More Munitions!" but "Keep the Atmosphere Pure."—Messrs. Connolly Bros., Blackley, Manchester, were summoned at Manchester, on June 2nd, for permitting a black smoke nuisance at their works.—Mr. Pickford (for the Corporation) said the magistrates had previously made an order for abatement on the defendants so long ago as December, 1900, and the nuisance was still existent.—Inspector Chisholm said that on April 20th he took observations of defendants' chimney, and in 30 minutes black smoke was emitted for a total period of 4½ minutes. When he saw the fireman the latter said he had been as careful as possible, and the emissions must be due to the bad coal they were getting.—Mr. Connolly said that when he was before the Court on April 7th last he read a letter which his firm had received from Lord Kitchener, showing that they were really working seven days a week to get out urgent War Office orders. They were still working on munitions and were at their wits' end to turn out the goods fast enough. He also read a letter from a colliery company, stating that for the present the firm would have to be satisfied with any kind of coal they could send, as they were crowded out with Government work. The works had been completely changed from steam to electric driving. Electrical machinery had been installed at a cost of £750, and an eighth motor was put in last week. He suggested that that showed that the firm were striving to meet the Corporation's requirements. They were taking all their power from the Corporation, and they had also had a complete transformer house erected for them by the Corporation. He thought the present summons might be withdrawn, and said he did not see how they could do any more than they had done to try to abate the smoke nuisance. They were working night and day on war contracts, and had even had to employ men 75 years of age to help them to get the work out. A fine of 30s. was imposed, the Bench intimating that whilst they fully appreciated the difficulties of the firm they had to maintain the purity of the atmosphere as far as possible. Mr. Connolly remarked that it was hard lines that the firm should be fined again.

A Pocket Lamp Battery Syndicate.—The use of pocket electric lamps in Germany has assumed great importance among the rank and file of the army, and the production of batteries in particular has reached an exceptionally high level in recent months. A short time ago the battery makers were brought together in the form of a central organisation for war deliveries, and this has now been followed by the constitution of a syndicate of pocket-lamp battery makers at Charlottenburg, Berlin.

Anglo-Belgian Electrical Co-operation.—Writing with regard to M. R. Steylaers's paper on this subject, M. Nouet, Editor of our esteemed contemporary *La Lumière Electrique*, points out that several small errors have occurred in connection with the names and addresses of certain French firms: The Société Française d'Electricité A.E.G., 72, Rue d'Amsterdam, Paris, which was sequestrated (*mise sous séquestre*) on November 24th, 1914, included in its administrative council M. Thurnauer (not Thurnauw), ex-manager of the Thomson-Houston Co., from which he has recently resigned. The address of the Société Industrielle d'Energie Electrique is 60 (not 30) Rue Caumartin, and M. Cohen (not Cahen) is a member of the administrative council of this company, as well as of the Société d'Electricité de Varsovie and of the Société Continentale de Traction et d'Eclairage. Otherwise our *confrère* finds the article interesting and accurate. We are much indebted to him for his kind assistance.

Russia.—A firm at Ekaterinburg, who formerly represented German concerns, desire to get into touch with United Kingdom manufacturers of locomobiles, internal combustion engines, and electric lamps. "Correspondence with this firm should preferably be in Russian, and, failing this, French is the only other language in which they would be prepared to correspond." Communications in this connection should be addressed to the British Vice-Consulate, Ekaterinburg.

An agent in Warsaw wishes to secure the agencies of United Kingdom manufacturers of electric lamps and wire.

Inquiry is made for the names of United Kingdom manufacturers of electric lamps and fittings, and carbons for arc lamps.

A firm desires to hear from United Kingdom manufacturers and exporters of engineering supplies for factories and railways.

A firm wishes to get into touch with United Kingdom manufacturers of electric power plant, appliances for teaching physics in schools, and lifts.

Manufacturers, &c., of the goods mentioned should apply, in the first instance, to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C., for the names and addresses of the respective inquirers. Further communications regarding the inquiries should be addressed to the British Consulate, Warsaw.—*Board of Trade Journal.*

Commandeering Spelter.—According to the *Times*, the Munitions Committee contemplates issuing instructions to commandeer all spelter other than that being used for making cartridge metal, and prohibiting the use of spelter for galvanising sheets and wire, other than that for Government purposes. As a result of this no quotation for the metal was given by the Metal Exchange on Monday. The above action has become necessary owing to the difficulty of obtaining supplies of the metal, which are now obtained almost entirely from the United States. In normal times the United Kingdom's chief sources of supply are Belgium and Germany, which between them provide over one-third of the world's production. Since the war began Germany has prohibited the export of the metal. The last quotation for American spelter in London was £97 a ton, which compared with £22 before the outbreak of hostilities.

Australia and Enemy Goods.—The *Sydney Morning Herald* reports that on April 19th the Prime Minister, Mr. Fisher, received a deputation representing the Associated Chambers of Manufactures of the Commonwealth. It was asked that a 25 per cent. surcharge should be imposed on enemy goods for 10 years after the war. Mr. Fisher pointed out that when peace was declared there would be no enemy goods. It was then urged that the Commonwealth should bring in a three-schedule tariff on Canadian lines. This would provide for preference to British goods, a lesser preference to most favoured nations, and an ordinary tariff for enemy goods. The Prime Minister indicated that already considerable preference was given to British goods. Under the new tariff he promised that the matter would receive full consideration by himself and the Cabinet.

Re Custodis, Ltd.—In the House of Commons, on Tuesday, Mr. Runciman replied to questions with reference to Custodis, Ltd., and the Alphons Custodis Chimney Construction Co. He said, according to the *Times* report, that both companies were incorporated in this country, and therefore entitled to carry on business here, but last October an inspector of the latter company was appointed by the Board of Trade, in order that the Board of Trade could be satisfied that it was not trading with the enemy. Whatever guarantees had been given by the company to others as to no German capital being involved, he must be guided by the register of shareholders. It was an English company, with a majority of shares held by Germans—that was why an inspector was appointed.

Petrograd Electricity: Hitch in Procedure.—According to the *Novoe Vremya*, the Petrograd Town Council having decided to buy out the three electrical concession concerns, namely, the 1886 Company, the Electrical Equipment Co. (formerly Helios), and the Belgian Co., the Governor of the town has protested. The administrative body finds that the decision to purchase took place in contravention of the statutes of the town government. Specifically, the contravention consists in ignoring the regulation that all important questions affecting the town's economy may only be decided with a minimum attendance of 81, and with a majority consisting of two-thirds at least. The Governor protests that on the occasion in question the required majority was not present.

To Ourselves from "The Front."—A correspondent who is somewhere with the Forces (it is believed at the Dardanelles) writes home under date May 20th to a friend as follows —"Next time the ELECTRICAL REVIEW man calls tell him that it reaches us every mail, and is read by a wide circle of engineers from every firm of any size in Britain. It always recalls your kindly forethought in arranging for it to be sent."

We are delighted to receive such messages as this from readers who are "doing their bit." We shall look for (may we soon receive) a letter from the writer from an address in Constantinople!

Anchor Volunteers.—About 80 men employed at the Anchor Cable Works, Leigh, Lancashire, who are engaged on Government work, last week joined the Leigh Athletes Volunteer Force.

War Munitions.—In the House of Commons, on Tuesday, it was stated that the approximate number of firms in the United Kingdom who had offered to manufacture munitions of war, but had not received direct orders from the War Office, was 300. Of these over 50 were engaged as sub-contractors. A question was was asked as to whether the Chancellor of the Exchequer would give the names of firms who were being subsidised or guaranteed by the Government for the extension of their factories or the erection of new factories. Mr. McKenna, in reply, doubted whether it would be in the public interest to give the particulars asked for at the present moment.

Personal.—Mr. Percy Taylor, assistant electrical engineer to the Darwen Corporation, who recently joined the mechanical transport service, has been appointed mechanical staff sergeant, and is in charge of a convoy of cars in South-East England.

Mr. Wilfred Pearson, son of Mr. J. Pearson, of the Altrincham Electric Supply, Ltd., till recently with the 5th Cavalry Reserve Scots Greys at York, has been gazetted second-lieutenant and appointed to the East Yorkshire Regiment now at Harrogate. Mr. Herbert Pearson, his brother, is with the King's (Liverpool) Regiment at Salisbury.

Mr. A. W. Empson, A.M.I.E.E., A.M.I.Mech.E., F.C.S., who recently resigned his appointment as chief station engineer to La Compania de Electricidad de Marida, Yucatan (Mexico) in order to serve in the British Army during the war, has joined the Motor Machine Gun Section, and is now in training at Bisley Camp. His permanent address is 14, Scarcroft Hill, York.

Mr. E. W. Davey, electrician, of 17, St. Andrews Road, Exmouth, has joined the Royal Flying Corps for active service.

Mr. A. Greed (meter tester), and Mr. J. Brooke (of the clerks' staff), of the Dewsbury Corporation electricity department, have joined the Royal Engineers; and Mr. J. Passmore (shift engineer) has entered the Navy as electrical artificer.

Roll of Honour.—We regret to learn of the death from wounds (caused by a sniper's bullet) of Captain John Chapman, of the 1st-5th Leicestershire Territorial Regiment. At the outbreak of war he held the rank of Lieutenant, but was shortly afterwards promoted Captain, and left with the regiment for the Front some time back. The regiment has been doing excellent work in the trenches. Capt. Chapman was a "Brush" boy, having served his pupilage with the Brush Electrical Engineering Co., Ltd., afterwards serving in the works electricians' department, and latterly being attached to the company's London office. He was a young man of attractive personality and of great promise in his profession, and his death at the early age of 26 years will be regretted by all who knew him. His popularity in his native town of Loughborough—whence the remains were taken for burial—and the sincere regret of his fellow-townsmen, as well as of the military authorities, at his demise, was demonstrated on Wednesday last week, when the honours of a military funeral were accorded, preceded by a Church service at which representatives from all sides were present. The directors and staff of the Brush Co. have conveyed their expression of regret and condolence to the bereaved relatives.

On May 26th, a bursting shell caused the death of Private Frederick Vere Shanks, of the 1st-4th Battalion, King's Own Yorkshire Light Infantry. Private Shanks was employed in the electricity department of the Wakefield Corporation.

Rifleman G. Frith, of Peel Green, Eccles, who has died at a hospital in France from wounds received in action, was formerly employed by the British Westinghouse Electrical and Manufacturing Co., Ltd., Trafford Park. He was 20 years of age.

Intelligence has reached Torquay that Mr. C. Walker, of the Corporation electricity clerks' staff, has been killed in action; and that Mr. Harding, a stoker at the works, is reported missing from H.M.S. *Goliath*, recently sunk in the Dardanelles.

Lieutenant J. Lindsay Drummond, of the 1st Royal Scots Fusiliers, has arrived at Dumfries on sick furlough. The lieutenant, who was an engineer in one of Glasgow's electric power stations before the war, went out to the Front in December. He was badly wounded in both ankles at St. Eloi.

Corporal A. E. Irving, of the Yorkshire Regiment, who worked on the Burnley Tramways before the war, has been awarded the D.C.M. He displayed conspicuous gallantry at Neuve Chapelle on March 12th, when by throwing bombs on the enemy he caused them to evacuate the trenches and come under the fire of his comrades.

Gateshead Tramwaymen and Red Cross.—As a result of their King's Theatre Matinee and Town Hall concert on April 21st (Gateshead and District tramwaymen), an amount of £91 was handed over to Whinney House for Red Cross purposes.

Denmark.—A firm in Copenhagen desires to secure the agencies of United Kingdom Manufacturers of electrical specialities and novelties. Apply first to the Commercial Intelligence Branch of the Board of Trade, London, for the name, and subsequently address the British Legation, Copenhagen.

REVIEWS.

The Electric Furnace. Second Edition. By A. Stansfield, D.Sc. 1914. London : Hill Publishing Co. Price 17s. net.

The first edition of this book appeared in 1907, but since that time the science of electrometallurgy has made rapid progress, and, as a consequence, the present edition has been increased to more than twice its original size, and the whole text has been reset. The author states in his preface that all recent developments of importance have been included, but as the revision has occupied at least three years, it has been impossible to insert some of the most recent work on this subject. The purpose of the book has been to trace the evolution of the electric furnace from its simplest beginnings, and to set forth, as briefly as is consistent with clearness, the more important facts relating to theory and practice. There is no doubt that the author has achieved this object, and has presented a most interesting and instructive contribution to the literature of electrochemistry.

This volume covers not only the progress, but most of the essential features of the design and operation of electric furnaces, and should be of immense value to both the student and the manufacturer.

The first chapter is entirely historical, and gives a brief survey of the development of electric furnaces to date. The next four chapters deal with the classification, efficiency, construction and operation of electric furnaces. Chapter II describes the essential features and classification of the various types of furnaces. Each class is clearly described, and diagrammatically illustrated. Chapter III is devoted entirely to questions of efficiency and cost. The economic relations between electricity and fuel heat are fully described and discussed. Furnace construction and design are dealt with in detail in the next chapter, which constitutes one of the most important features of the book. The opening pages give an account of the different refractory materials in use for furnace lining. The thermal conductivity of furnace materials is considered from both the theoretical and the practical standpoint. A few pages are devoted to the radiation and convection of heat, as a preliminary to a detailed study of the various types of electric furnaces. The whole chapter is fully illustrated with diagrams, curves and tables, and is clearly elucidated by means of practical examples. Chapter V treats of the operation of electric furnaces. It opens with an account of the different forms in which electric power is supplied at the present time, and the methods of coupling the supply of energy to the furnaces. Heat production, power consumption, regulation and control in furnace practice are all discussed in a clear and concise manner.

The next chapter opens the section treating of the various uses of electric furnaces. Chapter VI begins with a description of the various laboratory furnaces, followed by the large-scale process of steel smelting. Chapter VII introduces the possibilities of the production of pig-iron from its ores, a considerable amount of space being deservedly devoted to this youngest of electrical industries. The production of steel from metallic ingredients is described in Chapter VIII. The details of this branch of the electrometallurgical industry are now thoroughly well known, and need no further comment.

Chapter IX describes the various attempts made to place the production of steel from iron ore on a commercial basis, but this must still be regarded as in the experimental stage. The manufacture of ferro-alloys and silicon is briefly dealt with in Chapter X, and the production of graphite and carbides in Chapter XI. A considerable amount of space is devoted to the electrometallurgy of zinc and other metals in Chapter XII. This section of the book is extremely interesting, but the industry can scarcely be regarded as having advanced beyond the experimental stage. Chapter XIII describes miscellaneous uses of the electric furnace. The production of nitric acid, phosphorus, and carbon bisulphide is illustrated therein. Various processes of the electrolysis of fused material are described in Chapter XIV, including the production of sodium, aluminium and calcium.

The last chapter attempts to indicate the direction of future development in electric furnace construction, and concludes a very interesting survey of the more important features of electrometallurgy.

The book is fully and clearly illustrated throughout, and freed as far as possible from superfluous details. The text is accompanied by numerous tables and curves. The mathematical and chemical portion of the book is of an elementary nature. Many pages are frequently devoted to the description of plant which has already proved inefficient. This procedure is necessary when it illustrates novel features in furnace construction. The value of the book would have been greatly enhanced had the author given details as to the cause of inefficiency, or at least indicated the reason for suspending operation. There is no doubt, however, that this book forms a very useful addition to our electric furnace literature. The writer is a recognised expert on this subject, and gives a considerable amount of first-hand information. The book will be generally recognised as a standard work on the subject of electric furnaces.

Electrical Engineering in India. By J. W. Meares. Calcutta : Thacker, Spink & Co. Price 15s. net.

This volume represents a most successful attempt to provide a treatment of electrical matters such as is likely to be required by the engineer who, not having specialised in electrical work, wishes to extend his knowledge in this field or to solve some particular problem. The author has succeeded in getting between the covers of a book of reasonable size and price, sufficient elementary matter to furbish up, if necessary, the rudimentary knowledge assumed to have been acquired at one time by the reader; and, in addition, a treatment of the subjects of domestic applications of electricity, installation methods and costs, electrical plant and supply, and sundry heavy-current applications—the treatment being throughout well suited to the end in view. The volume combines the technical merits of treatises on special branches of electrical engineering with the convenience in reference of a pocket book. So many attempts at covering such a wide field have ended in disastrous failure or cursory mediocrity, that it is particularly gratifying to find a work packed full of information, obviously selected with care and experience and set out in such manner that it can be understood and applied by any engineer, whether reading straight through the volume or using it as a work of reference.

Part I—the elementary section of the book—includes practical definitions and explanations of electrical terms and symbols, as well as brief notes on the chief electrical apparatus and machinery, and connecting and distributing systems. The author appears to have realised just what could be left out of elementary notes intended for engineers, and, while including no absurdly elementary or purely academic matter, he has left no gaps unbridged. In Part II, which is concerned with domestic applications and the cost and installation of the apparatus required, electric lighting, ventilation, pumping, heating and cooking are dealt with first, the information presented being a happy combination of descriptive and explanatory matter, and standard data required for general estimating and design and for installation work. The author does not commit the error, made frequently by "practical" writers, of giving arbitrary rules or mere generalisations and qualitative information; definite information and practical examples are given throughout, and where formulæ are included their conditions of applicability are specified. The chapters on wiring and accessories do not encroach upon the ordinary wireman's manual, but contain just the information (general and concerning sizes, capacities and costs) likely to be useful to the engineer called upon to specify and supervise a wiring installation.

Part III, dealing with electric plant and supply, is quite up to the standard of the rest of the book. Direct and alternating-current motors, their characteristics, control, applications and prices are treated satisfactorily, and Chapter XIV is devoted to the important subject of plant for private supply. Determination of the kilowatt capacity required is discussed in detail, brief notes relate to types of generators, and practical information is presented concerning the cost and general characteristics of various types of prime movers. The possibilities of the Humphrey pump in this connection are discussed. Public supply costs are analysed and the subject of tariffs is treated clearly, a number of actual examples being included. Two chapters dealing with water-power and its development include a useful collection of formulæ, standard data and general information concerning turbines, pipe-lines and associated equipment. Chapters on electric traction are equally valuable and contain even more definite data and instructions for its application. Electricity in mining is dealt with in the shortest and least satisfactory chapter in the book; we feel sure it is within the author's capabilities greatly to improve this chapter. Transmission systems, equipments and costs are treated clearly and in sufficient detail, and the last two chapters deal with specifications, depreciation and maintenance, and with testing.

The appendix includes the I.E.E. form of model general conditions of contract. An exceptionally complete index (occupying 33 pages) greatly increases the value of the work, and is the best we remember seeing. In proportion to its size, this book contains very few illustrations, but those included are excellent; it is free from diagrams useless to the readers for whom it is designed, and is unencumbered by the numerous half-tone illustrations, which so often mar works of this nature. We notice few printers' errors; there are one or two dropped figures or letters in mathematical expressions, but not where their absence can cause doubt or confusion. Two blocks are transposed on page 55, but the author informs us that this was due to the printers, after a correct proof had been passed. Some of the data included refer only to India, and Indian coinage is used throughout. The scope and quality of the book are remarkable and, we believe, unique. An Anglicised edition could be prepared easily and should meet a wide demand.—R. E. Neale.

LEGAL.

Calmont, King & Co. *v.* Owen.

In the City of London Court, on Friday last, before his Honour Judge Atherley-Jones, K.C., a claim was made by Calmont, King and Co., Ltd., London, against Thomas H. Owen, cycle and motor dealer, Blaenau Festiniog, to recover £2 13s. 10d. for electric lamps supplied to his order.

Judge Atherley-Jones stated that the defendant had written several letters to the Court, explaining why he should not pay the amount. Plaintiffs' solicitor stated that in October, 1913, plaintiffs quoted defendant for certain electric lamps to be supplied at fixed prices. These prices ruled only for the season. Deliveries took place at those rates, and then prices went up. Defendant now urged that he ought to have the latter deliveries of goods at the former rates. There were three invoices sent up by the defendant to the Court. The first was at the old prices, the second was at an extra price, which defendant had actually paid, and the third was the subject of the present action. The third was for £2 13s. 10d. Defendant had paid £1 8s. 4d. into Court, deducting £1 5s. 6d., the increased price on the old invoices and on the sum now claimed. Of course that could not be allowed. Defendant wanted deductions from amounts actually paid.

Judge Atherley-Jones found for the plaintiffs for the amount claimed, with costs.

Bristol Tramways and their Electric Supply.

In the Chancery Division, on Tuesday, June 8th, Mr. Justice Neville had before him a petition by the Bristol Tramways and Carriage Co., Ltd., for the sanction of the Court to an extension of its powers, including the supply of electricity to other firms.

Mr. Clauson, K.C., who, with Mr. Gordon Brown, appeared in support of the petition, said they had surplus electricity which they desired to supply to others.

His Lordship expressed his approval of the proposed extension of objects, but thought that the notices convening the necessary meetings had not given the required seven clear days.

Under these circumstances, Mr. Clauson asked that the petition should stand over in order that fresh meetings might be held, and be restored to the list for formal sanction; or, should the company think that they could persuade the Court of Appeal to take a different view as regards the notices, dismissed, so that the opinion of the Court might be taken on the point.

His Lordship said the order might go in either way, as the company desired.

BUSINESS NOTES.

Consular Notes.—CUBA.—Recent issues of the *Gaceta Oficial* announce that the following persons have been granted permission to install electric power and lighting plant in Cuba. Senor Francisco Arredondo y Bentancourt at Jobabo, in the municipal district of Victoria de las Tunas; Senor Dorindo Vazques, in the town of Florida, Province of Camaguey, and Senor Perfecto Rodriguez, in the town of Florida. In each case the concession will be rescinded if the plant is not in working order within a year from the date of the concession.

DOMINICAN REPUBLIC.—The American Consul at Santo Domingo reports that the erection of a new electric light plant in Santo Domingo is so greatly felt that it is a daily subject of discussion in the local Press and by those who, realising the deficiency of the lighting service, are constantly clamouring for its betterment.

In June, 1914, a contract was entered into between the municipality and S. Michelena, whereby it was agreed that there would be created a Corporation, with a capital stock of $160,000, $60,000 of which would always be held by the municipality, with the object of establishing an electrical plant for the public and private lighting of the city of Santo Domingo and the supplying of power for industrial and domestic purposes. Among other things Mr. Michelena bound himself to attend to and complete the formation of the stock company within a specified period of time, after which the work for the erection of the plant was to begin.

The municipal Council in its session of March 30th last passed a report rendered by the city's attorney, in which it was held that the municipality was not bound for the erection of the electric-light plant, and the contract with Mr. Michelena was declared rescinded. In the same session a Committee of three was appointed to study and take under advisement the form and the means for the realisation of the work. It was also resolved to contract a loan for the installation of the new plant.

PHILLIPINE ISLANDS.—The American correspondent at Manila reports that Lucban, Taycbas Province, is to install a hydro-electric plant to supply light and power to the municipality. The proposed plant will cost $30,000. The machinery will be purchased from American importers, and the plant will be ready for operation in August. The project will be financed by Filipino capital, through a corporation floated in the municipality. The power for the plant will be generated by the water of the Pagsipi River, which flows through the municipality. The electric light and power station will consist of a Pelton water turbine, coupled to a General Electric alternator, a concrete dam across the river, a headgate, flume, penstock, a complete power plant, transmission and distributing line. The system will require 42,000 ft. of wiring and 1,600 ft. of flume line, with a capacity of 900 litres a second. Construction will begin at once. Lucban is one of the centres of the Phillipine hat industry. One of the incentives for constructing the new lighting and power system was the great need for better lighting in the houses where the hat industry is being conducted.

RUSSIA.—The Administration of Waterways of the Interior in Russia has prepared an explanatory note in regard to the project of law concerning the utilisation of water-power. The note mentions the latest technical improvements achieved in this direction during the last ten years. The utilisation of water-power is of special importance, inasmuch as the electrical energy obtained can be transmitted to considerable distances. Hydroelectric power can be used in all kinds of industries where motive power is used, but it is of special importance in mining, electrochemical and metallurgical industries, and in the manufacture of a number of articles important in agriculture. Of the greatest importance, however, is the use of hydroelectric power in the exploitation of ways of communication as a change from steam to electricity on railways becomes a necessity in many cases, even for long distances. The 24 large rivers of European Russia, not including the Caucasus, can furnish 1,000,000 H.P., and the hydraulic resources of Siberia have not yet been ascertained. The total supplies of water-power in Russia are estimated by some investigators at 12,000,000 H.P. in comparison with the total supplies in Western Europe of 34,000,000 H.P. Western Europe, as well as the United States, is covered with a network of hydroelectric installations which, in the principal countries of Europe, produce more than 3,500,000 H.P. In Russia a considerable number of applications have been received during the last 20 years, which circumstance has proved the necessity for utilising the water-power, but the granting of concessions, as well as any activity by the Government itself, has been impeded by defects in the Russian regulations. Even in cases where the exploitation of water-power may be given over to private enterprise it is always closely connected with the interests of the State. The right of exploitation conferred on a private individual places him in a position to control industry which, under existing conditions, the Government believes should belong to it. The right of exploitation of the water-power, therefore, should be given to private individuals only on condition that it will be under the control of the State. The regulations which the Government propose to put into force to bring about this end have already been given in detail in the Electrical Review.

Liquidations. — Coast Development Corporation, Ltd.—A meeting of creditors was held on Tuesday last, June 8th, at Winchester House, Old Broad Street, E.C.

Beck Engineering Co., Ltd.—A petition for the winding up of this company has been presented by the Sloan Electrical Co., Ltd., of Conradty House, Golden Lane, E.C., and will be heard on June 15th.

Engraving on Celluloid.—One of the arts in which we have been largely dependent upon Germany is that of engraving on celluloid, and we understand that the great bulk of engineers' rules, scales and protractors were obtained from that source up to the commencement of the war. We are therefore glad to learn from the United Metal Engraving Co., Ltd., of 40, High Bridge, Newcastle-on-Tyne, that they have developed a process of engraving on white and clear celluloid which, they claim, is equal, or superior, to the German process. We have received samples of both kinds, a transparent protractor, which is a really beautiful piece of work, and a section of scales for a slide rule which merits high commendation. We trust that the result of the company's enterprise may be the capture of this important branch of German trade.

Fire.—An outbreak of fire at Carron Iron Works, at Falkirk, did considerable damage, the grinding mills and grinding shops, with valuable machinery, including large electric motors, being involved.

A Manchester Exhibition.—The Ironmongery and Hardware Trades' Exhibition, which was opened on June 3rd in the City Exhibition Hall, Manchester, is to close to-morrow, Saturday. Mr. L. A. McGeoch, president of the Ironmongers' Federated Association, Inc., is chairman of the Exhibition. The exhibits include the following :—W. & T. Avery, Ltd., weighing machines ; Carborundum Co., Ltd., abrasive materials ; Carron Co., electric stoves and cooking and heating apparatus ; Excelsior Fibre Co., Ltd., fibre goods ; E. O. Walker & Co. (electrical contractors and engineers) ; G. D. Gibson & Co., Ltd., electric vacuum cleaners ("Doty," "Duplex" and "Dumore"), and electric motors for sewing machines ; Eyre & Sons, Ltd., electric light fittings ; and the Falkirk Iron Co., Ltd., who are making electric cooking ovens, grills, toasters, fires and other like apparatus.

For Sale.—Salford borough electrical engineer invites tenders for the purchase of 10 miles, 1·2 sq. in., and 2 miles, 1·0 sq. in. single L.T. paper-insulated, lead-covered cable.

The British Gas Co., Bristol, have for disposal about 40 tons of carbon from vertical retorts. Particulars are given in our advertisement pages to-day.

Trade Announcements.—The sales and advertising departments of Messrs. Siemens Bros. Dynamo Works, Ltd., incandescent lamp and fittings department, Dalston, have now been transferred to 39, Upper Thames Street, E.C. From this address the combined lamp and supplies business will in future be controlled. The rearrangement has been made essential by the rapidly increasing turnover of Wotan and Tantalum lamps. Extensions in the manufacturing departments have been accomplished from time to time, and it will be remembered that exceptionally large premises at Shacklewell Lane were occupied some three years ago to provide store accommodation for the large stocks held by the company. Although this released a certain amount of space and temporarily eased the situation, the introduction of new types of lamps, including gas-filled lamps, demanded that further extensions should be made. As a result Dalston Works will now be devoted solely to lamp manufacture, and the output correspondingly increased. It is also hoped that the centralisation of the lamps and fittings selling organisations will prove to the convenience of customers. All correspondence relating to "Dalston" material should be addressed to 39, Upper Thames Street, E.C.

Messrs. Neville, Williams & Co. have disposed of their business as follows :—The Ensign electric fires, heaters and cooking apparatus to Messrs. Ikin & Eads, Ltd., 47, Marylebone Lane, London, W.C., who will continue the branch of the business under the same name and management, and who will accept responsibility for all outstanding guarantees for heater units, and will continue to supply Ensign electric fires and heaters ; the Varsulat varnishes, frosting and colouring lacquers and insulating materials to Messrs. Bi-Metals, Ltd., 57, Lant Street, London, S.E.

Mr. William Sweetmore, electrical engineer, of Heywood, Lancs., announces that he has removed to more central premises at 6, Market Street, Heywood.

Book Notices.—The *Journal and Transactions* of the Society of Engineers (Inc.), for May, contains a paper by Mr. A. H. Barker on "Heating and Ventilation" and a discussion thereon, both of which are of interest to electrical engineers, who are in possession of the ideal means of performing these functions.

The *Faraday House Journal* for the Summer term contains a "Note on the Third Harmonic in Transformers," by J. Goodman ; an article on "Interpolation," by Dr. Alexander Russell, and a variety of information regarding the fortunes of past and present students, including a supplementary list of those serving in the Allied Forces.

"Constant Voltage Transmission." By H. B. Dwight. London : Chapman & Hall. Price 5s. 6d. net.

Bankruptcy Proceedings.—T. Duesbury, Engineer, Electricity Department, Sutton Coldfield.—Receiving order made June 4th on creditor's petition.

J. W. & T. W. Tattersall (Tattersall & Tattersall), electrical engineers, late of Willesden Lane, London.—Discharge suspended for three weeks from May 11th, 1915.

Australia.—From the British General Electric Co., Ltd., of Australia, we have received a useful hanging wall map of Australia.

Catalogues and Lists.—Dowsing Radiant Heat Co., Ltd., 39 and 40, York Place, Baker Street, London, W.—24-page illustrated and priced catalogue relating to "Hot-point" irons for industrial (laundry, tailoring, dressmaking and millinery) and domestic use, also "Eadisk" cookers, and "Belenus" boilers, branders, soldering irons and several industrial heating devices. Copies of the catalogue will be forwarded on application.

Messrs. L. Andrew & Co., 2, Whitworth Street West, Deansgate, Manchester.—Price list of india-rubber hose, tubings, Leclanché and other batteries, bell wire, &c.

LIGHTING and POWER NOTES.

Australia.—In connection with the agreements entered into between the Sydney City Council and the Municipalities of North Sydney and Waverley, for the supply of electrical energy, the Electric Light Committee of the City Council has recommended that authority be given for the provision and laying of the necessary cables and high-tension network. The cost of the works proposed to be carried out in North Sydney is £31,000, and in Waveley, £10,500.—*Sydney Morning Herald.*

A company is being formed in Melbourne to take over the plant of the Toora (Vic.) Electric Light and Power Supply Co. and to extend the mains to Foster for the purpose of supplying electricity to the town. Under the new scheme it is proposed to utilise the Franklin River Falls, where there is an abundant supply of water, in lieu of the present gas suction plant.—*Tenders.*

Bangor.—Price Increase.—The City Council has adopted a recommendation of the Lighting Committee to increase the price of current for electric lighting to 6d. per unit.

Barrow.—Annual Report.—The report of the year's working of the electricity undertaking shows that the output had increased by 72 per cent. and the revenue amounted £26,585, as against £20,148 in the previous year. The gross profit was £12,718, compared with £8,689, the net profit £3,163, an increase of £2,650. The units sold reached 3,597,410, as against 2,081,317 in the previous year. The total cost per unit was 0·925d., as against 1·321d. in 1914.

Batley.—Loan Sanction, &c.—The L.G.B. has sanctioned the borrowing of £3,391 for the purposes of electric cable extensions ; the Electricity Committee recommends that the surplus on the revenue account of the electricity undertaking should be applied to clearing off the debit balance on the suspense account. In respect of the cable extensions, the representations made by the Council in London have been of such a character that the electric cable extensions to Healey, Carlinghow and Bradford Road West can be proceeded with.

Belfast.—A Sub-Committee of the Council has been appointed to consider the entire question of the electricity department and its reorganisation, and to report to a special meeting of the Council on or before the 24th inst.—*Belfast News Letter.*

Blackburn.—The Electricity Committee has decided to inform applicants for a supply of electricity in the Wilpshire district that, owing to the war, the Committee cannot see its way to proceed further with the matter at present.

Bradford.—Workhouse Lighting, &c.—The new electric lighting installation of the North Bierley B. of G., at Clayton, was formally opened last week. It had been considered that economy might be effected in regard to the lighting of the various buildings, the cost of gas for the previous five years being about £500 per annum. Two engines are being utilised of 18 and 40 B.H.P. respectively, and both can be used for driving the two 25-KW. dynamos or for laundry purposes. Current is supplied for 750 lights. The estimated cost of the installation is £1,260. Mr. T. Roles, the city electrical engineer, has acted as consultant for the scheme.

The Corporation Electricity Committee has decided to make a contribution of £10 for the current year to the funds of the Engineering Standards Committee.

Bredbury and Romiley.—The U.D.C. has consented to overhead wires being erected in connection with the supply of electricity to the district from Stockport, provided that the cables are laid underground when the Council requires it.

Burnley.—The L.G.B. having intimated that it would not be prepared at present to sanction the raising of any further moneys for the purpose of laying ordinary service cables, the E.L. Committee has decided that the cost of laying and connecting of services be paid out of revenue.

Cheriton (Kent).—Camp Supply.—The Military authorities have erected a generating station on St. Martin's Plain, and overhead wires have been carried over the public roads without any arrangement with the U.D.C. The Council has decided to communicate with the authorities on the matter, so as to fix responsibility should any accident arise from the live wires.

Chichester.—Restricted Lighting.—Owing to restricted street lighting, the Electricity Co. has allowed the T.C. a rebate of £100 on the public lighting contract, which has been cancelled. A new contract is based on a sliding scale of charges, according to the number of lamps used.

Colchester.—Year's Working.—During the last financial year, the Corporation electricity department sold 1,658,596 units, an increase of 25,000 on the previous year. The revenue for the year was £18,110, and the gross profit £7,813; the surplus after meeting financial charges, £813, was carried to reserve. It has been decided to increase all lighting charges by ½d. per unit.

Continental. — Spain. — Two concessions have been granted, according to *Industria e Invenciones*, for the establishment of hydroelectric works for the generation of electric current for local lighting purposes. The site of one of these stations is on the River Molins, near Tobera, in the province of Burgos, and of the other on the River Mundo, in the province of Albacete.

Doncaster.—Proposed Loan.—The L.G.B. has suggested that the Corporation's application for sanction to borrow £2,500 for electrical service mains be deferred.

Dover.—Proposed Loans.—The L.G.B. has sanctioned a loan of £1,000 for new services on condition that the money is spent on work for the Naval and Military authorities only. The cost of other connections will be met out of revenue. With reference to an application for a loan of £6,000 for a 1,000-kw. set, the L.G.B. has pointed out that the circumstances justify a smaller machine being installed. The T.C. has decided to let the matter stand over.

Annual Accounts.—The report of the Corporation electricity department for the year ended March 31st last shows total receipts amounting to £25,669, and a net profit, after payment of all outgoings, of £2,928. During the year 330,000 more units were sold than in the previous year.—*Dover Express*.

Dundee.—The report of the Corporation electricity department for the past year shows an increased revenue of £6,739 over the preceding year. Expenditure had increased to the extent of over £7,500. Dealing with the estimates for the current year, owing to the abnormal price of coal, &c., the expenditure is estimated at fully £13,000 over last year. From this must be deducted the net profit carried forward of £2,835. To cover the balance the estimates have been framed with 10 per cent. extra price on lighting, 10 per cent. on tramways supply, and 15 per cent. on power. The accounts and estimates were approved.

Durham.—Price Increase.—The Newcastle Electric Supply Co. has increased the price of current supplied in the city by ·02d. per unit for every 6d. by which the average quarterly cost of coal used is above 7s. per ton, or *pro rata* for smaller variations of cost.

Enfield.—Street Lighting.—As the North Metropolitan E.P. Distribution Co. has not responded to an invitation to submit proposals for street lighting by electricity, the U.D.C. has decided to ask the Tottenham District Light, Heat and Power Co. if it is prepared to continue the lighting for a further year from July 1st on the terms contained in the existing contract.

Frimley.—Prov. Order.—At a meeting of the D.C. on June 1st, it was reported that the York Town and Blackwater Gas Co. had written urging the advisability of delay in laying the E.L. cables; the Council decided not to acquiese in the company's proposed application to the B. of T. for an extension of time in which to carry out the obligations under the prov. order for E.L.

Gillingham (Kent).—The T.C. has decided to give a supply of current at ·7d. per unit to Messrs. Goldsmith, for the Rainham Cement Works, providing the firm undertakes the whole responsibility of laying the cable, the Council to have the option of purchasing the same.

Gloucester.—Loan Sanction.—The L.G.B. has, according to a local paper, telegraphed its consent to the request of the Electricity Committee for permission to lay a main, at a cost of £1,500, to supply the Gloucester Railway Carriage and Waggon Co., which is engaged on Government work.

Grays.—Increased Prices.—In order to meet the large increase in the price of coal, advanced wages, &c., the T.C. has increased the charges for current for lighting and power by 10 per cent. from July 1st.

Grimsby.—Year's Working.—During the year ended March 31st the Corporation electricity department sold 2,787,298 units, showing a slight increase on the previous year. The year's working resulted in a net profit of £2,817, as compared with £4,061 in the previous year, and after making certain appropriations to capital outlay and for war charges, a balance of £721 remains for disposal. The engineer, Mr. Vignoles, points out that the first six months of the year were very satisfactory, but judging from the last quarter, a serious loss in revenue from private consumers must be anticipated unless conditions change.

Hove.—The T.C. has been recommended to accept the revised terms of 5½d. and 1½d. per unit for the first and succeeding units respectively submitted by the Brighton Corporation for current supplied to Aldrington and is also recommended to increase the charge for current to consumers at Aldrington from 5d. to 5½d. per unit as from 30th inst.

Kendal.—The T.C., in consequence of the great increase in the cost of coal and other materials, has decided to advance the price of current to consumers for lighting by 1d. per unit, and to kinemas and to power consumers by ½d. per unit, the increase in each case being one-sixth.

Lancaster.—Year's Working.—The annual report of the electricity department for the year ended March 31st, shows that the revenue amounted to £9,111, as compared with £9,185 in the previous year. The total expenditure shows a reduction of £135; there was a decrease of 8,967 units sold for lighting, and of 20,741 units for power. The total net profit was £410, as against £348, and this has been carried to reserve.—*Lancaster Guardian.*

London. — Battersea. — The Electricity Committee reports having been in negotiation with the Fulham and Hammersmith B.C.'s, with a view to linking up the undertakings of the three municipalities. The estimated cost of laying two ·15 sq. in. mains between Battersea—Fulham—Hammersmith is £17,441, to be borne equally between the three Councils concerned. The Committee recommends an agreement being entered into; the Finance Committee recommends application being made to the L.C.C. for sanction to, and the advance of, a loan of £5,814, the Council's share of the estimated cost of mains.

Poplar.—The Finance Committee of the B.C. has considered the report of the Electricity Committee on the disposal of the net surplus of the electricity undertaking, for the year 1914-15. The Committee has deferred consideration of certain of the proposals, but recommends that the proposal to transfer £3,500 to the credit of the general fund be approved.

St. Pancras.—The Finance Committee of the L.C.C. has notified the B.C. that it is prepared to recommend the borrowing of £15,000 by the B.C. for a new 5,000-kw. turbine, subject to the B.C. agreeing to repay within one-half of the period now unexpired, the debt outstanding on the plant and machinery for which a term of 42 years has been granted, and which will on the introduction of the new machinery fall within the category of stand-by plant. The condition is not to apply to the 2,360-kw. of plant, which it is stated will be required for working plant in daily use. The recommendation of the L.C.C. is subject to the consent of Treasury.

The B.C. has decided to adhere to its previous decision in regard to the reduction of outstanding loan periods and points out that the proposed £15,000 expenditure is very urgent, as the B.C. has already incurred liability for the amount in question.

In connection with the completion of the loan of £22,530 for new boilers at King's Road electricity station, application is to be made to H.M. Treasury for consent to the borrowing of the amount as the additional boiler accommodation is very necessary.

Loughborough.—Year's Working.—The past year's working of the Corporation electricity undertaking resulted in a gross profit of £2,992, as against £2,759 in the previous year, and a net balance of £104 remained after meeting all charges, as against £392 in 1914. During the year 929,000 units were sold; the maximum load was 559 kw., and the connected load 1,505 kw. The motors connected totalled 910 B.H.P., and the works costs at ·836d. per unit represented a fall of ·108d. as compared with 1914.

Luton.—Plant Extension.—In view of the necessity of increasing the generating plant to provide security in the supply to many firms engaged in Government work, the engineer, Mr. Cooke, has advised, and the Electricity Committee agreed to, the purchase of a 3,000/3,700 kw. Ljungstrom turbine set, to be erected within six months, at a cost of £11,175. An additional air filter, cooling tower, and piping will bring the cost up to £14,450. Further, he recommends the erection of a sub-station and installation of two 500-kw. converters at a cost of £5,200; this building will provide accommodation for an additional 2,000 kw. of converting plant. High and low tension cables will also be required at an estimated cost of £6,000, making a total proposed expenditure of £25,650, the borrowing of which it is proposed to ask the L.G.B. to sanction.

Middleton.—Price Increase.—The Electricity Committee has increased the price of electricity from June 1st as follows:—For lighting purposes by ½d. per unit, for motor power purposes by 12½ per cent.

Midhurst (Sussex).—The Midhurst and District Electric Supply Co. has applied to the B. of T. for consent to use 400-volt overhead transmission lines at Midhurst, Easebourne and West Lavington.

Manchester.—The Ratepayers' Association has forwarded a letter to the Treasury urging that sanction should not be given at present to the carrying out of the £500,000 electricity scheme at Barton, as it would tend to draw skilled labour from work more immediately necessary for the prosecution of the war.

Morley.—Year's Working.—The annual report of the borough electrical engineer shows that the total expenditure for the past year was £2,284, as compared with £2,228 during the previous 12 months. There was a gross profit of £1,640 on a total revenue of £3,925, but after payment of interest on loans and sinking fund charges there was a net deficit of £301, as against £443 in the previous year.

Northampton.—New Power Station.—The Finance Committee of the T.C. has considered the proposals of the Northampton Electric Light and Power Co. to construct a new generating station on land on the south side of the river, opposite Midsummer Meadow. The Committee states it has no desire to hamper the operations of the company, but as the greater part of the receipts of the undertaking are, and will continue, to be derived from consumers in the borough, and the borough funds will receive no benefit from the rating of the proposed station, which will be virtually wholly situated outside the borough ; it has directed the town clerk to notify the B. of T. that the proposals are open to objection from this point of view, and to draw the attention of the company to the nuisance which might arise from smoke from the chimney stacks of the projected generating station.

Oulton Broad.—Restricted Lighting.—With reference to the rebate for street lighting, which has been previously referred to in the Electrical Review, the U.D.C. has offered the Electricity Co. 60 per cent. of its account during the time the restricted lighting is in force. This, it is understood, is acceptable to the company.

Peterborough.—Year's Working.—The accounts of the electricity undertaking for the year ended March, 1915, show that the revenue amounted to £10,393, as against £10 231 in the previous year ; the total working expenditure was £5,647, against £5,415. With interest, provision for repayments and capital expenditure out of revenue, the capital expenditure was £7,217 for the year.—*Peterboro' Standard.*

Reigate.—Infirmary Lighting.—The B. of G. has decided to adopt electricity for lighting the new infirmary ; inquiries will be made of the T.C. as to rates for supply.

Rochdale.—Proposed Loans.—It is proposed that application be made to the L G.B. for sanction to the borrowing of £4,400 for electricity mains. The Board is also to be requested to consent to the borrowing of £20,171, to cover the amount payable to contractors on existing contracts, the whole of the expenditure having been sanctioned by the L.G.B. in March, 1914.

Rotherham.—Loan Sanction.—The Treasury has sanctioned the borrowing by the Corporation of £8,400 for the purchase of two water-tube boilers for the electricity undertaking.

St. Annes.—Year's Working.—The annual report of the electricity works states that the revenue for the year amounted to £12,055, compared with £11,725 for the previous year. The total working expenses amounted to £6,573, compared with £6,211, and the total expenditure to £7,787, leaving a gross profit of £4,268. The gross profit was equal to 7'84 per cent. on the capital outlay at the commencement of the year. During the year 1,191,703 units were sold.

St. Helens.—Year's Working.—The charges for electricity are to be increased by 10 per cent. from July 1st.

The revenue from the undertaking for the past year amounted to £30,179, and the total expenditure to £29,641, there being a net profit of £538.

Shipley.—Year's Working.—The income from the electricity undertaking for the past year was £13 226 and the expenditure £13,629, leaving a deficit of £403. The deficit is due to increased wages and assessment and heavy expenditure on new plant.

New Plant Inaugurated.—Last week two new turbo-alternators were formally started up at the electricity works, and will replace the four original turbine sets. The new plant will halve the unit steam consumption of the original machines and facilitate supply to local factories.

Stretford.—During the past year the total number of units generated was 2,782,600, as compared with 2,726,355 in the previous year.

In connection with the lighting of Longford Hall, a cable is to laid from the street mains to the hall, at an estimated cost of £50.

Swansea.—Year's Working.—The annual report of the Electric Lighting and Tramways Committee for the year ended March 31st last, shows a total income amounting to £33,297, as against £32,986 for the previous year. The total works expenditure was £18,965, as against £18,562, including an allowance of £397 to men on military service ; there was an increase of £1,400 on the loan charges, and the net result of the year's working was a profit of £1,786, as against £3,312 for 1914. The reserve fund amounts to £8,996. The profit has been carried to the rate account.

Tasmania.—The contracts made by the Hydro-Electric Co. have now been transferred to the Government, and Mr. Dickinson, of Messrs. Alfred Dickinson & Co., has accepted the position of consulting engineer.

The question of the utilisation of the power derived from this scheme has been under consideration, particularly in connection with the proposed electrical treatment of the Blythe River and other iron deposits. Owing to the large outlay that would be necessary for a steel rail-making plant, and in view of the fact that the Newcastle works are to specialise in that direction, attention has been directed to the possibilities of producing other marketable lines, such as steel fencing wire. It is assumed that a charge of £2 per H.P. per annum would pay the cost of the transmission line, and that on this basis the cost of manufacture would be less than by blast furnace smelting.—*Commonwealth Engineer.*

Tunbridge Wells.—Loan Refused.—The L.G.B. has refused consent to a loan for additional boiler plant and a new cooling tower at the Corporation electricity works, on the ground that there is no immediate necessity for the work. The Board has also decided to cancel £1,696—portion of a loan of £6,658 sanctioned on November 14th, 1907, and not expended.

Wakefield.—The Council has resolved to discontinue its opposition to the Stanley Electricity Order before Parliament.

The Council has also decided to apply to the L.G.B. for sanction to borrow £4,000 for the remodelling and extending of the destructor plant.

L.G.B. Inquiry.—An inquiry has been held concerning the application to borrow £4,000 for extensions of the electricity undertaking. It was estimated that the sum asked for would meet the requirements of the department for two years. There was no opposition.

Weaverham.—The Weaverham Electric Supply Co., Ltd., has entered into a contract with the Weaver Refining Co., Ltd.. Acton Bridge, for a minimum supply of 50,000 units per annum for three years.

West Bromwich.—The T.C. has decided to increase the price of electricity to all consumers 20 per cent. in order to meet the extra cost of materials and wages.

TRAMWAY and RAILWAY NOTES.

Ashton-under-Lyne.—A deputation representing the tramwaymen employed by the three authorities in the Ashton district, waited upon the authorities on the 4th inst., with a view to getting them to reconsider their refusal of an application for an increase of wages. It is understood that the authorities decided to adhere to their previous decision.

Blackpool.—Women Conductors.—Some [illegible] employés of the Tramways and Electricity Department are now on war service, and six men are on munitions service. The Tramways and Electricity Committee has authorised the engagement of 12 women conductors, authority also being given to increase the number in the event of these being insufficient. The women conductors will receive the same rate per hour as youths receive during their first year of service as conductors, but their hours will probably be shorter.

Bolton.—War Bonuses.—The application of the local branch of the Amalgamated Association of Tramway and Vehicle Workers for a war bonus of 2s. 6d. per week for motormen, overhaulers, cleaners and day labourers, has been refused. Other alleged grievances of the men have been referred to the manager and the representatives of the Association for mutual adjustment.

Bradford.—Year's Working.—The working of the Corporation tramways during the year 1914-15 shows a net profit of £32,500, as compared with £29,500 the previous year. The total income was £305,000, an increase of £8,000 on 1913-14, representing 11¼d. per car-mile as compared with 11½d. The expenditure totalled to £272,500, and included an item of £2,800 for war allowances. Rates and taxes were reduced by £2 000 on account of reassessment of the undertaking. The total mileage run was 6,372,000, as against 6,256,000. In connection with the Corporation's railless system, there was an increase in receipts of £2,800 consequent upon the opening of new routes in the city ; the total income was £4,316 (5¼d. per car-mile), as against an expenditure of £6,016 (8d. per car-mile), there being therefore a deficit of £1,700, as compared with £411 a year ago. During the year renewal of track absorbed £22,[illegible] as against £[illegible]. The reserve and renewals account now stands at £75,208, and the total capital expenditure at £1,052,000, of which £440,000 has been repaid.

Burnley.—War Bonuses.—An application by the Corporation's tramway employés for a bonus of [illegible] per week has been refused by the Tramways Committee, and the refusal has been confirmed by the General Purposes Committee.

Doncaster.—Proposed Loan.—The B. of T. has intimated to the T.C. that it is unlikely that the loan of £8,550 applied for for the tramway undertaking will be sanctioned.

London.—On Monday last a collision occurred between two L.C C. cars near the main gates of the Arsenal at Woolwich. Eleven people were injured, three seriously.

One effect of the recent strike of L.C.C. tramwaymen was a decrease in receipts in two weeks of [illegible] as compared with the same period of last year.

A new tube station at Maida Vale has been opened on the line from Paddington to Queen's Park. The station is entirely staffed by women.

Manchester.—The Tramways Committee has decided not to accede to an application from the Municipal Employés' Association for an advance of wages on behalf of certain grades of workmen in the employ of the department.

At the City Council, on Tuesday, it was stated that the number of Corporation tramway employés who had joined the Colours was 1,925, and in a few weeks it would be 2,000. The cost to the city was now £1,316 per week.

Rochdale.—The building of the new car-shed has had to be postponed owing to the impossibility of obtaining a loan for the purpose.

Sheffield.—Women Conductors. — The Corporation tramway department has decided to employ women car conductors and cleaners. Already 80 women have specially volunteered for this class of work.

The general manager of the undertaking has been requested by the Municipal Tramways Association to act as its representative on the Electric Vehicle Committee of the I.M.E.A.

Sunderland.—The Corporation Tramways Committee has decided to engage 12 women as car conductors.

Stalybridge.—The Dukinfield T.C. has decided to petition against the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board's Bill in the House of Commons.

West Ham.—Year's Working.—There is a surplus of £272 on the working of the tramway undertaking of the Corporation during the year ended March 31st last. It is proposed to transfer this sum to the reserve and renewal funds. The expenditure amounted to £119,935, and the income credited to the revenue account to £152,212, which includes £3,786 in respect of receipts due from other authorities in connection with through running. It has again been found necessary to realise part of the investments to cover the cost of renewals, &c. The investments at March 31st stood at £15,613, after the foregoing realisations, but the whole of the reserve and renewals fund has now been earmarked for various purposes.

The B. of T. has given its sanction to the borrowing of £1,560 for the replacement of the controllers on the tramcars. In view of the desirability of confining fresh capital expenditure at the present time within the narrowest possible limits, the Corporation has been recommended, at the request of the L.G.B., to postpone the purchase of the 15 new tramcars until after the war.

TELEGRAPH and TELEPHONE NOTES.

A Telegraph Spy Charge.—Abdon Jappe, a Dane, was remanded at Plymouth on Tuesday on charges of attempting to elicit for the enemy information respecting warships, and of possessing apparatus capable of tapping telegraphic and sending telephonic messages.

Australia.—The Post Office accounts for 1913 and six months of 1914 show a deficit on working of £53,547, as compared with £20,081 for the previous year. After charging interest, pensions, &c., the total loss was £501,456, compared with £407,102. The increased deficit was largely due to arbitration awards affecting postal electricians and linemen. There were 132,699 telephones in use in the Commonwealth, and in five of the six States automatic exchanges had been opened or were under construction. A loss of £151,446 was incurred on the telegraph branch, but the most serious loss was due to the telephone service, amounting to £296,424. Wireless telegraphy showed a deficiency of £35,656, compared with £11,599 in the previous year.

The capital expenditure on telephone lines and equipment, exclusive of trunk lines, was £1,125,625, and on telegraph and telephone trunk lines £267,242. The working expenditure in the telephone branch was £1,079,461, an increase of £149,549. A Committee was appointed to inquire into the large deficiency in connection with the telephone service, and its report is now under consideration; it is stated that immense economies are possible.

In accordance with the scheme approved by the International Time Commission of Paris, Melbourne radio-station is now transmitting time signals at the hours of noon and midnight, Melbourne time—which is 10 hours ahead of Greenwich mean time.—*Wireless World.*

Canada.—Our correspondent writes:—1,136 telephone companies have made returns for 1914, compared with 1,075 in 1913. The miles of wire now in use amount to 1,343,090, an increase of 250,563 over 1913. In 1914, the urban mileage amounted to 926,947, the rural to 380,142. There is 1 mile of telephone wire for every six of population. The number of telephones in use is 521,144, or one for each 15·5 of population. There is no other country, except the United States, which can show so high a ratio.

China.—The Government proposes to carry out an extensive plan for the installation of wireless telegraphy, especially in the North-Western provinces.—*Eastern Engineering.*

Pacific Cable.—The story that an attempt had been made to cut the cable at Bamfield, B.C., has been officially contradicted.—*T. and T. Age.*

Trans-Atlantic Wireless.—Wireless communication between the United States and Germany has been severely handicapped lately by static conditions prevailing in the North Atlantic at this season of the year. The wireless station at Sayville, L.I., has been frequently isolated from the sending plant at Nauen, Germany. The same conditions exist at the Tuckerton, N.J., plant. Such messages as are received at Sayville are, for the most part, fragmentary, or often impossible to decipher.—*T. and T. Age.*

United States.—The first daylight message from the new naval radio station at Darien, in the Panama Canal Zone, to the Navy radio station at Arlington, near Washington, was received on April 30th. The distance is 2,000 miles. The sending and receiving radius of the new Darien station is 4,000 miles. The radio installation at the Darien station is on the Poulsen arc system, and this station will be the most powerful in the world using exclusively this type of equipment. Since the United States Navy has been in temporary control of the German radio station at Tuckerton, the Poulsen arc system has been installed at that point and is being successfully used in communicating in daylight, as well as by night, with the station at Eilvese, Germany, over a distance of about 4,000 miles. The number of words handled each week averages about 10,000.—*Electrical Review (U.S.A.).*

Wireless Injunction.—The U.S.A. Circuit Court of Appeals has affirmed the order of Judge Hough, granting a preliminary injunction restraining the De Forest Radio-Telephone and Telegraph Co., the Standard Oil Co., of New York, and Lee De Forest from infringing the fundamental Marconi and Lodge patents relating to wireless telegraphy.—*T. and T. Age.*

Wireless Amalgamation?—According to the *Financial News*, the presence of Mr. S. F. St. J. Steadman on the board of the new Poulsen Wireless Co., the registration of which was announced in our last issue, is very significant. Mr. Steadman is the private legal adviser of Mr. Godfrey Isaacs, and his new directorship coincides with reports that the relations between the Government and the Marconi Co. are not so intimate as they were, and that in future the Poulsen system is likely to occupy a more prominent position than formerly. It suggests that "the Poulsen people are tending to coalesce with those who control the Marconi Co."

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—Aug. 11th. One 1,000-kw. D.C. generator complete, liquid starter, &c., for City Council. See "Official Notices" June 4th.

Adelaide.—July 14th. Galvanised-iron wire, for P.M.G.'s Department. See "Official Notices" June 4th.

Sydney.—July 19th. City Council. Meters for the Electric Light Department, Town Hall. Specification 10s. 6d.

July 19th. City Council. Maximum-demand indicators. Specification (10s. 6d.) from Electric Light Department.

July 19th. Steel towers for 33,000-volt transmission line. Specification (10s. 6d.) at E.L. Department, Town Hall.

July 21st. N.S.W. Government Railways and Tramways Department. One 250-k.v.a. turbo-generator.*

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Batley.—June 16th. 1,500 tons of pea nuts (washed) for the Corporation electricity station. Manager, Electricity Works.

Belfast.—June 16th. Corporation. Six or 12 months' supply of steam coal (23,000 or 45,000 tons respectively) for the electricity works. Forms of tender from Mr. T. W. Bloxam, City Electrical Engineer.

Colchester.—June 15th. Steam coal (about 5,500 tons), for the Corporation Electricity Works. Mr. W. Frisby, Electrical Engineer.

Ealing.—June 21st. Coal for the T.C. Electricity Works. Mr. J. Douglas Knight, Electrical Engineer and Manager.

Eastbourne.—June 26th. 160 ft. of 14-in. cast-iron circulating water piping and valves. See "Official Notices" to-day.

Edinburgh.—June 21st. Two 5,000-kw. turbo-alternators and condensing plant, for Portobello supply station. See "Official Notices" May 21st.

Exeter.—June 14th. Corporation. Three or six months' supply of steam coal, for the Electricity Department. Specification from the Town Clerk.

Glasgow.—June 16th. Corporation. 145,000 tons of coal (singles and pearls) for the electricity generating station. Specification from Mr. W. W. Lackie, 75, Waterloo Street.

Kirkcaldy.—June 14th. Corporation. 100 half-watt 1,000-c.p. lamps and lanterns for street lighting. See "Official Notices" May 28th.

Lancaster.—June 19th. Corporation. Six, nine, or 12 months' supply of coal and slack for the electricity works Forms of tender from Mr. J. B. Patterson, Electricity Works.

London.—St. Pancras.—June 14th. Corporation. Twelve months' supply of Welsh and steam coal for the electricity stations.

Metropolitan Asylums Board.—June 30th. Lighting installation at the Grove Fever Hospital, Tooting Graveney, S.W. See "Official Notices" to-day.

Fulham.—June 30th. 11,000 tons of coal, for the Borough Electricity Works. See "Official Notices" to-day.

West Ham.—June 14th. Installation of lighting and water-heating apparatus at Knox Road Special School, for Education Committee. See "Official Notices" May 28th.

Manchester.—June 16th. 40-kw. steam dynamo for Cottage Homes, Styal, for Manchester Union. See "Official Notices" June 4th.

Maidenhead.—Coal for the T.C. electricity works for year ending September 30th, 1916.

Plymouth.—June 24th. 13,500 tons of steam coal for the Electricity Department. Specification from the Electrical Engineer.

Rangoon.—August 11th. Installation of a system of fire-alarms, for the municipality. Specification (10s.) from Messrs. Ogilvy, Gillanders & Co., 67, Cornhill, E.C.

Redditch.—June 14th. h.t. three-phase switchboard. See "Official Notices" May 28th.

Shrewsbury.—June 18th. Corporation. Twelve months' supply of best rough slack and best steam coal, for the Lighting Committee. Particulars from Mr. C. M. Johnston, Engineer and Manager.

Tasmania.—Launceston.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Hobart.—July 5th. Lead-covered telephone cables; glassware and other material for batteries; telephone instruments, &c., for P.M.G.'s Department. See "Official Notices" May 28th.

Warrington.—June 18th. e.h.t. cable, for Electricity and Tramways Committee. See "Official Notices" to-day.

Wigan.—June 21st. Corporation. Two water-tube boilers with mechanical stokers. See "Official Notices" to-day.

CLOSED.

Australia.—The following contracts have been placed:—

P.M.G.'s Department, South Australia.—
  28 tons galvanised iron wire, 400 lb. per mile, £20 5s. per ton.—R. Johnson, Clapham & Morris.
  51 tons h.d. copper wire, 200 lb. per mile, £96 per ton.—B.I. & Helsby Cables, Ltd.

Victorian Railways Dept. (Electrical equipment of Melbourne suburban system.)—
  Track, feed-boxes, signal transformers, switchgear, &c., £15,512.—A. Reyrolle & Co., Ltd.
  Electrically-operated car-shed cranes, £4,480.—Chambers, Scott & Co., Ltd.
  Track bonds, £7,085.—B.I. & Helsby Cables, Ltd.
  Fuse, distribution boxes and fuses (Schedule rates).—Siemens Bros. Dynamo Works, Ltd.

N.S.W. Railways and Tramways Dept.—
  Electrically-driven capstans for Bullock Island, £4,682.—Meadowbank Manufacturing Co.

—Tenders.

P.M.G.'s Department, South Australia.—
  22,800 insulators, porcelain.—F. Kanematsu, £581.

P.M.G.'s Department, Victoria.—
  Accumulator battery, Tudor type, for Perth, W.A., £322.—J. R. W. Gardham.
  Three miles cable, paper-insulated, 104 pairs, £392 per mile; three miles cable, paper-insulated, 39 pairs, £223 per mile.—British Insulated and Helsby Cables, Ltd.

Sydney Board of Water Supply.—Ryde pumping station, one steam turbine and condenser, Mobbs' Hill pumping plant.—
  Willans & Robinson, £4,041.
  William Adams & Co., £5,166.
  Belliss & Morcom, £4,376.
  Australian General Electric Co., (a) £4,375, (b) £4,917.
  Standard Waygood Hercules, Ltd., £5,500.
  Falkiner Electric Co., (a) £5,250, (b) £5,965, (c) £5,390, (d) £5,210, (e) £4,675, (f) £4,490.
  Haes & Eggers, (a) £3,867, (b) £4,685, (c) £4,896, (d) £5,575, (main tender) £4,216.

The Engineer-in-chief recommends the acceptance of Messrs. Willans and Robinson's amended tender for £4,289.

Sydney City Council.—Street lamp fittings—
  British General Electric Co., alternative £816, formal tender £1,035.
  Aust. General Electric Co., alternative D £1,107, alternative B £1,295, alternative C £1,249, alternative C1 £1,870.
  W. G. Watson & Co., formal tender £1,399.
  Aust. General Electric Co., formal tender £1,487.
  W. G. Watson & Co., alternative A £1,458.
  Aust. General Electric Co., alternative B1 £1,543.
  W. G. Watson & Co., alternative B £1,706.
  Aust. General Electric Co., formal £1,742.
  W. G. Watson & Co., alternative D £1,764.

Aust. General Electric Co.'s tender alternative B1, amounting to £1,543, recommended for acceptance.

Nitra incandescent lamps.—
  Lawrence & Hanson, for lamps manufactured in Holland, £481.
  Aust. General Electric Co., for lamps manufactured in America, £481.
  W. G. Watson & Co., for lamps manufactured in Holland, £584.
  Aust. General Electric Co., for lamps manufactured in England, £556.
  British General Electric Co., for lamps manufactured in England, £875.

Aust. General Electric Co.'s tender for £481 recommended for acceptance.

Transformer testing apparatus.—
  Aust. General Electric Co., £269.
  Haes & Eggers, £329.
  Aust. General Electric Co.'s tender recommended for acceptance.

Insulator pins.—W. G. Watson & Co., Ltd., £64; W. Elder & Co., £100; Storey & Keers, £100, J. Sonnerdale & Son, £129, W. Adams & Co., £283. Messrs. W. G. Watson & Co.'s tender recommended for acceptance.

Bradford.—The Tramways Committee has accepted the tender of the M. & G. Truck and Engineering Co., Ltd., for 100 tramcar trucks at £87 each, and Messrs. Brown, Boveri & Co., Ltd., for 200 tramcar motors at £110 each.

The Electricity Committee has accepted the offer of Messrs. Hayward Bros. & Eckstein, Ltd., London, for glass flooring (switchboard lights) at Valley Road Electricity Works, at £118; also that of the British Westinghouse Co. for two oil switches.

Caledonian Railway.—The Edison & Swan United Electric Light Co., Ltd., has received a contract for Royal Ediswan lamps.

Chelmsford.—The Essex Education Committee has accepted the tender of Mr. E. C. Porter for the E.L. installation at the County High School for girls, Chelmsford, at £73.

Crewe.—The T.C. has accepted the tender of Messrs. J. Simon & Sons for best Great Row slack coal for the electricity works, at 16s. 10d. per ton, subject to satisfactory tests.

Darwen.—The T.C. has accepted the tender of Messrs. G. B. Leach & Sons for coal for the electricity works for one year.

Dartford.—The U.D.C. Electric Supply Committee has accepted the offer of Messrs. E. J. & W. Goldsmith, Ltd., to supply 890 tons of Rubbly Culm, at 19s. 6d. per ton delivered.

Hull.—The Education Committee received 10 tenders for the electric lighting installation and fittings for the new girls' secondary school. That of Messrs. T. W. Vaughan & Co., Ltd., London, at £1,009, has been accepted. It was pointed out that the tender was £400 less than any other, and it was suggested that a mistake had been made.

Leigh.—The following tenders have been provisionally accepted:—

Rotary converter, £895.—Bruce Peebles & Co., Ltd.
Switchgear, £71.—Switchgear & Cowans, Ltd.
Stirling boiler, £2,044.—Stirling Boiler Co., Ltd.
Underfeed stoker, £408.—Underfeed Stoker Co., Ltd.

Meter Contracts.—The Wallasey Council has placed a contract for 12 months' supply of single-phase meters with the Electrical Apparatus Co., Ltd. The St. Annes U.D.C. has made a contract with the same company for 100 d.c. house-service meters during the next 12 months.

Messrs. Chamberlain & Hookham, Ltd., have received contracts for meters for the coming year from Paisley and Wallasey.

The British Thomson-Houston Co., Ltd., has received a contract from Wallasey County Borough for 12 months' supply of s.p., a.c. house-service meters. Messrs. Ferranti, Ltd., have secured a contract for annual supply of a.c. meters for the same Corporation.

Sheffield.—The following tenders have been accepted by the Electricity Supply Committee:—

Underfeed Stoker Co., Ltd.—Renewal of mechanical stokers at Neepsend, £3,165.
Bradshaw & Co.—Two natural-draught water-cooling towers, including foundations and all fittings and accessories, £8,514.
E. Taylor, Ltd.—Excavations and building of reinforced concrete retaining wall at Neepsend, £2,246; also excavating trench and laying 21-in. cast-iron drain pipe, £699.

The tender of Messrs. Brown, Bayley's Steel Works, Ltd., has been accepted by the Tramways Committee for the supply of 500 steel tramcar tires.

Stockport.—The following tenders have been accepted by the Electricity Committee:—

W.I. water-piping for exhaust, and 1,250 new stoker links.—Babcock and Wilcox, Ltd., £85 and £26.
Oil filter.—C. C. Wakefield & Co., £13 10s.
Stanchions for new crane.—Leah & Rowbotham, £109.
Patent roof-glazing, engine-house extension.—Mellowes & Co., Ltd., 1s. per sq. foot.
a.c. testing set.—Eckstein, Heap & Co., Ltd., £41.
Feed-water heater, with separator.—Worthington Pump Co., Ltd., £144.
20-in. valve for circulating pump.—Alley & MacLellan, Ltd., £19.
Circulating water screens.—F. W. Brackett & Co., Ltd., £100.
5-b.h.p. motor for driving screening apparatus.—McClure & Whitfield, £31.

The Health Committee has accepted tenders of Messrs. McClure and Whitfield for electric lighting, at £58 and £22 respectively.

Sunderland.—The T.C. on Wednesday accepted the following tenders:—

British Thomson-Houston Co., Ltd.—Bearings for split-pole rotary.
Doulton & Co.—Stoneware insulators.
Key Engineering Co.—Cable ducts.
B.I. & Helsby Cables, Ltd.—E.H.T. cable and copper strip.

FORTHCOMING EVENTS.

North of England Institute of Mining and Mechanical Engineers.—Saturday, June 12th. At 2 p.m. At Newcastle-on-Tyne. General Meeting.

Salford Technical and Engineering Association.—Saturday, June 12th. At 3 p.m. Visit Stuart Street Power Station, Manchester.

Point Five Association.—Thursday, June 17th. At 7 p.m. At Trinity House, Oxford Street, W. Meeting.

Incorporated Municipal Electrical Association.—June 17th and 18th. At Institution of Electrical Engineers, Victoria Embankment, W.C.

Thursday, June 17th.—At 10 a.m. and 2.30 p.m., reports, 5 p.m. parade and demonstration of electrical vehicles.

Friday, June 18th. At 9.30 a.m., Council Meeting; at 10 a.m., Annual General Meeting.

NOTES.

Merchandise Marks Act Prosecution: Summonses Withdrawn.—Before Sir John Knill, at the Mansion House Police Court, on Wednesday, the British Thomson-Houston Co., Ltd., of Mazda House, Upper Thames Street, appeared to answer an adjourned summons charging them with having, on March 5th, unlawfully applied to the "one only electrophone," a certain false trade description, viz., the "one only B.T.H. Electrophone," contrary to the provisions of the Merchandise Marks Act (1887). A second summons charged the defendants with selling an electrophone to which a false trade description had been applied.

Mr. Bodkin, for the prosecution, said that, as the result of a consultation, the Alderman would not be troubled further with the case. Mr. Hammer, at whose instance these proceedings were brought, as the owner of the designs and patents which were mentioned on the last occasion, was advised, whether rightly or wrongly in law, that he was obliged to take these proceedings in order to prevent the further dispersal of these instruments, which contained his registered designs and patents, in order to preserve his rights therein, and to let it be generally known that he was not personally acquiescing in the dispersal or distribution of these instruments by way of sale. The defendant company fully appreciated this position, and they had made certain arrangements which were entirely acceptable to the prosecution. In view of this, he (Mr. Bodkin) would like to say that, so far as they were concerned, for the reasons he had indicated, there must not be any expressed or implied reflection upon the British Thomson-Houston Co., Ltd., for any part they had taken in the distribution of these articles. In the circumstances he asked leave to withdraw the summonses.

Mr. Hunter Gray, for the defence, said that, in the course of the last hearing, some question was raised as to the B.T.H. Co. having a factory in Berlin. This was not so. In point of fact these instruments came from an English company incorporated in this country, who have a branch in Germany. They were made by them and sent to the defendant company.

Mr. Bodkin: The question of a sub-contractor now explains the contradiction.

Sir John Knill: I am pleased, indeed, to hear what you have said. The summons will be withdrawn.

Fatalities.—Falkirk.—Sheriff Moffatt conducted an inquiry into the cause of death of John McClumpha, engineer, who was employed in No. 1 pit, Polmaise Colliery. It was stated that he met with his death while engaged in repairing an electric coal-cutting machine. When the repairs had been nearly completed the machine was set in motion before McClumpha got clear and he was caught by the teeth of the cutting disk, sustaining injuries which proved fatal on the spot. The jury returned a formal verdict in accordance with the evidence.

Kirkcaldy.—By falling from a gangway, James Philip (28), an electrician, was instantaneously killed while engaged in installing a system of electric lighting in the new cork mill of the North Linoleum factory, at Kirkcaldy. He was employed by Messrs. Melville, Robb & Scott, electrical engineers, Kirkcaldy.

Brighton.—According to the Press reports of the inquest into the death of Ernest Percy Belcher, aged seven, who was killed on Volk's (Brighton) electric railway, one of the directors said that strong wire netting was placed at two parts of the line, but youngsters brought pliers and cut it. Expert evidence was given to show that the maximum pressure never exceeded 170 volts. No accident like the present one had ever before occurred on the railway. The jury agreed that the line should be fenced on the south as well as on the north side, and that notices warning persons against crossing it at other than the recognised crossings should be erected. The company, it was stated, were prepared to do everything in their power towards making the railway safer. A verdict of "Accidental death through coming into contact with a live rail" was returned. There was no culpable negligence.

I.M.E.A. Development Committee.—At the last meeting of the Committee, held on April 16th, a report was received from the Publicity Sub-Committee on the work done with regard to a preparatory scheme for the production of printed matter on a co-operative basis.

Mr. Dunlop, on behalf of the B.E.A.M.A. Council, offered the use of offices and clerical assistance in connection with the routine work of purchase and distribution of such printed matter, at least during the early stages of the work, and the Committee expressed its appreciation of this offer.

It was resolved that Mr. Courtenay, of the General Electric Co., should act on the Publicity Sub-Committee in place of Mr. C. Palmer, at present on active service.

A report was received from the Electrical Installations Sub-Committee, and considered.

A report was also received from the Domestic Appliances Sub-Committee, outlining a preliminary scheme for certain technical investigations which the Committee hopes to put in hand at an early date.

The Committee recommended the inclusion of Mr. Shaw, of Worcester, and Mr. Wilmshurst, of Derby, as members of this Sub-Committee, also that from time to time members of manufacturing firms should be co-opted for advice and assistance in regard to specific objects which might be considered helpful to the work of the Development Committee.

In discussion it was pointed out that although depletion of staffs and restrictions placed on borrowing money must considerably hamper development work, yet there remained with most undertakings a large amount of new business to be obtained with very little expenditure, and therefore there still existed room for selective canvassing and publicity work which might be directed to helping manufacturers and traders under the present difficult conditions, if electricity supply were put forward more particularly in regard to power, on the strength of its real time and labour-saving advantages, and not merely as an improvement on existing conditions.

The Secretary reported the correspondence he had had with Mr. Wakeman, Society for Electrical Development, New York, and the Committee instructed him to thank Mr. Wakeman for material sent and offers of assistance and co-operation, which the Committee appreciated very much, and to express the hope that under more favourable conditions in the near future further development in this direction might become possible.

The next meeting will take place on June 16th.

Institution and Lecture Notes.—Physical Society of London.—At the meeting held on May 28th, a paper "On Numerical Relationships between Electronic and Atomic Constants" was read by Dr. H. S. Allen, and one "On a Method of Calculating the Absorption Coefficients of Homogeneous X-Radiation" was read by Mr. H. Moore.

Two experiments illustrating novel properties of the electron currents from hot metals were shown by Prof. O. W. Richardson. The first demonstrated the cooling of a tungsten filament when an electron current was allowed to flow from its surface. This effect is analogous to the cooling due to latent heat when a liquid evaporates, or to the similar phenomenon due to the heat of reaction when a gas is emitted by chemical decomposition of a solid.

The second experiment demonstrated the flow of electron currents from a hot filament to a surrounding cylinder against various opposing P.D.s up to about 1 volt. The data can be used to find the velocities of the emitted electrons.

A short account of recent experiments on High Permeability in Iron was given by Prof. Ernest Wilson.

Liverpool Engineering Society.—Prof. E. W. Marchant has been elected chairman for the coming year.

Association of Consulting Engineers (Incorporated).—The annual general meeting was held at Caxton Hall, Westminster, on Monday, May 31st, 1915, Mr. G. Midgley Taylor presiding. The chairman moved the adoption of the report of the Committee, and stated that the Association had recently elected several prominent engineers to membership, and from what could be gathered by conversation with consulting engineers generally, the Association was held in high esteem. It was evident that the Association occupied a very strong position, and in course of time, when its usefulness became better known, it was anticipated that it would include in its ranks the majority of the consulting engineers not only in Westminster, but also in the United Kingdom. One of the heaviest tasks undertaken by the Committee was a consideration of the Model General Conditions of Contract issued by the Institution of Electrical Engineers, to which considerable objection had been taken. It was felt that general conditions of contract should be applicable to contracts generally, and that works pertaining to the electrical branch of the profession should not require any special treatment. The objections were communicated to the Institution of Electrical Engineers, and the Association was thanked for its views.

During the past year the Book of Professional Rules and Scale of Fees had been revised, and, judged by the number of applications received for the book, not only from members of the Association, but from Government departments and the engineering profession generally, it had been found of great general utility.

Although membership of the Association was confined to principals of firms, there were no fewer than five of its members serving with His Majesty's Forces.

The adoption of the report was seconded by Mr. W. J. E. Binnie, and carried unanimously. The hon. treasurer, Mr. S. R. Lowcock, then presented his report, showing a balance in excess of expenditure of £65, compared with £13 last year.

Four London and two country members of the Committee having retired by rotation, the ballot for new members resulted as follows:—

The four London members elected were Messrs. W. Ll. Preece, W. J. E. Binnie, Ernest L. Mansergh, and E. Brough Taylor. The country members elected were Messrs. Walter Emmott (Halifax), and F. W. Hodson (Loughborough).

The report shows that six new members have been elected during the year, and the membership now stands at 74.

American Institute of Electrical Engineers.—On May 18th, Mr. John J. Carty, chief engineer of the American Telephone and Telegraph Co., was elected president of the Institute.

Electric-Light Switching Competition.—Messrs. A. P. Lundberg & Sons inform us that the overseas results of the competition or examination published in November last are as follows:—

Advance-Grade Certificate.—R. Drilhon, Pau (B.P.), France.

Intermediate-Grade Certificates.—H. Christall, London, Ontario; S. W. Ghosh, Calcutta.

Preliminary-Grade Certificates.—E. H. Asavaid, Bombay; P. N. Chiney, Bombay; J. J. Irani, Poona; J. Rustomji, Bombay.

Patents and Alien Enemies.—The Board of Trade has granted a licence to Messrs. R. S. Wright & E. E. Burnside in respect of Patent No. 35,101 13, granted to Bauer.

Alien Partners.—In a circular letter to the Press, Mr. Harold Benjamin draws attention to the case of Englishmen who have in partnership with them gentlemen, born alien enemies, who have become naturalised here; whilst most of these naturalised partners are men whose integrity is above all suspicion, the firms with which they are associated are suffering very much undeserved hardship as a consequence of the present strained feeling in commercial circles towards naturalised alien enemies. As a case in point, an Englishman is in a large way of business, in partnership for a term having many years to run with a German-born gentleman who has been in England a good many years and become naturalised, but whose name is strikingly Teutonic. Since the war, and particularly during the last month or so, the English partner has practically had to do all the work, and his partner remains more or less in retirement, but, nevertheless, is entitled to his moiety of profits, and such profits are being seriously affected as a result of other firms' disinclination to continue to do business with a firm having an Englishman in partnership with a former German. The English partner has it put plainly to him by important customers that they decline to do business with his firm solely on account of his partnership and the firm's name; it would not help matters to alter the firm's name so long as the partnership subsists, and it is a fact that Englishmen in such positions as the one mentioned stand to suffer heavy losses because they are saddled with partners who are, perhaps naturally, as it is their livelihood, disinclined to retire voluntarily.

If English partners in such circumstances put their heads together, Mr. Benjamin thinks they could address themselves to the Government on the subject, with a view to seeing whether some, and what, legal relief should be accorded.

Exhibition Space Contracts in War Time.—At the Westminster County Court on Monday, Lips, Ltd., lockmakers, sued Walter Cawood, Ltd., organisers of a Shipping and Engineering Exhibition which was to have been held at Olympia last year, and C. H. Luke and F. W. Bridges, organising managers, for the return of £9 paid as deposit for allotment of space at the exhibition and damages for the exhibition not being held. According to a report of the case appearing in the *Financial Times*, defendants did not agree to the postponement of the exhibition until 1916 or 1917. The defendants gave as one reason for the exhibition not being held in 1915, that exhibitors engaged on Admiralty and War Office work could not prepare suitable exhibits in time, but plaintiffs maintained that an exhibition this year would have attracted a great deal of attention, and would have been a very great success. Defendants said that the overwhelming majority of the exhibitors wanted the exhibition postponed. Judge Woodfall gave judgment for the plaintiffs for £9 and costs, with leave to defendants to appeal. In doing so, he said that he thought that the extreme probabilities were that the defendants had taken the wisest course, not only in their own interests, but in the interests of exhibitors. The question arose as to how far the outbreak of the war relieved one from the performance of a contract. So far as the law applicable to that problem was applicable to the present case, it was sufficient to say that because it made a burden and inflicted a hardship, that was not a ground to relieve defendants from their obligation.

Aluminium Solder.—Referring to the paragraph in our issue of March 5th on this subject, Mr. H. Grinlinton, of 243, Karangahape Road, Auckland, N.Z., informs us that Mr. Overend and he have made further progress, and can now solder any metals together by their process. Aluminium, or any other metal or alloy, can be soldered to cast-iron and other metals, and a variety of solders can be used. The process is applicable to aluminium cables, and tests are in progress to ascertain whether boiling water has any effect on such joints; at the time of writing no deterioration had been observed. Aluminium terminals, we are informed, can even be soldered direct on carbons, instead of casting lead tops on them. The statement that the Government had placed an order for 100 terminals was not correct, but the Government is inquiring into the merits of the process. We understand that the method can readily be taught to any mechanic in a few minutes. Mr. Grinlinton has sent us samples of the solder adhering to aluminium.

New Rays.—It is reported from New York that a new electrical ray, discovered by Mr. Charles Stanley, is being investigated by the Government Department of Health. It is claimed that Mr. Stanley's invention does all that it is possible for the X-rays to do, and more, because the surgeon would be able to seek for bullets in a wound without fear of burning. There is no danger to the operator or patient.

Professional Classes in War Time.—A meeting in support of the Professional Classes War Relief Council was held on the 1st inst., and was addressed by Sir John Simon and others. It was stated that the Council was spending £430 weekly; at the outset between £3,000 and £4,000 was subscribed, but the income was falling off, and unless the receipts were increased the work of the Council would come to an end within three months. At least £25,000 was needed to carry on the work in the coming year.

Appointments Vacant.—Electrical foreman (£280 +) for Federated Malay States Government Railway; foreman overhead lineman for Bolton Corporation Tramways; shift engineer (£2 7s. 6d.) for Warrington Corporation; resident assistant engineer (85s.+) for parish of Willesden. Particulars are given in our advertisement pages.

Volunteer Notes.—3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion orders, by Colonel S. G. Grant (Officer Commanding).

Motor-Cars.—It is proposed to entertain wounded soldiers from various military hospitals next Sunday afternoon at Wembley Camp. Members desirous of lending their motor-cars for this purpose are requested to communicate immediately with the Adjutant, stating seating accommodation available.

Week-End Parades.

Saturday:—Route March. Battalion will parade at Baker Street Station at 2.30 p.m. Train to Wembley Park. Drums and bugles will attend. Note.—Particular attention will be paid to march discipline.

Sunday:—6 a.m. Reveille.
10 a.m. Church Parade.
10.20 a.m. Battalion Parade under Adjutant.
2.15 p.m. Battalion Parade under Commandant

A. G. Joiner, *Captain and Adjutant.*

Educational.—Manchester Municipal School of Technology.—The Session 1915-16 will commence on October 5th. Matriculation and Entrance Examinations will be held in July and September. Further particulars are given in our advertisement pages to-day.

Inquiries.—Makers of celluloid boxes for accumulators, and the Helier battery, are asked for.

Prices Advance.—Messrs. Ercole, Marelli & Co., London, E.C., announce that, owing to the increase in the price of raw materials, all their prices are increased by 10 per cent.

Foreign Trade.—The May Figures.—The following are the electrical and machinery figures given in the official returns for May.—

	Month of May.	Inc. or dec.	Five months, 1915.	Inc. or dec.
Imports.				
	£	£	£	£
Electrical goods and apparatus, excluding machinery and uninsulated wire	87,588	− 39,269	371,300	− 308,944
Machinery ...	801,889	+ 64,166	3,453,720	− 1,565
Exports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	233,560	− 153,268	1,193,192	− 239,757
Machinery ...	1,830,300	−1,566,586	7,944,539	−8,426,634

Insulated Zinc Conductors.—It is reported that the use of zinc wire, insulated with regenerated rubber, has been sanctioned in Germany during the war, as a substitute for ordinary rubber-insulated copper leads for low-pressure installation work. Although having a lower conductivity, the insulated zinc conductors are declared to have proved to be a practical and appropriate substitute, and the Sales Bureau of the United Makers of Insulated Wires announces that deliveries are now available.

The Metric System.—The report of the Decimal Association for 1914 states that since the outbreak of the war public interest in the metric system has very greatly increased; many inquiries have been received by the Association, and several daily papers have advocated the adoption of the system. The trend of opinion is that if decimal coinage were adopted in this country, the public would soon demand a decimal system of weights and measures, and therefore the Association has resolved to give precedence to the question of coinage. On March 17th, 1915, the Association of Chambers of Commerce of the United Kingdom unanimously resolved that the immediate adoption of the metric system would be a valuable means of assisting British firms in their competition in countries where that system is in vogue. The metric carat came into force on April 1st, 1914, and has given general satisfaction; on May 1st, 1914, an absolute unit of barometric pressure and metric measurements of rainfall were adopted for official records. In the new British Pharmacopœia all weights and measures are given in the metric system. Further progress has been made in the use of the system in the textile industries.

British representatives abroad are pointing out the futility of issuing catalogues in terms of British weights and measures. The Committee of the British Society in the Argentine Republic unanimously holds that the most expeditious way to capture German trade in Latin-America would be the adoption of the decimal and metric systems. American Consuls are urging upon their country the urgent necessity of adopting the metric system. China has instituted a set of weights and measures based entirely on the metric system, the sole standards being the metre and kilogram.

The secretary of the Association, Mr. G. E. M. Johnson, is on active service with the Honourable Artillery Company.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. ALEX. MCINTOSH, who went from Edinburgh in 1900 as meter superintendent and consumers' clerk to the Woking Electric Supply Co., has now received the additional appointment of mains superintendent to the company. Mr. Jewell, who for the last 16 months has been mains superintendent to the company, has severed his connection with the undertaking.

It is announced that CAPT. GRAY, of the Howitzer Brigade, R.F.A., borough electrical engineer of Accrington, has become engaged to Miss Lillie Boyle, youngest daughter of the late Mr. Robert Boyle and Mrs. Boyle, of Blackburn.

The Gillingham (Kent) T.C. has increased the salary of MR. A. C. LINES, commercial assistant at the electricity works, to £140 per annum.

MR. R. W. KLITZ, the chief assistant of the borough electrical engineer, Wimbledon, has applied for leave of absence to enable him to join the Army for the duration of the war.

Conformably with his recent election, MR. ALAN A. CAMPBELL SWINTON was on June 3rd admitted a Fellow of the Royal Society.

The Bury T.C. has increased the salary of MR. S. J. WATSON, electrical engineer, from £550 to £650 per annum.

MR. F. C. LEESE and MR. A. E. LEESE, sons of Ald. Leese, who recently resigned their positions under the Stoke-on-Trent Electricity Committee, have been presented by their former colleagues with a Gladstone bag each. The presentations were made by Mr. C. Cuthbertson, resident engineer of the Stoke works, supported by Mr. S. G. Marston, mains superintendent for the southern area. Mr. F. C. Leese had been a mains inspector of the southern area for 11 years, and his brother had been a switchboard attendant for two years.

Tramway Officials.—MR. J. F. CAMERON has been appointed general manager of the Northampton Corporation Tramways, at a salary of £300 per annum, rising on approved service by two annual increments of £25 each to a maximum of £350. Mr. Cameron was formerly electrical engineer to the undertaking, but was appointed temporary manager six months ago following upon the dismissal, with £300 compensation, of the late manager, Mr. J. Gottschalk, who was of German birth. At Monday's meeting of the Town Council one member protested against the dishonourable way in which the Council was acting towards the late manager. He stated that it was held out to him that he would be able to apply for his old position after the war.

MR. G. H. MARGRAVE, chief clerk in the Northampton Corporation Tramways office, has resigned upon being appointed manager of the Wolverton Steam Tramway. MR. H. W. SYKES has been appointed chief clerk and MR. I. J. GEE second clerk at Northampton.

The salary of MR. F. BUCKLEY, the Wigan Corporation tramways manager, has been increased from £225 to £275 per annum, with a further advance next year to £300.

MR. J. C. WHITELEY, assistant manager and engineer to the Chatham and District Light Railways, has been appointed tramway manager by South Shields Corporation.

MR. SAUNDERS, acting manager of the Dartford tramways, met with a motor accident last week, and sustained, amongst other injuries, a fractured collar bone.

Consequent upon the deaths of Mr. W. C. Gordon, manager, and Mr. R. S. Tresilian, secretary, of the Dublin United Tramways Co., the directors have appointed MR. GEORGE MARSHALL HARRISS, chief electrical engineer, as general manager. MR. TAIMAN, a member of the electrical staff, has been appointed principal electrical engineer; and MR. BROPHY, who was principal assistant to Mr. Gordon, is appointed traffic manager. MR. MCHUGH, chief accountant to the company, succeeds to the secretaryship, and his principal clerk, MR. RATHBONE, becomes chief accountant.

General.—We mentioned in our last issue the names of several gentlemen upon whom distinction had been conferred in the King's Birthday Honours' List which appeared just as we went to press last week. These should be supplemented by the following:—

BARON READING is appointed a G.C.B. (additional), and BARON MOULTON a K.C.B. (additional) in the Civil Division, in recognition of services during the war.

WILLIAM PETERSON, Esq., L.L.D., C.M.G., Principal and Vice-Chancellor of McGill University, Montreal, is appointed to the Most Distinguished Order of Saint Michael and Saint George.

HUGH TROWBRIDGE KEELING, Esq., A.M.I.C.E., Chief Engineer and Secretary to the Chief Commissioner, Delhi, is appointed to the Most Exalted Order of the Star of India.

WILLIAM MAXWELL, Esq., C.I.E., M.V.O., Director-General of Posts and Telegraphs, is appointed to the Most Eminent Order of the Indian Empire.

ROBERT RICHARD GALES, Esq., A.M.I.C.E., Indian Public Works Department, Engineer-in-Chief, Hardinge Bridge, Sara, Bengal, receives the honour of Knighthood.

RAI CHUNILAL BASU BAHADUR, F.C.S., Teacher of Physics and Chemistry, and Fellow of the Calcutta University, is appointed to the Imperial Service Order.

RICHARD JOSHUA KEYS, Esq., Indian Telegraph Department, Deputy Superintendent, Traffic, Simla, is appointed to the Imperial Service Order.

In the *London Gazette* list of recent appointments under the Civil Service Commission, the following notices appear:—

Admiralty.—First assistant electrical engineer, HARRY HEWLETT RICHARD GREEN.

Admiralty.—H.M. Dockyards and Naval Establishments: Electrical mains and distribution supervisor, THOMAS HANDEL CAWTHRA; electrical station supervisor, H. W. G. J. JACKSON.

MR. HOWARD EADY, telephone manager for the Jersey District, who is leaving to take charge of the Exeter District, has been presented by the staff with an inscribed silver salver.

T[illegible]lford Board of Guardians has decided that, in consideration [illegible] amount of work devolving upon MR. BOSTOCK, the engi[illegible]he able way in which he has carried out the work of [illegible] electric cables between the administration block and the sc[illegible]he be granted an honorarium of £10.

COUNCILLOR WHITESIDE has been elected chairman of the Stretford Electricity Committee for the ensuing year.

The *Times* states that MR. J. G. B. STONE has been elected to fill a vacancy on the board of the Madras Electric Tramways (1904), Ltd., rendered vacant by the death of Mr. T. E. Ivens.

MR. WILLIAM SMITH, who has been Controller of Telegraphs at the General Post Office, Edinburgh, since April, 1911, has retired from the service after 45 years' connection with it. He is an authority on high-speed telegraphy, and sat on several committees in connection with telegraph improvements.

MR. SIDNEY FRANCIS SCHMID, electrician, of 30, Thorneycroft Street, Birkenhead, announces that by deed poll he has assumed the surname of Smith. He is a natural born British subject.

Obituary.—MR. R. W. SMITH SAVILLE.—The death occurred at Darwen on the 2nd inst. of Mr. R. W. Smith Saville, aged 47, who went to Darwen from Burton-on-Trent. He was responsible for many important undertakings, notably the electrification of the tramways, the laying of the tramways to Hoddlesden, and the completion of the electricity works. Up to three years ago he was joint manager of the tramways.

The *Times* records the death of SIR ARTHUR TREDGOLD LAWSON, chairman of the firm of Fairbairn, Lawson & Co., engineers, Leeds, at the age of 71 years.

The death occurred at Bolton recently, of MR. EDWIN WHITTAKER, who was at one time the superintendent of the Accrington tramways. He was with the Accrington tramway department during the time of the old steam locomotion, and for some time after the system was electrified.

The death has occurred in a Dublin hospital of MR. WALTER ORR MCILVEEN, chief clerk in the Belfast Corporation electricity department. Deceased was in his 39th year. He had been associated with the Belfast electricity undertaking for 20 years.

NEW COMPANIES REGISTERED.

Nordisk Electrical Power Co., Ltd. (140,530).—This company was registered on June 2nd, with a capital of £10,000 in £10 shares, to develop water and other powers for the production of electric, pneumatic, hydraulic or other power or force, to transmit, distribute and supply the same throughout the United Kingdom, Northern Europe, and elsewhere. The subscribers (with one share each) are: W. A. Cox, 6, Solva Road, Winchmore Hill, N., secretary; E. Cant, 102, Maidstone Road, New Southgate, N., accountant. Private company. The first directors are not named. Registered office: 18, High Street, Holborn, W.C.

Southdown Motor Services, Ltd. (140,534).—Registered June 2nd, by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C. Capital, £51,250 in 50,000 7½ per cent. non-cum. part. pref. shares of £1 each, and 25,000 deferred shares of 1s. each. Objects: to adopt an agreement with the Brighton, Hove & Preston United Omnibus Co., Ltd., Worthing Motor Services, Ltd., and the London & South Coast Haulage Co., Ltd., to acquire any tramway or light railway, and any trolley vehicle (being any mechanically-propelled vehicle adapted for use upon roads and moved by electrical power transmitted thereto from some external source), motor or other omnibus, ship, boat, aeroplane or airship, or motor or other cab undertakings in the United Kingdom or elsewhere. The signatories (with one preferred share each) are: W. F. French, 314, High Road, Balham, S.W., engineer; J. J. Clark, Goldstone House, Hove, director. Private company. The first directors (to number not less than two or more than seven) are Sir James Bradford, Kt., Alderman J. J Clark, J.P., A E. Cannon, A. D. McKenzie, W. F. French, and W. S. Wreathall. Qualification, 100 shares. Remuneration, £50 each per annum (chairman £25 extra). Solicitors: E. M. Marx & Colbourne, 62, Old Steine, Brighton.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Duram, Ltd.—Particulars of £20,000 debentures, created March 23rd, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £5,600. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Kingolite Co., Ltd.—Charge as additional security, dated May 14th, 1915, (supplemental to debenture dated July 9th, 1914, securing £400). Property charged: certain royalties. Holder: E. D. Taylor, [illegible], Ha[illegible]wood Road, Stamford Brook, W.

Bournemouth and Poole Electricity Supply Co., Ltd. (55,189).—Capital, £500,000 in 25,000 ordinary, 7,500 4½ per cent. preference, and 17,500 6 per cent. 2nd preference shares of £10 each. Return dated April 1st, 1915. 15,000 ordinary, 7,500 4½ per cent. preference, and 17,500 6 per cent. 2nd preference shares taken up. £10 per share called up on 15,000 ordinary, 7,500 4½ per cent. preference and 15,000 6 per cent. 2nd preference, and £6 per share on 2,500 6 per cent. 2nd preference (new issue). £390,000 paid. Mortgages and charges: £187,500.

Madras Electric Tramways (1904), Ltd. (80,361).—Capital, £200,000 in £5 shares (25,000 pref.). Return dated April 6th, 1915. 20,000 preferred and 11,452 ordinary shares taken up; £5 per share called up on 13,500 preferred; £67,500 paid; £89,760 considered as paid on 6,500 preferred and 11,452 ordinary. Mortgages and charges: £59,540.

Eastern and South African Telegraph Co., Ltd. (13,306).—Capital, £600,000 in £10 shares. Return dated May 26th, 1915. All shares taken up; £600,000 paid. Mortgages and charges: Nil.

Brompton and Kensington Electricity Supply Co., Ltd. (25,913).—Capital, £300,000 in £5 shares (20,000 pref.). Return dated April 1st, 1915. 6,007 preferred and 33,993 ordinary shares taken up; £5 per share called up on 6,007 preferred and 32,993 ordinary shares; £195,000 paid; £5,000 considered as paid on 1,000 ordinary shares. Mortgages and charges: Nil.

British Electric Transformer Co., Ltd. (76,351).—Capital, £200,000 in £1 shares (100,000 pref.). Return dated April 2nd, 1915. 61,988 preferred and 85,498 ordinary shares taken up; £1 per share called up on 52,764 preferred and 9,529 ordinary shares, and 7s. 6d. per share on 14 ordinary; £62,298 5s. paid thereon; £15 12s. 6d. paid on 25 shares forfeited; £85,179 considered as paid on the remainder. Mortgages and charges: Nil.

Metropolitan Electric Supply Co., Ltd. (25,395).—Capital, £1,500,000 in 200,000 ordinary and 100,000 preferred shares of £5 each. Return dated March 30th, 1915. 200,000 ordinary and 76,121 preferred shares taken up; £5 per share called up on 195,936 ordinary and 76,121 preferred; £1,360,285 paid; £20,320 considered as paid on 4,064 ordinary. Mortgages and charges: £628,000.

British Insulated and Helsby Cables, Ltd. (52,285).—Capital, £1,000,000 in 100,000 preferred and 100,000 ordinary shares of £5 each. Return dated April 5th, 1915. All shares taken up. £5 per share called up on 74,470 preferred and 40,065 ordinary; £572,675 paid; £427,325 considered as paid on 25,530 preferred and 59,935 ordinary. Mortgages and charges: £700,000.

Northwich Electric Supply Co., Ltd. (46,958).—Capital, £35,000 in 25,000 ordinary and 10,000 preferred shares of £1 each. Return dated April 14th, 1915. 5,000 preferred and 18,525 ordinary shares taken up; £23,525 paid. Mortgages and charges: £10,810 4 per cent. debentures (part of £11,000 authorised).

County of London Electric Supply Co., Ltd. (34,320).—Capital, £1,600,000 in 80,000 preferred and 80,000 ordinary shares of £10 each. Return dated March 29th, 1915. 65,000 preferred and 65,000 ordinary shares taken up; £1,300,000 paid. Mortgages and charges: £1,000,000.

CITY NOTES.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

MR. W. L. MADGEN, presiding at the annual meeting, held at Electrical Federation Building, W.C., on Monday, said that it was in 1914 that their electric supply business began to assume considerable dimensions. They were now supplying current for power, traction and lighting purposes in the boroughs of Smethwick and Dudley, also in the districts of Oldbury and Halesowen, while they held the principal share interest in the Kidderminster undertaking, which would, in due course, be connected up to the main system of supply. Their first main power station for the purposes of this supply was situated upon a suitable site on the canal at Smethwick, where they would have a plant capacity of 19,125 KW., including the extensions now approaching completion. The smaller generating stations at Dudley and Kidderminster were in a different category, and as developments required it, the smaller steam dynamos which they contained would be displaced by high-efficiency turbine sets of ample capacity to utilise to the best advantage the capital represented by the boiler plant, buildings, etc. Expenditure upon land, buildings, machinery, etc., at the close of the past year stood at £398,560, including £180,991 expended during the year. Much of their capital expenditure during the construction period had, of course, not yet fructified, but the business they had done enabled them to recommend a dividend of 3 per cent. The policy of the company in consolidating the electric supply in the district under one management promoted cheap production, distribution and administration, and thus enabled business to be done upon satisfactory terms. They were provided with a plant capacity and mains sufficient for dealing with a considerable increase in business, and looked forward to continued improvements in their returns. The Treasury had granted authority to issue £150,000 of preference shares or debentures, and arrangements were now in progress for the issue of this capital.

Mr. C. SHIRREFF HILTON seconded the adoption of the report, which was carried unanimously.

Gravesend & Northfleet Electric Tramways, Ltd.

THE annual meeting was held on Monday at Electrical Federation Offices, Kingsway, W.C. The report submitted showed that the revenue for 1914 was £20,807, as compared to £14,081, the increase being due to development of motor-omnibus services. After deducting all expenses, including repairs and maintenance, £1,800 for debenture interest, setting aside £1,250 for renewals fund, £5,461 remains, plus £879 brought forward. There is to be placed to reserve £1,001, to reduction of commission on shares and debenture issue account £1,500, and after paying a year's preference dividend on the 6 per cent. cumulative preference shares to December, 1908 (£2,400), £1,439 is to be carried forward. £7,912 has been expended on capital account during the year, chiefly for motor-omnibus business. The capital is to be reorganised and the arrears of preference dividend from 1909 to 1914 dealt with, in order to put the company upon a sound basis to facilitate the raising of funds to provide for additional motor-omnibus business. A scheme was put before the annual meeting for cancelling the arrears of preference dividend and converting the holders' shares into an equal number of ordinary shares. In place of the late Mr. J. F. Albright, Mr. P. N. Gray has been elected a director.

United Electric Tramways of Monte Video, Ltd.

THE directors' report for the year to 31st March, 1915, gives the following results of the operation of the tramway system for the year to October 31st, 1914 (the fiscal year of the Uruguayan Co.):—

	1913-14.	Decrease.
Gross receipts	$[illegible]	$[illegible]
Operating expenses	[illegible]	11,[illegible]
Net receipts	[illegible]	44,[illegible]
At exchange of $4.7 to the £	£1[illegible],477	£9,[illegible]
Passengers carried	4[illegible]	[illegible]
Car miles run	7,[illegible]	61,911
		Increase.
Percentage of operating expenses to gross receipts	[illegible]	1.28

The falling off in traffics was due principally to financial stringency throughout the whole of South America, accentuated in the latter months of the year by the European conflict, and to an abnormal rainfall and bad weather conditions during practically the whole year. The services also suffered interruptions in consequence of the municipal repaving works which were in progress during the greater portion of the period under review. The effect of the adverse conditions will be felt most heavily during the year now current, the receipts for which show a continuous decline. Although all possible care has been taken to counteract the decrease in receipts, and important economies in operation have been effected, the percentage of working expenses shows a further slight increase. This is more than accounted for by special expenditure necessitated by storms and floods, increase in maintenance charges, and discounting of nickel and silver currency. The construction and equipment of the two substations, referred to in previous reports, has been completed, and both stations are in operation, although the Diesel engines have not yet been taken over from the contractors. Owing to the high price of oil fuel, it has been decided for the present to operate the substations on Sundays and Feast days only, and in case of emergencies. The new Administration Office building having been completed, the officials and their respective staffs were installed there early in 1914. The amount receivable from La Sociedad Comercial de Montevideo in respect of revenue was £133,818. The profit and loss account for the year, after providing for administration expenses, and charging £48,850 for debenture interest, shows a credit balance of £77,035, making, with £12,641 brought forward, £89,676. There had been set aside for redemption of debenture stock £3,370, for redemption of the preference and ordinary share capital £2,500, and for renewals and contingencies £25,000. After paying 6 per cent. on the preference shares and 4 per cent. on the ordinary, £12,973 is to be carried forward.

Annual meeting, June 14th.

German South American Telegraph Co.

THE report of the Deutsch-Sud-Amerikanische Telegraphen Gesellschaft, of Cologne, for 1914, states that an increase in traffic and a considerable augmentation in the receipts took place in the first seven months, as compared with the corresponding period of the previous year. On August 5th, the cable between Borkum and Teneriffe was interrupted by the English, and two days later the station at Lome had to cease working. Nevertheless, it was possible to maintain the connection between Monrovia and [illegible] until August [illegible]. During the night of November [illegible] the cable between Teneriffe and Monrovia was diverted, presumably by a British ship, whilst the wireless station at Monrovia was closed on September 1st, at the request of the Liberian Government. According to the agreement with the banking group which is closely associated with the company, the directors took over in the course of the year at the price of £[illegible] the shares held by the group in the Compania Telegrafico-Telefonica del Plata, of Buenos Aires. The Argentine company suffered in 1914 from the unfavourable economic conditions which prevailed in all South American countries, and which were aggravated by the outbreak of the war, and the accounts of this subsidiary company consequently closed with a small loss for the year. The total receipts of the South American company, including the income of £[illegible] brought forward, amounted to £[illegible],000, as contrasted with £[illegible] in 1913. On the other hand, general expenses absorbed £[illegible], as against £[illegible], the cable renewal fund £[illegible] as in 1913, the cable maintenance fund £[illegible] as compared with £[illegible], and depreciation £[illegible] as against £[illegible]. The telegraph and the cable network requires £11,300, as contrasted with £10,800, and the interest service on the loans of £[illegible] needs a further sum of £17,000, as against £16,000 in 1913. As net profits, the accounts show the amount of £[illegible] as against £[illegible], and the dividend on the ordinary share capital of £625,000 becomes reduced from 6½ per cent in 1913 to 6 per cent. last year.

American Westinghouse Co.

[illegible] states that while the annual report of the Westinghouse Electric & Manufacturing Co. for the fiscal year ending March 31st, 1915, is silent on the point of the greatest public interest concerning that organisation, to wit, the amount and character of the orders for war material it has received from European countries, it is, nevertheness, a document which is entitled to attention. The income statement for the year compares with the figures of the preceding fiscal period as follows:—

Year ending March 31st.	1914-15.	1913-14.
Gross sales	$33,671,485 ...	$43,733,646
Manufacturing costs	31,109,074 ...	39,016,423
Manufacturing profit	2,562,411 ...	4,717,222
Other income	1,158,527 ...	1,280,856
Total income	3,720,939 ...	5,998,078
Charges, depreciation, etc. . .	1,711,195 ...	1,939,269
Balance	2,009,744 . .	4,058,809
Preferred dividends	279,909 . .	279,909
Common dividends .	1,427,350 .	1,405,989
Surplus	302,485 ...	2,372,911

The balance remaining after payment of charges, depreciation allowances (which item was $357,069) and preferred dividends, was equal to 4.63 per cent. on the $37,325,087 of common stock, against 10.73 per cent. earned on that class of shares in 1913-14. The report shows a large reduction in sales and profits, due not only to the unfavourable business conditions of last autumn and winter arising from the war, but to the strike in June and July, 1914, at the company's main establishment near Pittsburg. The value of the unfilled orders on March 31st, 1915, is given as $8,951,410, as compared with $7,951.385 at the end of the preceding year, and with $12,061,473 of orders on the books on March 31st, 1913. The visible improvement in the company's business is accordingly slight, but, as already mentioned, the report gives no facts as to the foreign war orders, which, according to general understanding, were not received and booked until within the month of April.

Electrical Power Storage Co., Ltd.

THE scheme for the amalgamation of the above company with Messrs. Pritchetts & Gold, Ltd., was approved at an extraordinary general meeting, held on June 3rd, at 4, Great Winchester Street, E.C. Mr. JAMES GRAY, who presided, first explained the reasons why the board had considered the proposal made by the firm mentioned. For some years the E.P.S. Co. had been seriously handicapped in London by rent, rates, and taxes, which were so much higher than in the provinces. During the last few years changes had been made in the management, and many economies effected, which had partly counteracted these drawbacks. Their principal drawback had been the lay-out and condition of their present works, which precluded the economical and rapid handling of goods necessary in these days of keen competition. They had come to the conclusion that the abandonment of the existing works was necessary, and negotiations for securing new works were proceeding when Mr. Pritchett approached the speaker with an amalgamation proposal. Messrs. Pritchetts & Gold could, at Feltham, provide accommodation for this company for a much lower outlay than they could have obtained new premises for themselves, and great economies could be effected by combining the two organisations. The larger shareholders had cordially approved of the provisional scheme for amalgamation, which was to take effect by the sale of substantially the whole of the property and assets of the company for shares and debentures of Pritchetts & Gold, Ltd. The company would retain its book debts and cash and discharge its liabilities. It would transfer to the amalgamated company (*a*) investments at market value; (*b*) its plant, tools and furniture, valued at the date of the agreement at £8,000; (*c*) its stock-in-trade upon terms; and (*d*) its patents, goodwill and benefit of contracts for £13,658. The purchase price would be satisfied by the issue of the following securities of the amalgamated company, viz.:—(*a*) £10,000 first mortgage debentures (part of an issue of £30,000) carrying interest at 5 per cent., payable half-yearly, and redeemable at par on June 30th, 1917, or at the option of the company, at any earlier date, with a premium of £5 per cent.; (*b*) 18,658 ordinary "B" shares of £1 each; (*c*) 4,000 deferred shares of 1s. each; and (*d*) preference shares or debentures for the balance. To carry the amalgamation into effect, it would be necessary for this company to go into voluntary liquidation, and the name of the amalgamated company would become "Pritchett & Gold and Electrical Power Storage Co., Ltd." The purchase price to be paid by Pritchetts & Gold, Ltd., would enable the debenture holders of the E.P.S. Company to receive an exactly equivalent amount of debentures of the amalgamated company, viz., £10,000, bearing the same rate of interest and redeemable on the same date as their present debentures. It was anticipated also that the liquidators would be enabled to distribute to the shareholders one 10 per cent. non-cumulative "B" ordinary share of £1 of the amalgamated company for every ordinary or founder's share of £5 of this company, and, in addition, one deferred share of 1s. of the amalgamated company, for every five ordinary or founders' shares of this company. The writing off of £4 per share was very drastic, but under the circumstances it was unavoidable. In the last balance sheet the item of patents and goodwill stood at £67,885, notwithstanding that the principal patents had long since expired. Moreover, a good deal of the plant and tools was now practically obsolete; in fact, they were valued at the date of the provisional agreement at £8,000. The capitalisation of Pritchetts & Gold, Ltd., was very conservative and having regard thereto, they considered the exchange offered to the shareholders of this company fair and reasonable. Indeed, they had in contemplation the writing down of the capital by £4 per share before this scheme of amalgamation was suggested, as it was quite apparent that no new capital could have been obtained for new works until this was done. The deferred shares of 1s. each were, so far as capital value was concerned, only nominal, but as they were entitled to the reversion of profits after paying dividends on the preference shares and the "A" and "B" ordinary shares, the deferred shares would, they expected, be of considerable value for dividend purposes. As indicated in the circular to the shareholders, however, a moiety of the dividend on the deferred shares to be issued to the shareholders of this company would be deferred up to a maximum of £5,000 until all obligations under maintenance contracts of this company expiring before December 31st, 1919, were exhausted. A similar indemnity had been granted by Pritchetts & Gold, Ltd., against their maintenance contracts, the proportion of dividend to be withheld being reduced in proportion to the smaller number of contracts which they had running. In regard to the position of maintenance contracts, it would be realised that until a fund was built up to provide for these contracts no part of the current manufacturing profits would be available for distribution. Under the scheme of amalgamation it was anticipated that the dividend on the "B" ordinary shares would be earned without difficulty, and after the indemnity of £5,000 against maintenance contracts had been provided there would be a very substantial dividend on the deferred shares, rendering these shares of real capital value.

The necessary resolutions were seconded by Sir JAMES PENDER and carried unanimously, Messrs. James Gray and W. A. Reid being appointed liquidators.

Middleton Electric Traction Co., Ltd.—The total revenue for 1914 was £18,557 and the expenditure £16,966, including £2,495 for debenture interest and £3,000 for renewals. After paying a dividend of 5 per cent. per annum on the cumulative preference shares for the half-year ended January, 1912, £649 is carried forward. Total capital expenditure, £160,045. Passengers carried, 2,958,738, as compared with 3,022,741 in 1913; average receipts per passenger 1·48d., as compared with 1·47d.; average working expenditure per passenger ·86d., as compared with ·92d. Proportion of expenses to receipts 59 per cent., as compared to 63 per cent. The annual meeting was held on Tuesday at Electrical Federation Offices, Kingsway, W.C.

Nairobi Electric Power and Lighting Co., Ltd.—It is announced that in consequence of the present irregularity and delays of mails from Nairobi, it will not be possible to present the accounts for 1914 until a later date. The Nairobi accounts are to hand, but certain other matter, necessary before the accounts are finally closed and printed, has not yet arrived. The directors have, however, declared a final interim dividend of 4 per cent. in respect of 1914 on both preference and ordinary shares, making 10 per cent. in all paid for the year. Special local conditions make it inadvisable for the board to declare an interim dividend for the half-year ending June 30th, 1915, payable promptly, and same will be deferred until the results of the half-year's working are known.

Devonport and District Tramways Co.—The annual meeting was held on Monday at Electrical Federation Offices, Kingsway, W.C. The directors reported that an agreement had been entered into for the sale of the tramways to the Plymouth Corporation as on October 2nd, 1915. The balance on revenue account for 1914 amounted to £8,831, which is to be distributed amongst the shareholders *pro rata* to their holdings.

International Light and Power Co., Ltd.—The directors recommend a final dividend of 1½ per cent., less British income-tax, on the preference shares for the final quarter ending June 30th, being 6 per cent. for the year.

Yorkshire (West Riding) Electric Tramways, Ltd.—An interim dividend of 3 per cent. (being at the rate of 6 per cent. per annum) on account of the dividend accrued on the 6 per cent. cumulative preference shares is announced.

Stock Exchange Notice.—The Committee has ordered the following securities to be quoted in the Official List:—

Waygood-Otis, Ltd.—Further issue of 15,000 ordinary shares of £1 each, fully-paid, Nos. 135,001 to 150,000; and 15,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 135,001 to 150,000.

Manila Electric Railroad and Lighting Corporation.—The directors announce a dividend of 1½ per cent. for the quarter ending June 30th.

New General Traction Co., Ltd.

The directors report that the revenue received and accrued during the year ended March 31st, 1915, amounted to £20,358. The general expenses, including directors' fees and legal charges, amounted to £1,893, and the debenture interest, less income tax, to £7,023. The profit was £11,059, plus £6,502 brought forward, making £17,561 available for distribution. The directors recommend a 4 per cent. dividend, absorbing £10,480, and £7,081 is to be carried forward. The accounts of the Norwich Electric Tramways Co. show that there was an increase in the traffic receipts for the year, but also an increase in the expenses. A dividend of 3 per cent. was paid by that company for the year ended June, 1914. The Douglas Southern Electric Tramways, Ltd., paid 1½ per cent. on its preference shares in respect of the year ended October, 1914. The outbreak of war was responsible for the great decrease in traffic receipts. The income received from the Philadelphia undertaking for the year ended December, 1914, amounted to £13,912.

Annual meeting, June 15th.

Barcelona Traction, Light and Power Co., Ltd.—At a meeting of 5 per cent. first mortgage bondholders, held in London on Tuesday, an agreement was approved for the creation and issue of 7 per cent. prior lien bonds and for modifying the terms of the trust deed.

STOCKS AND SHARES.

Tuesday Evening.

There remains a general air of lassitude over prices, and business does not give much indication of material improvement. At the same time, there is a little going on in some of the departments of the Stock Exchange, and a welcome recovery has occurred in the price of Brazilian Tractions. On the other hand, an outstanding feature is provided by a furthe slump in the Income bonds of the Electric Railways, and this has had the effect of depressing both classes of shares in the same company. Stock Exchange rumour insists that the passage of the Dardanelles has been already forced, but that the Admiralty prefer to keep silence on the point at present.

The Rio de Janeiro rate of exchange has moved up sharply to 12 7/16d. after touching 1s. per milreis. That there should be some sort of reaction was natural enough, though it seemed so long in coming that people with Brazilian securities have been getting frightened, and it required but a small amount of pressure to sell for the price of Brazil Tractions to crumble noticeably. The price has been down to 49½, but is now 4 points higher; and the rally in the exchange has revived hopes that the dividend may be maintained at its regular 6 per cent. level. Some people seem to think that it would not be at all a bad thing if the directors decided to lower the dividend, if only to save the quarterly uneasiness which worries shareholders when the date of dividend declaration draws near. Certainly there is ample excuse for the directors to plead prudence in reducing the dividend from its present comparatively high figure.

The further fall of 6½ points in Underground Electric Income bonds affects a wide circle of investors; and since there is no apparent reason for the drop, some of the holders are beginning to get more than a little anxious. It is fresh in the mind of everybody that Sir Edgar Speyer just lately resigned his position as chairman of the company, so, of course, the supposition is advanced that he may have been wishing to realise some of his bonds and shares. This is sheer guesswork, and we must admit that to us it sounds a little improbable, because, putting it on its lowest ground, Sir Edgar Speyer's firm is so intimately connected with the Underground Electric Railways Company that selling from his personal account would depreciate the firm's holdings—and, as we have pointed out before, the limited character of present-day markets renders them particularly susceptible to a mere modicum of buying or selling.

It is obvious enough that the London General Omnibus Company must be doing extremely well, but the District Railway and other Tubes cannot be making much profit at present. With so little known data to work upon, it is difficult to form reliable opinions about the security of these particular bonds; but, having regard to the acute nature of the fall, and the fact that, so long as they get their full interest, the return on the money invested at the present price comes to nearly 10 per cent., making allowance for the fact that the coupons are paid free of tax, some sort of a recovery does seem likely to take place.

Notwithstanding the slightly dull tone which envelops investment markets, it is still none too easy to pick up stock in certain markets. We have referred over and over again to the difficulty that exists in obtaining good-class electrical issues, and, in view of this, it may be of some use to set out a selection of a few bonds and stocks which can be actually bought at the present time. Even in the following cases there are several in which the amount of stock on offer is limited to a few hundred pounds, but we submit them in order to show the yields obtainable from securities on offer at the present time:—

Stock and Bonds.	Price.	Yield.	Dividends due.
Anglo-Argentine Trams 4 per cent. Deb. ...	84	4 15 0	Jan., July
Anglo-Argentine Trams 4½ per cent. Deb.	90	5 0 0	Jan., July
British Columbia Electric Railway 4½ per cent. Cons. Deb. ...	80	5 6 0	Mar., Sept.
British Columbia Electric Railway 5 per cent. Pref. ...	75	6 13 0	[illegible]
British Electric Traction 4½ per cent. 2nd Deb.	75	6 0 0	May, Nov.
B.A. Lacroze Tramways 5 per cent. [illegible] Mort. Debs. ...	90	5 11 0	June, Dec.
Met. Electric Supply 3½ per cent. Mort. Deb. ...	76	4 12 0	Jan., July
Rio Tram 5 per cent. 1st Mort. 30-year Gold ...	94	5 9 0	Jan., July
Rio Tram 5 per cent. 50-[illegible]	80	6 5 0	April, Oct.
South American Light & Power 5 per cent. Deb.	90	5 11 0	April, Oct.
South Met. Elec. Light 4½ per cent. 1st Mort. Deb. ...	95½ free	4 14 0	April, Oct.
Toronto Power 4½ per cent. Con. Guar. Deb. ... (Guaranteed by Toronto Railway Co.)	88[illegible]	5 2 0	May, Nov.
Vancouver Power Co. 4½ per cent. Deb. (Guaranteed by British Columbia Elec. Rly.)	78	5 9 [illegible]	Jan., July
Winnipeg Elec. Rly. 4½ per cent. Deb.	89 free	5 1 0	April, Oct.

The Electricity Supply list is disposed to droop, this applying both to the ordinary and the preference shares. City of Londons have given way to 13¾, a drop of 10s. Westminsters fell 5s., and so did Charing Cross. This, of course, is the season of the year in which illumination shares are completely out of favour; and the weakness is noticeable in gas stocks, just the same as in some of the electric light descriptions.

(How bloodthirsty the ordinary pacific Englishman can become may be instanced by the remark of a member of the National Guard returning from trench-digging at the beginning of the week, when he said, as the train passed the power station of the Charing Cross Company, that if a Zeppelin were to aim at that and, missing it, to strike a prisoners' camp near by, he, for one, would shed no tears. But this, it must be added, was at the end of a very hot day; and the effect of trench work upon the temper during the weather experienced in the first part of the week, it were best left to the wives of some of us to describe.)

The Mexican group continues flat. Mexican Trams fell 3, the 6 per cent. bonds 2 points. Depreciation of the currency is the worst-feared result of the revolution. Germany seems to be marching much the same path as is Mexico in this matter, and neutral manufacturers are already declining German bills, insisting upon payment in gold. It is all very well for German financiers to clash the loud cymbals about the credit of their country, and so long as trade is confined purely to internal channels, the paper manufacturers can work day and night without the country feeling much damage. But when it comes to trying to pass this sorry stuff along to other nations, there will be a different tale to tell. And it is plain as a pike-staff that, when the day of reckoning arrives after the war, there will be literally hundreds of German houses go smash, for lack of gold, as distinct from paper money.

The Telegraph market is a little irregular. Great Northerns have again advanced, a rise of £2 taking the price to 3 Globes are unaffected by the declaration of a final dividend on the ordinary, bringing the total distribution for the year up to 6 per cent., the same as before. Marconis are decidedly better, on dividend anticipations, and American Marconis strengthened to half-a-guinea.

Callenders eased off to 12⅛, and small falls have occurred in Edison & Swan and British Westinghouse preference shares, while Aluminiums are 6d. higher. The Rubber market shows a good deal of quiet strength as the price creeps up steadily towards the level half-crown. Armament shares have advanced a trifle, owing to the insistent demand for munitions; and most of the copper shares are good, on account of the buying from the United States.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		[illegible]	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Blackpool-Flectw'd	May 29	2,70[illegible]	+ [illegible]	21	8,776	− 241	8	.
Bristol	28	12,133	+ [illegible]	[illegible]	[illegible]	+ [illegible]	[illegible]	
Chatham and Dist.	27	[illegible]	+ [illegible]	[illegible]	22,[illegible]	+ [illegible]	14·9[illegible]	.
Cork ..	27	2,1[illegible]	+ [illegible]	[illegible]	[illegible]	[illegible]	4·2	
Dublin	28	[illegible]	[illegible]	[illegible]	[illegible]	+ 7,[illegible]	[illegible]	.
Hastings	27	3,[illegible]	+ [illegible]			− [illegible]	19·8	.
Lancashire United	27	7,1[illegible]	+ [illegible]	21	84,6[illegible]0	− [illegible]	42	.
Llandudno Col. Bay	28	1,17[illegible]	+ [illegible]	[illegible]	[illegible]	+ [illegible]	[illegible]	
Tyneside	[illegible]	2,[illegible]	+ 27	21	11,486	+ [illegible]	11	.
Anglo-Argentine ..	27	21[illegible],701	−7,[illegible]	21	1,082,097	−100,176	..	..
Auckland	7	[illegible],447	−1,[illegible]	44	[illegible]	+ [illegible]	27·42	1·06
Calcutta	28	16,71[illegible]	− 444			− 444	..	
Kalgoorlie, W.A. ..	March	2,688	..	1	7,[illegible]			..
*Madras	Mar. 31	1,94[illegible]	+ 97	[illegible]	[illegible]	− 21[illegible]	..	.
Montevideo	Ma[illegible]	27,771	−1,2[illegible]	[illegible]	[illegible]	[illegible]	.	..
Dublin-Lucan Rly.	May 2[illegible]	[illegible]	+ [illegible]	21	[illegible]	+ 1[illegible]	7	..

* Two weeks.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price June 8, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	8¼	—	£6 1 8
do. 7 per cent. Pref.	7	7¼	—	4 10 4
Charing Cross Ordinary	5	4¼	— ¼	5 17 8
do. do. do. 4½ Pref. ..	4½	4⅛	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	13¾	— ½	6 11 0
do. do. 6 per cent. Pref. ..	6	12¼	—	4 18 0
do. do. 5 Deb.	5	112	—	4 9 8
do. do. 4½ Deb.	4½	96	—	4 13 10
County of London	7	11⅜	—	6 3 1
do. do. 6 per cent. Pref. ..	6	11½	—	5 4 4
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	95 xd	—	4 14 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1½	—	8 0 0
do. do. 6 per cent. Pref. ..	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	8½	8⅛	—	5 12 5
do. 4½ per cent. Pref. ..	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	74	— 1	4 12 0
St. James' and Pall Mall	10	7½	—	6 13 4
do. do. do. 7 per cent. Pref.	7	6⅝	—	5 9 10
do. do. do. 3½ Deb.	3½	75	—	4 13 4
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7¼	— ¼	6 4 2
do. 4½ Pref.	4½	4¾	— ⅛	4 14 9

Telegraphs and Telephones.

	Dividend, 1914.	Price June 8, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	105	—	5 14 4
do. Def.	1½	22½	—	6 13 4
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8½	—	5 17 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	13	—	*6 1 3
do. 4 Deb.	4	91	— 1	4 8 0
Eastern Tel. Ord...	7	132	— 1	*6 1 4
do. 3½ Pref.	3½	76	+ 1	4 12 1
do. 4 Deb	4	91	— 1	4 8 0
Globe Tel. and T. Ord.	6	11	—	*6 4 9
do. Pref.	6	11¾	—	5 2 2
Gt. Northern Tel.	22	33	+ 2	6 13 4
Indo-European	65/-	54	—	6 0 4
Marconi	20	$1\frac{27}{32}$	+ $\frac{1}{16}$	10 16 2
New York Tel. 4½..	4½	97	—	4 13 0
Oriental Telephone Ord.	10	2	—	5 0 0
do. Pref.	6	$1\frac{3}{16}$	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 3
United R. Plate Tel.	8	6⅛xd	—	*7 7 0
do. Pref.	5	5	—	5 0 0
West India and Pan.	1	1¼	—	8 0 0
Western Telegraph	7	19½	—	*5 18 5
do. 4 Deb.	4	91	—	4 6 6

Home Rails.

	Dividend, 1914.	Price June 8, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented ..	4	77	—	5 4 0
Metropolitan	1¼	29	—	4 7 2
do. District	Nil	16	— ¾	Nil
Underground Electric Ordinary ..	Nil	1¼	—7/6	Nil
do. do. "A"	Nil	4/-	—1/3	Nil
do. do. Income ..	6	70	—6½	*9 12 10

Foreign Trams, &c.

	Dividend, 1914.	Price June 8, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref. ..	5½	4⅜	—	6 5 9
do. 2nd Pref.	5½	3¾	—	7 6 8
do. 4 Deb.	4	84	+ 1	4 15 0
do. 4½ Deb.	4½	87	—	5 3 6
do. 5 Deb.	5	87xd	-	5 15 0
Brazil Tractions	6	53½	+ 3½	11 4 4
Bombay Electric Pref.	6	10⅜	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	32	—3	Nil
do. 5 per cent. Bonds ..	—	58	—	Nil
do. 6 per cent. Bonds ..	—	80	—2	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	39	—	Nil
do. 1st Bonds	—	48	—	—
Adelaide Sup. 6 per cent. Pref. ..	6	$5\frac{5}{16}$	—	5 13 0
do. 5 Deb.	5	108	—	4 17 1

Manufacturing Companies.

	Dividend, 1914.	Price June 8, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2½	—	5 12 0
British Aluminium Ord.	5	21/6	+ 6d.	4 13 0
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	11¼	—	6 13 4
do. Pref.	6	6⅛	—	5 0 0
British Westinghouse Pref.	7½	1⅞	— $\frac{1}{16}$	8 0 0
do. 4 Deb...	4	72	—	5 11 1
do. 6 p. lien	6	101	+	5 19 0
Callenders	15	12⅛	— ⅛	6 3 8
do. 5 Pref...	5	5	—	5 0 0
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	12/6	—3d.	Nil
do. do. fully paid	Nil	1⅞	—	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-xd	—	9 4 8
do. do. Pref.	7	1xd	—	7 0 0
Gen. Elec. Pref.	6	$10\frac{3}{16}$	—	5 17 8
Henley	20	14½	—	*8 0 4
do. 4½ Pref.	4½	4⅞	—	4 12 4
do. 4½ Deb.	4½	97	—	4 12 9
India-Rubber	5	9	—	5 11 1
Telegraph Con.	20	87	—	6 9 10

* Allowance made for dividends being paid free of income-tax.

Western Telegraph Co., Ltd.—The directors have declared the third quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1915, being at the rate of 6 per cent. per annum.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, June 9th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a " Nitric	"	19/-	..
a " Oxalic	per lb.	..	..
a " Sulphuric	per cwt.	..	..
a Ammoniac Sal	"	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	"	£9	..
a Bisulphide of Carbon	"	£21	..
a Borax	"	£22	..
a Copper Sulphate	"	£29	..
a Lead, Nitrate	"	£35	..
a " White Sugar	"	..	..
a " Peroxide	"	...	..
c Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	7d.	..
a Potash, Caustic (88/90 %) ..	per ton	..	..
a " Chlorate	per lb.	1/6	..
a " Perchlorate	"	1/6	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers ..	"	£11 10	..
a " Recovered	"	£8	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %) ..	"	£10 2 6	..
a " Chlorate	per lb.	10½d.	..
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks ..	per lb.	8¼d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£100	£5 inc.
b " Wire, in ton lots (1 to 14 S.W.G.)	"	£130	£5 inc.
b " Sheet, in ton lots ..	"	£130	£5 inc.
p Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/2 to 1/2¼	
c " " (solid drawn) ..	"	1/2¼ to 1/2½	..
c " Wire, basis	"	1/2¼ to 1/2½	..
c Copper Tubes (solid drawn) ..	"	1/1¾ to 1/2	..
g " Bars (best selected) ..	per ton	£104	£4 inc.
g " Sheet	"	£104	£4 inc.
g " Rod	"	£104	£4 inc.
d " (Electrolytic) Bars ..	"	£92	£3 inc.
d " " Sheets ..	"	£110	£3 inc.
d " " Rods ..	"	£98	£3 inc.
d " " H.C. Wire	per lb.	$11\frac{15}{16}$d.	$\frac{7}{16}$d. inc.
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	1/9	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/7	½d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	65/4	10d. inc.
l " Wire, galv. No. 8, P.O. qual.	"	£22	£2 inc.
g Lead, English Pig	"	£27 5	£6 10 inc.
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£15	£3 inc.
e Mica (in original cases) small ..	per lb.	4d. to 2/6	..
e " " " medium	"	3/- to 5/-	..
e " " " large ..	"	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/2 to 1/3½	..
p " " rolled strip & sheet	"	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	1/1	..
r Steel, Magnet, in bars	per ton	£80	..
g Tin, Block (English)	"	£167	£3 inc.
n " Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals ..	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Lift Accident.—A Manchester Coroner's jury inquired on Friday last into the circumstances of the death of Mordecai Reynolds (14), who received fatal injuries in a lift accident at the premises of the Provincial Incandescent Fittings Co., where he was employed. It appeared from the evidence that the boy had been placing parcels in the lift, which was electrically-worked, and a warehouseman on the third floor heard a scream and saw the lift ascending empty. He went downstairs and found the boy in the well of the lift. The warehouseman thought that the boy must have slipped while putting the parcels into the lift and grasped the starting lever to save himself, or else his coat had caught the handle. The manager said the lift was not in constant use, and anybody could use it, but he had instructed the deceased not to use it, and had reprimanded him three weeks before the accident when he found him in it. "Accidental death" was the verdict.

Rees Roturbo Manufacturing Co., Ltd.—The accounts for 1914 show a profit of £1,570, and after meeting interest on loans, the credit balance of £2,539 brought forward was reduced to £413.—*Financier.*

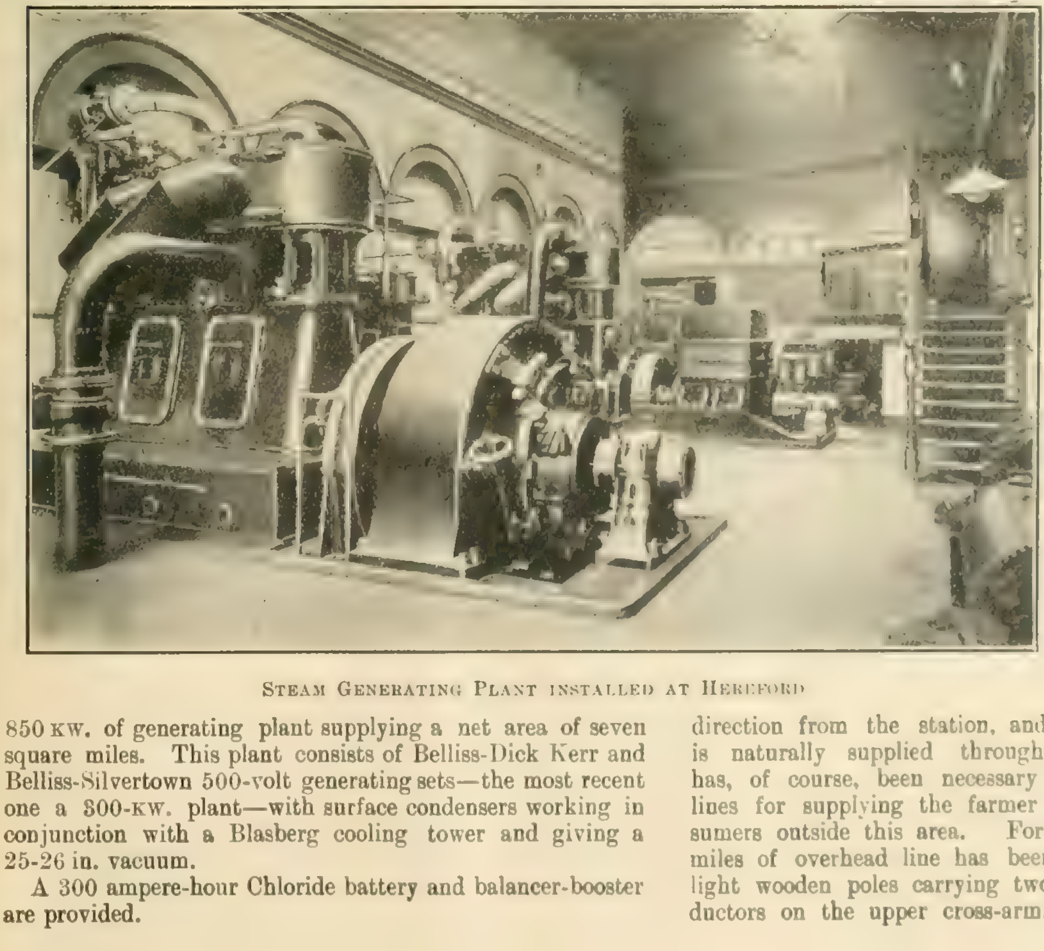
ELECTRICITY IN FARMING.—II.

FARMING SUPPLY AT HEREFORD.

If convincing evidence as to the value of electricity in agriculture is to be put before our supply engineers—those who are in touch with farming districts—it will no doubt come better from within than without, and we are glad to be able to give some details of the work carried out by an English central station engineer, Mr. W. T. Kerr, of Hereford, in meeting the electrical requirements of the farmers in the vicinity of his city, and of the general supply in Hereford, which is a typical agricultural centre, in the hope that the excellent results obtained may be an incentive to others.

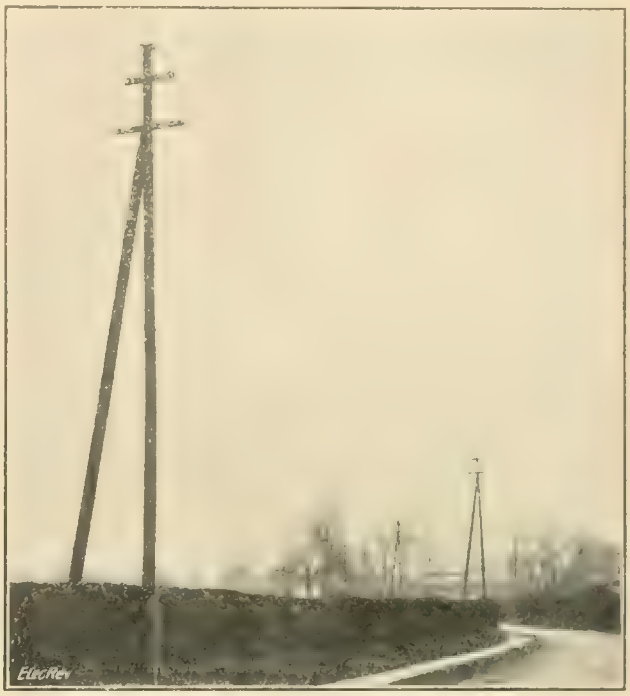
The Hereford Electricity Works

In the first place, we may point out that the electricity works, which started in 1898-99, now contain some 850 kw. of generating plant supplying a net area of seven square miles. This plant consists of Belliss-Dick Kerr and Belliss-Silvertown 500-volt generating sets—the most recent one a 300-kw. plant—with surface condensers working in conjunction with a Blasberg cooling tower and giving a 25-26 in. vacuum.


Steam Generating Plant installed at Hereford

A 300 ampere-hour Chloride battery and balancer-booster are provided.

Steam is supplied at 160 lb. pressure from one Stirling and two Lancashire boilers, which are fitted with Underfeed stokers, and provided with heated forced draught. The gases from the boilers are passed through an economiser, and both steam and electrically-driven feed pumps are installed. The presence of the older plant in the station has prevented the adoption of superheating up to now.

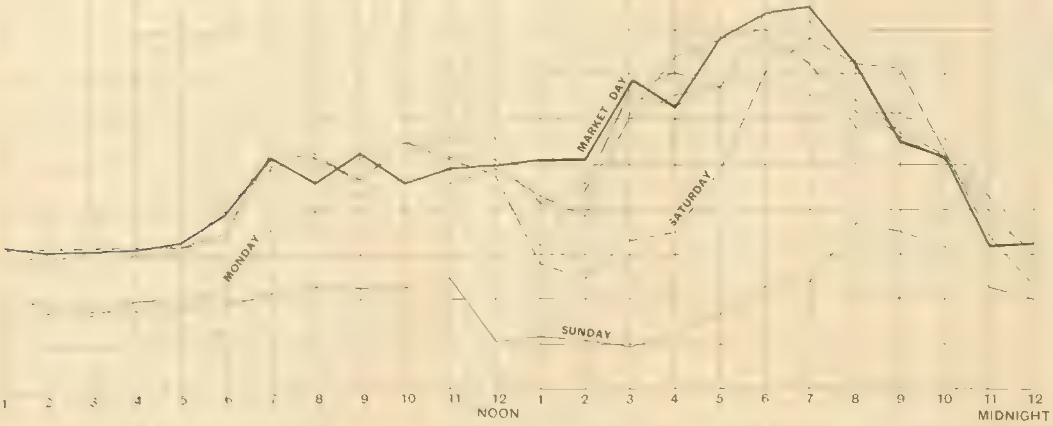


Transmission Line for Farm Supply.

Through the electrical development of this agricultural area, containing possibly 25,000 inhabitants, with, however, no factories, electric street lighting or tramways, over 1,300,000 units were sold during the last 12 months, and a load factor of 25½ per cent. was obtained, figures which speak for themselves.

Under these conditions the generating plant operates on some 5 lb. of fuel (at a cost of ·38d.) per unit, a mixture of slack and coke breeze being used at present owing to the coal crisis, and the overall steam consumption being, roughly, 30 lb. per unit.

The distributing network extends practically two miles out in every direction from the station, and while the built-up area is naturally supplied through underground cables, it has, of course, been necessary to adopt overhead pole lines for supplying the farmer and other scattered consumers outside this area. For this purpose some three miles of overhead line has been constructed, with fairly light wooden poles carrying two stranded-aluminium conductors on the upper cross-arm, and two galvanised iron guard wires—which serve as the neutral wire—on the lower arm.



Curves showing varying daily load for one week; Hereford Electricity Works.

At terminal poles adjoining the underground network the three-core armoured cable is carried to a dividing box at the top of the pole, the bare cable ends being joined to the overhead aluminium wires mechanically by means of Silvertown service joint connectors; at farm terminal poles Henley twin lead-covered wire, cleated to the pole and farm buildings, is used to couple the line and farm installation. Mr. Kerr gives the actual cost of such a line carrying two 7/10 stranded aluminium conductors and two guard-wires, erected in compliance with Board of Trade Regulations, as £110 per mile under normal conditions.

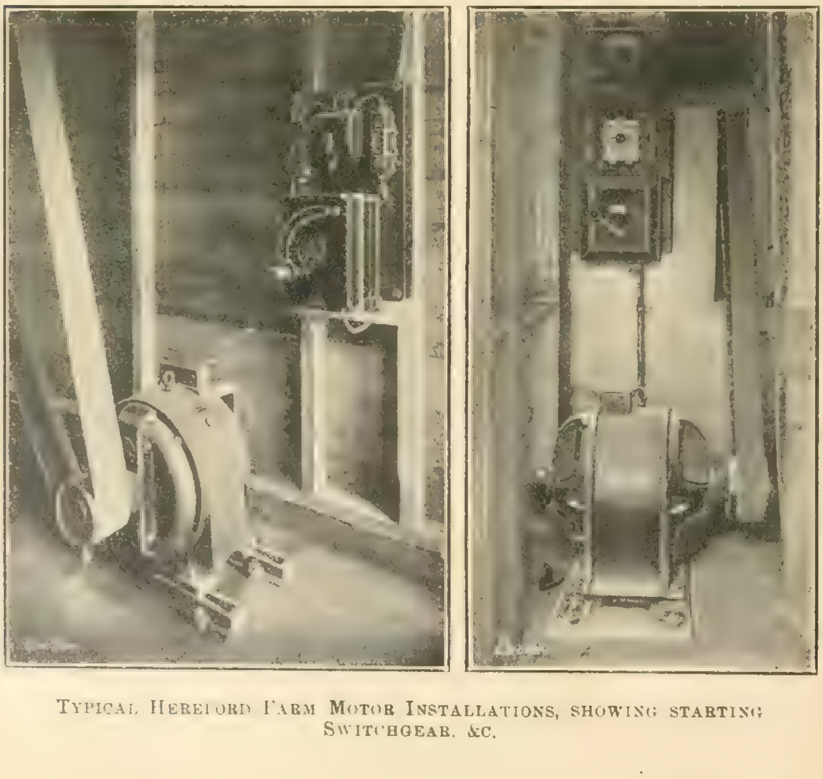
It is the practice to place such pole lines along the hedges where they are out of the way of cattle and field operations generally, and occasionally wayleaves for poles are demanded, of the order of 1s. per pole per year, where the owner of the land is not directly interested in the supply. So far, we gather that no maintenance has arisen on these lines, some of which have been in use for some years.

Mr. Kerr is at present supplying 10 actual farms, and we may refer to a typical case of one where from 80 to 100 cows are kept. Here a 7½-h.p. motor is, following a general practice, installed in a locked-up cupboard or cabin, and drives chaff-cutting, kibbling and pulping machines for preparing cattle food, and a small pump for supplying water; electric light is installed in the byers, foal yards and house, about 30 metal lamps being used, including four 50-c.p. lamps in a bracket fitting for general yard lighting.

This consumer took 633 units last year for lighting, at 4½d. per unit, and 930 units for power, at 3d. per unit, less usual discounts, and gave the supply undertaking a revenue of over £23 for the year, and Mr. Kerr estimates the average farm bill in his area at £20 per annum.

Underground Cable Terminal. Farm Terminal.

Terminal Poles on Farm Lines.



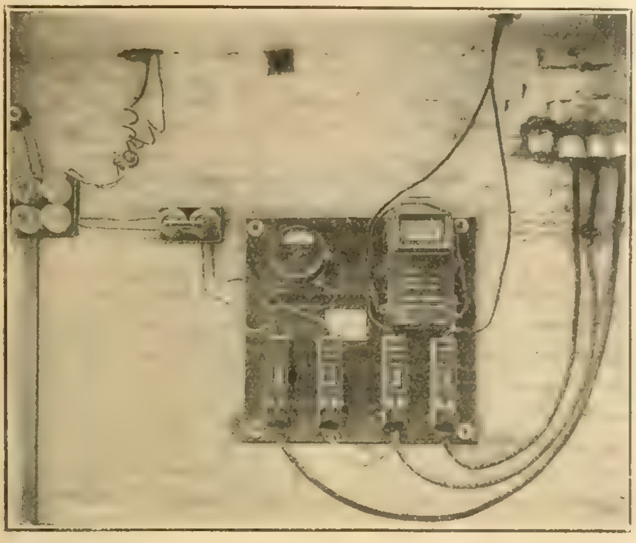
Typical Hereford Farm Motor Installations, showing starting Switchgear, &c.

It will be noted that both the cost of overhead lines and the average revenue are higher than those indicated in the American figures, while the cost of energy is — allowing for American values — cheaper here, the results showing that the English farmer is likely to prove a better customer than the American.

Moreover, Mr. Kerr considers it quite feasible to obtain an average revenue of at least £200 per annum per mile of line from farms and country houses.

Such a line, 1,000 yards long, was recently constructed to supply a farm where power is used in the manner previously indicated, and for milking 88 cows, and the electrical stimulation of root crops, &c., as an experiment, on some 20 acres of land, during the early morning and evening is under consideration, by means of apparatus controlled through a time switch; this line has attracted two other farms and two private houses *en route*, and it is found that *through the encouraging results every farmer will do all he can to get a supply*, and if necessary use his influence with the local Councils, which at first were strongly inclined to put difficulties in the way—following time-honoured precedents.

Such prices as 6d. per unit for lighting and 3d. per unit for power are quite acceptable to the farmer in this area, who gains in many ways by using electricity. Thus the first cost of his installation is probably not more than half that for steam or oil power. His fire insurance is greatly reduced, especially where power is used in a stack yard, in which case insurance may be as costly as the power itself with a steam engine.



Farm Terminal Board and Incoming Cables.

Overhead Wiring and Lighting in a Hereford Farmyard.

His labour costs less; the electric motor is always ready, and on a wet day, when outside labour is impossible, chaff-cutting and corn kibbling can be done; moreover, milking machinery is being found essential. The freezing of water in the cylinder jackets or the necessity of emptying them is against the internal-combustion engine in the winter, while magneto and other starting arrangements are scarcely suited to farm usage, and it is not surprising that starting troubles are the bane of this type of prime mover on the farm.

As a sequel it may be mentioned that *there are no petrol engines on farms in the vicinity of the Hereford distributing mains.*

To some extent recent legislation, in the shape of the Pure Milk Bill, has encouraged the use of electricity for lighting and power in cowhouses, which are being largely reconstructed in certain parts of the country, giving a convenient opportunity for installing electrically-driven food preparing machinery close to the cattle stalls, and of cutting fresh food every morning and afternoon of the week, when the cattle are fed, this having been found by experience to give an increased yield of milk.

Supply to an outlying farm is usually granted on a revenue guarantee of 10 per cent. of the cost of the line, and, in practice, amounts to from £7 to £8 per annum, which in view of the average farm bill for current can be safely given by the consumer; speaking generally, one-third of the energy is required for lighting and two-thirds for power. As previously indicated the electric motor has been very generally adopted in the old city itself, where we believe only a very few gas engines have survived its introduction.

Electrically-Driven Corn Kibbler, Hereford.

Hereford is a centre of the cider industry and its five cider mills have some 300 h.p. of motors installed, the cellar lighting and refrigeration plants offering long-hour loads. Then there are three brewery consumers, one being electrically equipped throughout; five saw mills, a tannery and a tile works.

A particularly desirable consumer is a flour mill operating for 120 hours a week, with a 61-kw. average demand; electric ovens are used in this mill for both baking and moisture tests.

Two 60-h.p. electrically-driven turbine pumps—two 20-h.p. automatic pumps for high-pressure supply are also in use—at the waterworks provide an easily adaptable load and the saddlery, leather, hay and corn businesses associated with a country town have largely adopted small motors, so that in all over 2,000 h.p. of motors has been installed, which consumed roughly a million units last year for industrial driving.

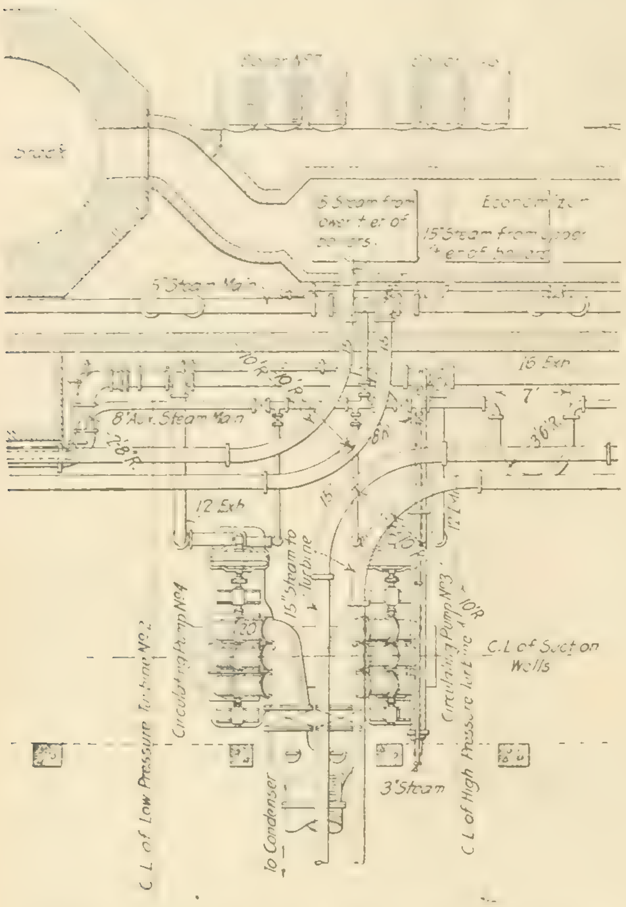
Copper.—Returns for May 31st, 1915, as set forth in Messrs. H. R. Merton & Co.'s statistical tables, again show an increase in visible supplies. The quantity, 34,090 tons, is 2,603 tons higher than for the end of April. English visible supplies have increased by the unusually large figure of 3,936 tons during the same period.

In detailed supplies a gratifying increase in European arrivals from North America is to be noted. This quantity, 31,085 tons, is only 3,315 tons under the average for the 12 months preceding August, 1914. Spain and Portugal exported to England and France during the month a quantity largely in excess of the pre-war average. Other countries (not specifically mentioned) contributed 8,166 tons, against a pre-war average of 4,910. Chile shipments are rather low for the month, but it must be remembered that they were high in April. Australian shipments are still a third below pre-war average.

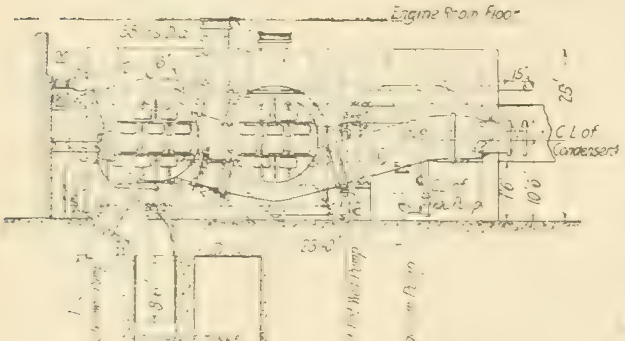
Total deliveries are 10 per cent. under pre-war average. The slowness with which the price has increased would appear to point to a fairly even balance between supplies and consumption.

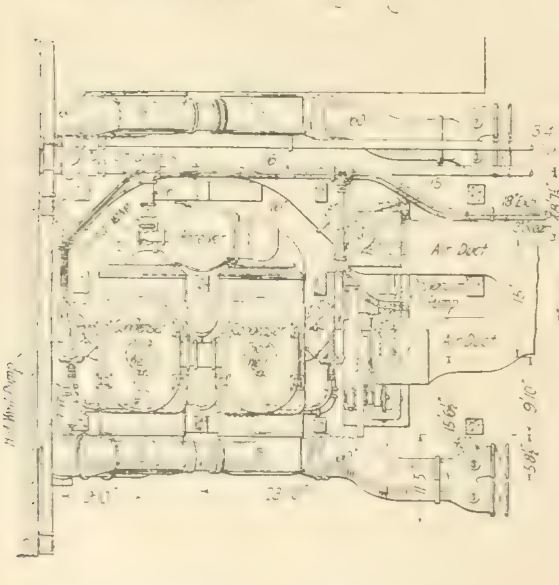
THE NEW TURBINE PLANT OF THE INTERBOROUGH CO., NEW YORK.

At the present time the reconstruction of the Seventy-Fourth Street station of the Interborough Rapid Transit Co., in New York, is being carried out with a view to meeting the increasing demand for power on the elevated lines.



Circulating Pumps and Piping, 30,000 kw. Turbine.





This station, which was built in 1901—14 years ago—and excited considerable interest at the time, contained eight 12,000-h.p. Allis vertical-horizontal Corliss engines, driving 11,000-volt Westinghouse revolving-field alternators at 75 r.p.m., and having a steam consumption in recent times of 17·3 lb. per kw.-hour.

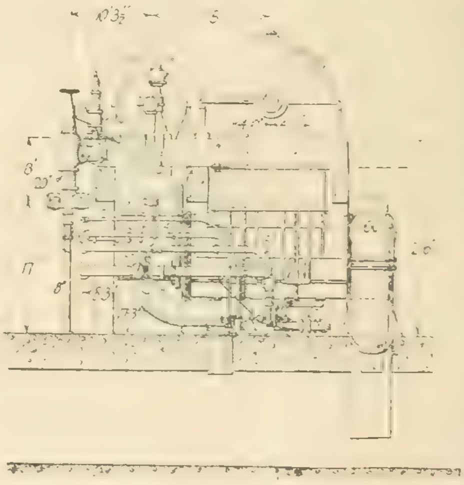
Later on there was added a 7,500-kw. Westinghouse turbine unit. Originally the engines were coupled to Worthington jet condensers, but in 1903 these were converted to barometric type condensers.

In the boiler house there were 64 Babcock boilers, each containing 5,200 sq. ft. of heating surface and six each of 6,000 sq. ft. heating surface; all were equipped with Roney stokers, and the gases were passed through Green economisers to four 278-ft. Custodis brick stacks. The generating plant operated on dry saturated steam at 160 lb. pressure, and with a vacuum of 26 in. The following remarks on the reasons for breaking up and replacing the engine units are quoted from *Power*:—

"The economy and the excellent physical condition of the units have caused many to wonder why low-pressure turbines were not connected to them, as practised with such satisfactory results at the company's Fifty-Ninth Street station. Briefly, the chief reasons are these: First, the economy of the turbine as a prime mover at the time of the Fifty-Ninth Street installation was not nearly as good as at present. Secondly, the engines at Fifty-Ninth Street, in addition to being in excellent physical condition, were designed for a higher pressure than those at Seventy-Fourth Street, and, quite important, they have poppet valves in the high-pressure cylinders, adapting them to high-pressure superheated steam, while this advantage is not possessed by the Corliss-valve units at Seventy-Fourth Street. Thirdly, the complete expansion turbines (turbine and generator combined) now going in at Seventy-Fourth Street were bought at a comparatively low figure—about one-third the price per kilowatt paid for the engine units. Fourthly, it is necessary to economise on space at Seventy-Fourth Street, and complete expansion turbines accomplish this far better than combination units."

The reconstruction will involve the installation ultimately of eight 30,000-kw. turbine units, but at present three of these sets are being substituted for four 12,000-h.p. (7,500-kw.) engine units, leaving four engine units and the 7,500-kw. turbine unit of the original plant; for one-half of the boiler plant opposite the turbines, the Roney stokers are being replaced by Taylor underfeed stokers, superheaters are being added and the economisers removed; turbine-driven feed pumps are also in part replacing motor-driven pumps and the main switchgear is being rearranged and reactances added.

The new turbine units each consist of two separate turbo-alternator sets side by side; one, the high-pressure set, consists of a single-flow turbine running at 1,500 r.p.m., while the other, the low-pressure set, consists of a double-flow machine running at 750 r.p.m. The turbines are of the reaction type throughout and are coupled through a large steam receiver. The arrangement was chosen to simplify design problems, particularly those relating to temperature range, blade speeds and steam congestion. The reliability of smaller units is also secured. Each complete unit rests on a steel frame foundation encased in concrete, leaving a good deal of space below for condensing plant, &c. A twin-shell Worthington surface condenser is placed under the turbine unit, hung from the turbine bedplates, but with the weight carried on springs. One shell is connected to each low-pressure exhaust outlet; the total tube surface is 50,000 sq. ft., and the condenser is designed to deal with 350,000 lb. of steam an hour with water at 60° F., maintaining a vacuum of 97 per cent. (29·1 in.).



Condensing Plant Arrangement, 30,000-kw. Turbine.

The circulating water for the twin condenser is supplied by a pair of triple centrifugal pumps of 75,000 gallons per min. capacity, which deliver to the two shells in parallel through a 60-in. pipe, the water being drawn through a revolving screen at the entrance to the inlet tunnel from the river. Each pump is driven by a 240 h.p. turbine, and one pump unit will carry the winter load.

The twin condensers are rigidly bolted to the turbine exhaust flanges, and a 36-in. equalising connection with a copper expansion joint is provided between the two shells, and in order to allow freedom of movement of the latter, the water pipe connections are made with rubber expansion joints. The condensate pumps for each unit are turbine-driven centrifugals of 800 gallons a minute capacity each, one pump being spare. Two cross-connected reciprocating air pumps are provided for the twin condenser, one being sufficient for the complete unit.

The pipe arrangement provides for delivering the condensate and auxiliary exhausts to a Hoppes open-type feed water heater; the receivers and the latter are also coupled through a heat-balance valve, the function of which is to interchange steam between the two according to which has the higher pressure.

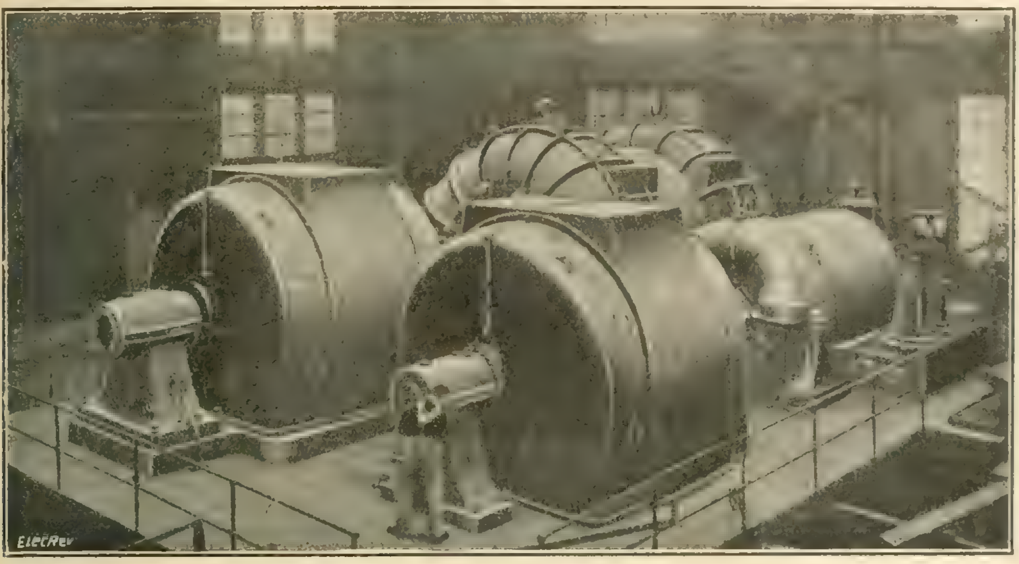
At about 27,000 KW. the receiver reaches atmospheric pressure and at 32,000 KW. it is at about 3 lb. gauge pressure.

The feed heater, to which reference has been made, is 9 ft. diameter and 21 ft. long, with a capacity of 1,600,000 lb. per hour; it contains 240 pans, each 4 ft. long, having a total area of 3 400 sq. ft.

The heater was installed partly because certain economisers had been removed to increase the effective flue area and partly owing to the good supply of exhaust steam from auxiliaries.

Turning to the boiler plant, which has been operated at 160 lb. pressure, although designed for 212 lb. with a factor of safety of 5, one half the boilers are now to be operated at 215 lb. pressure, 200° superheat, and the necessary alterations to fittings are being made, superheaters added, &c. Taylor underfeed stokers are being installed in place of the old ones, it being calculated that while under the old engine conditions a maximum of 1,150 KW. per stoker was obtainable, under the new turbine conditions 3,750 KW. will be satisfactorily carried.

Thus under the old conditions eight boilers were allowed for one 7,500-KW. unit, while the same number under the new conditions will be allowed for each 30,000-KW. unit.



Turbine Set of 30,000 kw., Seventy-Fourth Street Station, New York.

In the boiler basement four triplex feed pumps have been removed, and three turbine-driven centrifugal pumps, sufficient for the entire plant, installed: for each pair of boilers there is one turbine driving two stoker fans direct and the stokers also through helical reduction gears from the blower shafts.

The electrical switching arrangements have also been reconstructed to provide against the large amounts of energy which will now be concentrated on short circuit.

Between the generator and main bus-bars there is a 5 per cent. reactance, and between it and the auxiliary bus-bars is a 2 per cent. reactance.

The main bars are sectionalised through oil switches and groups of feeders run from each section. The 5 per cent. reactance coil is about 8 ft. 6 in. long, and the 2 per cent. coil 3 ft. 6 in. long, both being 4 ft. 6 in. diameter.

The generators, which are ventilated by rotor fans, the air being discharged into the boiler house, have about 8 per cent. reactance.

The steam consumption curve for the new units is a flat one, falling from 12·07 lb. per KW.-hour at 15,000 KW., to 11·27 lb. at 25,000 KW. (apparently the most economical load), and then rising to 11·63 lb. at 30,000 KW.

The steam consumption of the auxiliaries at the most economical load is 7·5 per cent. of the main turbine steam consumption, and 6 per cent. at full load.

The power consumption of the auxiliaries is 1·4 per cent. of the main turbine power at full load.

For the above particulars we are indebted to our American contemporaries, *Power* and the *Electrical World*, and to the latter for our views.

Cinematograph Exhibitors' Association.—The annual conference of the Cinematograph Exhibitors' Association of Great Britain and Ireland (Ltd.), has been held in Edinburgh. Following the meeting of the Association, which was held in private, a luncheon was given, presided over by Mr. R. C. Buchanan, president of the Edinburgh branch. Various speakers paid a tribute to the cinematograph industry's work on behalf of recruiting, while it was pointed out that there are at present 67,000 theatres in the country, and that the Association represented 2,000, with probably an average capital of £5,000.

LOAD FACTOR, OUTPUT AND COST.

By C. ASHMORE BAKER, A.M.I.E.E.

(*Concluded from page* 810.)

Attention is called to the following typographical errors in the preceding portion of this article (Elec. Rev., June 4th, p. 808):—

The equation for ρ immediately before equation (6) should be $\rho = 11{\cdot}8\,\lambda^{0{\cdot}831}$; that is to say, the value 0·831 is an exponent, and not a multiplier. Similarly in equation (9) the value 1·027 is an exponent.

In the paragraph following equation (9) the dotted curve referred to is in fig. 1, not in fig. 3.

In fig. 12 capital expenditure is dealt with. The logarithmic diagram in the right-hand top corner represents the entire list of 200 municipal undertakings in London and the provinces, with which we are dealing, and connects total capital and maximum load. The curves in the main diagram represent capital expenditure per kilowatt of maximum load for the various classes of undertakings.

With the exception of the London group, whose capital per kilowatt stands high almost throughout, the curves are not very divergent, and there is a good deal of interlacing; thus the ordinary provincial town curve starting highest crosses all the others before the 4,000-KW. point is reached, while that for the coal area towns starting lowest finishes well above the general average, and some 25 per cent. above the ordinary provincial towns.

A noticeable feature of the general form of these curves is their tendency to flatten out above the 5,000-KW. point, owing probably to the fact that the lower cost per kilowatt of large generating sets is counterbalanced by the higher cost per kilowatt of extended supply areas.

Influence of Ownership.

We now come to that highly controversial subject, the question of ownership, and I offer no apology for presenting this aspect of the question to the readers of this journal, believing, as I do, that the science of political economy is as much the province of the engineer as any other science; indeed, when we consider how inextricably finance is interwoven with engineering, it is safe to say that it is even more our province than many branches of even *physical* science.

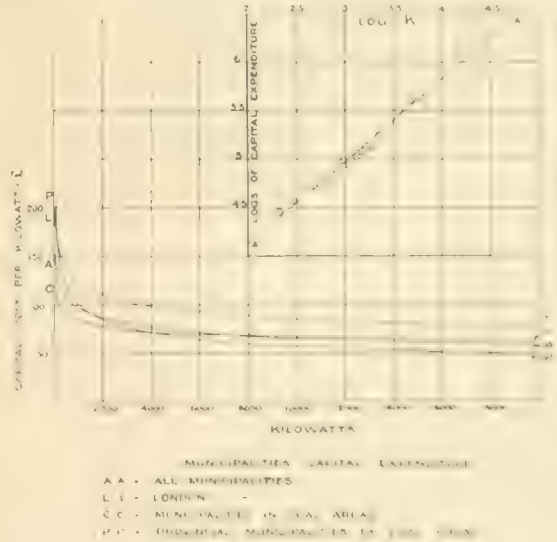


Fig. 12.

The question presents itself to me in the following form:—Under which of the two systems of ownership, public or private, can we produce and sell the largest number of units at the lowest average cost?

In asking ourselves this question, and endeavouring to solve it by applying the methods I have described, we must bear in mind that our comparison must take into account not only the elements of size and load factor, but we must also compare our two types of ownership class by class. I have, therefore, divided the company-owned undertakings into three classes corresponding with those into which the municipalities have been separated.*

Having calculated the K λ diagrams for each group in the usual way (see fig. 9) I have worked out the cost curve corresponding with this K λ diagram under each heading from the standard equations. Taking the values of this curve at all points at 100, I have worked out the ratios thereto of the costs for corresponding values of K for the two types of undertaking in the group to be studied.

Thus curve B, fig. 9, gives us the relation between load factor and maximum load for London undertakings owned by municipalities. If we work out from these co-ordinate values of K and λ a corresponding curve for total cost from the equation the data of which are given in Table I E, and divide the ordinates of fig. 10 (full line) by the ordinates of our new curve, we shall obtain a series of values giving us the dotted line in fig. 13.

This is a curve of percentages and represents the amount per cent. by which the total cost per unit in the case of London municipal undertakings exceeds the general average cost per unit incurred by municipalities as a whole.

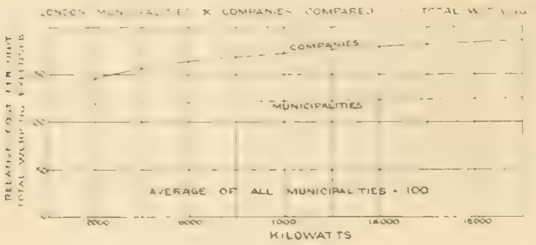


Fig. 13.

The full line curve in fig. 13 is calculated in the same manner so that we are comparing companies and municipalities class for class, size for size, and load factor for load factor.

Now let us look at the result. Dealing first with the provincial undertakings and taking the working expenses item by item, in some the Local Authorities show better results, and in others the contrary is the case. Thus on the items Oil, Waste and Stores, Wages of Workmen, and Rent, Rates and Taxes, the municipal figures are higher, but in the items for Fuel, Repairs and Maintenance, and Management, the companies' figures are higher (for Management in particular, considerably higher) than the municipal figures, the general result being that the total cost to the companies is some 7½ per cent. higher than that for municipalities. (See fig. 14.) This result is naturally reflected in the price charged.

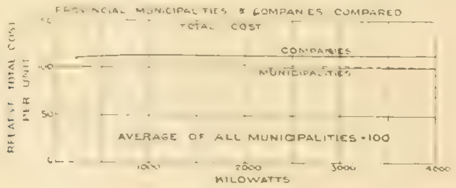


Fig. 14.

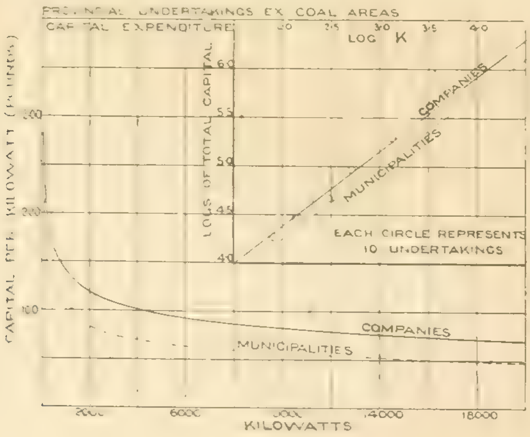


Fig. 15.

Turning to the London companies, there is not a single item, from the coal to the consumer, in which the companies' curve is not above, and considerably above, the municipal curve, the result being that the consumer pays to the company something over 20 per cent. more for his energy than he would pay to a municipality.

It should be noted, however, that load factor is an inverse function of the price charged, as will be seen later, and it is a question, therefore, if we are quite justified in basing our comparison on equal load factors; we should, I think, be quite justified in basing it simply on equal outputs were we considering the matter from the consumer's point of view. In such a comparison the municipalities would show to greater advantage still.

Figs. 15 and 16 show the capital expenditures of the provincial and London companies respectively, and in dotted lines the corresponding municipal capital expenditures. And here I must confess to an unpardonable crime against statistical ethics. Fig. 16 has been deliberately "faked."

In this figure each circle represents a single undertaking instead of a group, hence they are somewhat scattered.

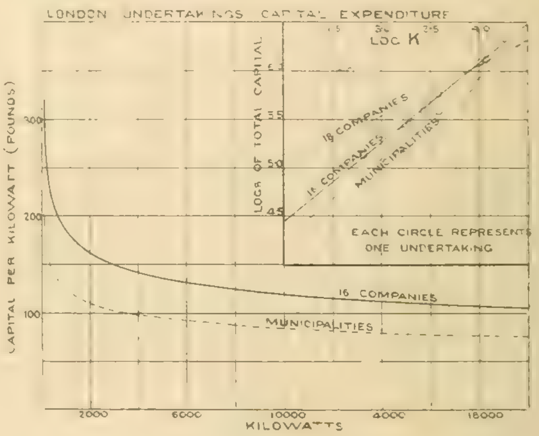


Fig. 16.

Now, if we take the whole 18 companies within the boundaries of Greater London, given in the returns which we are studying, we get a logarithmic diagram represented by the thin full line. If, however, we eliminate the two undertakings represented by the two circles near the top left-hand corner of the inset, and calculate our average from the remaining 16 concerns, we shall get the thick full line, which it will be noted is fairly parallel with the dotted municipal line. The thick black curve is calculated from the "faked" thick black line, and that is my offence.

The difference between the black and dotted lines represents, I suppose, dilution of various kinds.

Thus we have an answer to the question formulated above as to the most economical type of ownership; namely, that neither economy of first cost nor economy of administration or working is to be gained by private ownership.

Now if we look at fig. 17, we shall get an idea of how the question affects the consumer.

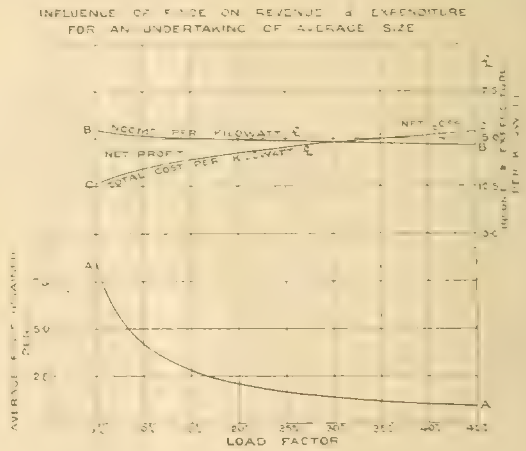


Fig. 17.

Curve A shows the relation between price and load factor for an undertaking of average size as derived from equation (8 and 9).

Curve B is the income per kilowatt obtained by multiplying the corresponding values of A by the load factor and by 87·6/240.

Note that this curve descends as the load factor increases.

Curve C is the total annual cost per kilowatt, and is arrived at by multiplying the values obtained from equation (6) by 87·6/240, and adding to the product a sum of £6 6s., being 7½ per cent. capital charges on an expenditure of £88 per kilowatt.

Note that this curve is an *ascending* curve, and that the vertical distance between B and C represents net profit as far as the point at which they cross. The distance separating them beyond this point would be net loss.

Now observe the difference in policy as between company and municipality, which these curves suggest. The object of the company is to keep net profits as high as possible, hence it has no interest in aiming at high load factors unless it can obtain exceptionally high relative prices; the trend of its policy is to keep prices up, as, in fact, the companies as a rule have done.

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* As there are only some half-dozen companies working in the coal areas, some of whose costs are above, and some below, the municipal average, I have neglected this class as offering no evidence either way.

The object of the municipality, on the other hand, is to sell as many units as possible at the lowest price compatible with financial stability. (I am speaking now, of course, of the more enlightened municipalities.) The municipal engineer, therefore, is continually working towards the crossing point of the curves and endeavouring to push that crossing point as far as possible to the right by lowering his working expenses, and increasing his load (compare fig. 7). The consumers respond by buying 40 per cent. or 50 per cent. more units per head of population where Local Authorities own the supply than they do in areas supplied by companies.

Fig. 18 gives us the relation between average price charged and the growth of sales in units per head of population per annum. It is taken over a period of five years, and inasmuch as the equation to this curve is practically the same for both companies and municipalities, it may be taken as being independent of ownership.

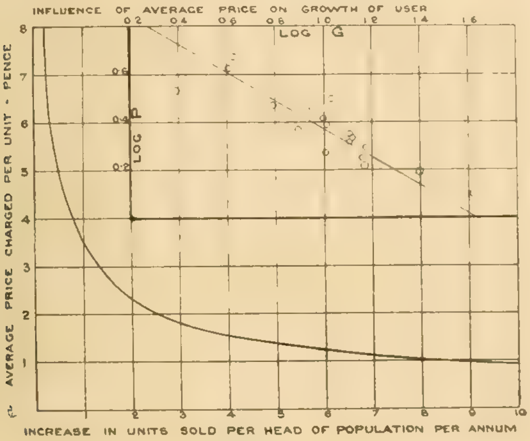

FIG. 18.

When we consider that the average cost of a municipally supplied unit was, for the year 1911-12, 1·62d., as compared with 2·37d. charged by the companies, the sociological value of public ownership becomes apparent.

Thus it is difficult to discover (outside the pockets of shareholders and directors) any justification for the general principle of the supply of electricity by private enterprise.

There are many questions of great interest which the methods of analysis and comparison, which have been described, would elucidate. Such questions are bulk supply, group ownership of undertakings, the relative economy of different types of plant, questions of tariff, &c., and the author trusts that the foregoing suggestions, which do not pretend to be more than a rough preliminary study of methods, may produce results of greater value from the hands of specialists.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Munitions of War.

In this time of National stress I suggest the immediate organisation of the workshops of the many electricity supply works in the Kingdom, both municipal and company owned, with a view to producing shells and other suitable munitions of war.

I suppose all these works have already lost some men to the Colours, but in every case they are compelled to retain enough men to deal effectively with any case of emergency that may arise in connection with these undertakings. These men could each do a certain amount of overtime for the good of the Empire. Moreover, they are for the most part skilled mechanics, and doubtless the Corporations and companies concerned would readily grant them the full use of their machine tools and workshops.

Possibly also additional service could be obtained from engineers resident in the towns or districts where the works are situated, and thus the plant could be maintained on practically continuous duty excepting when required for the pressing needs of the power station itself.

In this way a considerable source of production will be immediately tapped which otherwise must apparently remain dormant. Presumably the scheme would be worked in conjunction with the various munition committees which are being formed in the manufacturing centres. I feel sure the authorities would find both the managers and men of the electric power stations willing and anxious to do all they can to help the common cause on such reasonable terms as the Government are in a position to offer.

Geo. Wilkinson.

Electricity Department, Harrogate,
June 5th, 1915.

Automatic-Lift Accidents.

May we add a note on this subject endorsing Mr. Rosenbusch's suggestion that Mr. Broadbent, while justifiably criticising a lock of the type he illustrates, overlooks the qualities of other locks which have been available for many years.

It is, for instance, a very considerable period since we first sent out a lock which was free from all the defects enumerated by Mr. Broadbent, and in its present form it not only meets all the requirements laid down by Mr. Rosenbusch, but also another which in our view is a vital one, viz., that it shall be absolutely impossible to unlatch the gate without first cutting off current.

Mr. Butler asks for evidence as to the maintenance of an arc after an electric lock contact is broken. The writer has seen this on very many occasions, and holds the belief that under certain conditions it is possible in most of the locks in use. The conditions arise most frequently in automatic machines, but the arc can be obtained sometimes with car switch control.

It would only be mischievous to describe the conditions, but the cure is obvious—increase the length of break.

That of course means an increased length of stroke for all moving parts and a larger box, with cost in proportion. The chief difficulty in the way is the reluctance of our good friend the architect to provide the requisite space, or to have beautiful doors and enclosures disfigured by "those barbarous engineering fellows." So small boxes with short breaks are the rule.

An evil influence in automatic-lift switch design is born of the fact that in most control systems several switches are intended to make circuit only, and never to break it. Therefore, it is argued, short breaks will suffice, and that will cut down cost. But things do not always run as intended, and owing to some failure at a quite different point, due to dirt or bad lubrication, a poor innocent little "making" switch is called upon to break a comparatively heavy circuit, and trouble results.

In view of this contingency we have recently redesigned all our switches for every class of service, giving every switch a "breaking" capacity equal to the maximum current passing. We have suppressed the purely "making" switch.

Smith, Major & Stevens, Ltd.
C. G. Major, *Chairman.*

Northampton, *June 3rd*, 1915.

Cable Shortage.

I was much interested in reading in your issue of May 28th the letter from a contractor *re* above. My firm has had the same experience with wire supplied by one of the oldest English cable manufacturers, the deficient coil being 15 ft. short of the six switch wires our man should have got out of a full coil. The fact of finding one coil over the proper length does not remove the doubt in the contractor's mind as to whether he has been, and is, getting what he pays for; when one finds such errors with firms of high standing, it lessens the desire to deal with them.

Your correspondent, in finding a coil 5 yards too long, was more fortunate than we were; we measured three new coils in the presence of the local agent, and found only one to be correct length, viz., 110 yards, the other two coils being 4 ft. and 4 ft. 4 in. short respectively.

Perhaps if others would tell their experience in this direction, it might lead to the contractors getting full measure in future.

I need hardly point out that these deficiencies, small in themselves, mean an enormous saving of material to the larger manufacturers, increasing their dividends at the expense of the contractor, who has quite enough to look after, without measuring each coil of cable from the manufacturers.

A.M.I.E.E.

Appointments Vacant.

At the present time, when employers are asking for Associates of the Electrical Engineers Institution at labourers' wages, it would save the time of those looking for responsible posts to separate such vacancies below £2 per week from those up to £5. Those above that figure (when they occur) could be placed first to show budding youths what might happen to them.

I also suggest a home for those too old at 30, as that appears to be the age limit for most of the advertised posts.

In a Good Post.

Cab Signalling.

So far as Mr. Hans von Kramer's [illegible] is concerned, I surrender to him without offering so much resistance as a scratch of the pen. He has my unqualified permission to say that I cannot distinguish between Hertzian radiation and Faradic induction; that I know nothing (and think less) of the Railophone; and that I do not know the difference between the mantissa of a Naperian logarithm and the *n*-th differential coefficient of a trigonometric function. Of one thing only do I solemnly warn him: viz., that he will find it a far more stupendous task to enumerate my intellectual deficiencies than to tabulate the *real* merits of the Railophone, after the latter have been discovered.

I have spent many a weary hour calculating curves, frogs, and switches over which, for several years, trains have been running. I am, therefore, dimly conscious of the millions of times per month trains run over switch rails which, because they must be movable, cannot be fastened at the ends so easily as ramps can. The danger Mr. von Kramer mentions of a ramp being torn up is of the same kind as, and of no greater degree than, the danger to a switch rail. When one reflects that the accidental tearing up of switch rails, by objects wrongly hanging down from trains, does not occur as often as one time in a year, one can see how much practical importance attaches to the solitary exception which Mr. von Kramer cites.

I think that some rather authentic Railophone information may be obtained from British patent specification 19,467 of 1912 (of which, no doubt, I am profoundly ignorant), since that specification bears the name of Mr. Hans von Kramer. By examining fig. 2 of this specification, a nasty man like me might suspect:—(1) That any line-wire portion 3A would produce inductive effects towards the line of corresponding signals C as readily as the parallel portion of co-operating local loop *y* does; (2) that this same criticism applies in the opposite direction; and (3) that these wires produce such effects quite as energetically outwards from the track which they are intended to govern as they do either inwardly towards the centre line of that track or directly upwards.

By regarding the two tracks of this figure as the inner two of a four-track route, we at once see that each line-wire will emit inductive impulses as readily towards the wrong (adjacent outer) track as towards the right track. Indeed, in the more recently published descriptions this short-distance radiation (how iconoclastic!) to the "other" track is actually employed, at the local loops on double-track routes, for effecting the danger warnings on the trains.

It is in view of these facts that I shall be so happy when Mr. Acfield publishes the circuit diagrams and general descriptions (without taking the trouble to give details) which will enlighten humanity by revealing the "right lines" on which the Railophone can rationally be applied in the case of a double-track junction with a four-track route.

Wm. H. Dammond.

Nottingham, *June 7th*, 1915.

Your correspondent, Mr. von Kramer, must have either a very low opinion of the mental calibre of your readers or a very slight regard for his own reputation for truthfulness. Otherwise, he would not have applied the expression "illogical outburst" to Mr. Dammond's pertinent and clearly reasoned letter; nor would he have written cheap nonsense to the effect that he (Mr. von Kramer) did not think that Mr. Dammond would know the difference between the Faradic and the Hertzian classes of cab signals. Is Mr. von Kramer not aware that the very terminology, Hertzian and Faradic, as applied to wireless cab-signal classes, was introduced by Mr. Dammond? During the 20 months that Mr. Dammond's full-size tests—real tests—were taking place, more than a dozen persons spent a Saturday afternoon testing the mechanism, every person having had years of experience at electric light and power works, telephone or telegraph testing, or railway signalling. We were so surprised at the merits of the apparatus that we requested permission to return and bring others the next Saturday. Mr. Dammond replied that we were at liberty to bring anybody we wanted, and as many as cared to come. Not less than 30 came next time. On both occasions Mr. Dammond turned the whole installation over to us, instructing the driver to run the locomotive just as we dictated, and informing us that he hoped we would not hesitate to earth or break any wires, or other parts, as might be found necessary for thorough testing. From the experience gained on these two visits I know that in the Dammond system:—

(*a*) Full protection is given against wrecks like Bromford Bridge and Tottenham Hale as well as Aisgill, because "stop" and "run slow" are both indicated audibly and visually, and in such a way that a driver or fireman always knows which is intended for him.

(*b*) There is no danger of false clear signals being accidentally produced by induction or conduction from external electric sources.

(*c*) No errors, except safe ones, can result from earthing or open-circuiting or both.

(*d*) There is no danger or difficulty in the way of applying the system to electrified railways.

If the Railophone fails with respect to any of these four specifications, it is inferior to the Dammond system. Will Mr. von Kramer permit a committee of trained men, including utter strangers to himself, to make the same searching tests of his Midland installation as we made of the Dammond equipment? Will Mr. Acfield and Mr. Sayers, of the Midland Railway, concur with Mr. von Kramer in granting this permission?

E. Sowberg.

Nottingham, *June 7th*, 1915.

Overseas Trade—Nothing Done.

At the risk of being identified with the "I told you so" type of adviser, I would like to point out in respect to your very appropriate comments on the efforts (?) of the I.E.E.-B.E.A.M.A. group, that the result is exactly as I have continually pointed out or foretold right away from your issue of September 11th last. All over the world I have nearly always found technical institutions and trade associations either "lame ducks" or professional muddlers of an advanced type.

As all electrical people are not tied to the I.E.E. or the B.E.A.M.A., why not commence an individual independent overseas trade campaign?

Arthur Mallord Turner, M.A.

Wimbledon, *June 7th*, 1915.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

7,722. "Telephone or other electrical transmitter or receiver diaphragms." B. A. Pilkington. May 25th.

7,723. "Electric bomb-dropping device." F. Pamment. May 25th.

7,728. "Electrical resistances." B. Thomas & E. Thomas. May 25th.

7,757. "Electric starting systems for internal-combustion engines." C. F. Kettering & W. A. Chryst. May 25th. (Convention date, June 24th, 1914, United States). (Complete.)

7,758. "Electric starting systems for internal-combustion engines." C. F. Kettering & W. A. Chryst. May 25th. (Convention date, July 16th, 1914, United States.) (Complete.)

7,796. "Cable drums for field telephones and telegraphs." J. H. Reid. May 26th.

7,805. "Lamps for signalling." Jandus Arc Lamp & Electric Co., Ltd., & G. A. Murray. May 26th.

7,813. "Dynamo-electric machines particularly applicable for engine-starting systems." C. F. Kettering & W. A. Chryst. May 26th. (Divided application on 13,057/14.) (Convention date, September 13th, 1913, United States.) (Complete.)

7,826. "Electrical transformers." S. Ziani de Ferranti & Ferranti, Ltd. May 26th.

7,827. "Electrical transformers." S. Ziani de Ferranti, J. Roothaan, & Ferranti, Ltd. May 26th.

7,829. "Process for manufacturing metallic filaments for incandescent electric lamps and for other purposes." K. Nishimoto. May 26th. (Complete.)

7,840. "Electric signals." A. C. Brown. May 27th.

7,847. "Sparking-plugs." F. W. Miller. May 27th.

7,868. "Röntgen or X-ray apparatus." C. B. Burdon. May 27th. (Siemens & Halske Akt.-Ges., Germany.) (Complete.)

7,869. "Röntgen tube apparatus." C. B. Burdon. May 27th. (Siemens & Halske Akt.-Ges., Germany.) (Complete.)

7,923. "Slot closing devices for dynamo-electric machinery and other electric apparatus." Siemens Schuckertwerke G.M.B.H. May 28th. (Convention date, May 30th, 1914, Germany.) (Complete.)

7,946. "Portable or field telegraphs." S. F. Rutley & F. Rutley. May 28th.

7,953. "Wireless telegraphy." A. J. Roberts. May 28th.

7,963. "Telephone instruments." G. G. Turri. May 28th. (Convention date, June 1st, 1914, Australia.) (Complete.)

7,964. "Electric cooking-apparatus." Deutsche Gasgluhlicht Akt.-Ges. (Auerges). May 28th. (Convention date, December 12th, 1914, Germany.) (Complete.)

7,979. "Protected or armour-clad electric switches." H. H. Berry & W. J. Markham. May 29th

7,987. "Rotary converters." British Thomson-Houston Co., Ltd. (General Electric Co., United States.)

8,004. "Insulating-material and method of producing same." H. B. MacFarland & R. J. Shoemaker. May 29th. (Complete.)

8,010. "Electro-magnetic shuttle-driving apparatus for looms for weaving." E. Bachelet. May 29th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1914.

8,568. Gaseous or Vacuized Detectors for Radiant Energy, and Method of Controlling the action thereof. J. H. Hammond. April 4th.

10,275. Apparatus for the Electrical Transmission of the Energy of a Heat-Motor to the Driving Wheels of a Vehicle or the like. P. Biles. April 25th.

11,436. Protective Devices for Alternating Electric Current Machines. British Thomson-Houston Co. & F. H. Clough. May 8th.

11,739. Insulating Devices for Electric Traction Systems. British Thomson-Houston Co. (General Electric Co.). May 12th.

11,794. Electric Circuit Breakers and Switches. D. K. Morris, & Morris & Lister, Ltd. May 13th.

11,832. Protective Devices for Electric Circuits. British Thomson-Houston Co. (General Electric Co.). May 13th.

11,928. Generating Electro-magnetic Oscillations or High Frequency Currents. R. Arno. May 14th.

11,934. Method and Means of Producing Oscillatory Currents of Electricity of small Decrement and Close Wave-trains from Alternating and Continuous Currents of Electricity. H. Manders. May 14th.

11,950. Process for the Treatment of Ores and Solid Salts by Electrochemical Reduction. A. A. M. Hanriot. May 14th. (May 22nd, 1913.)

16,833. Control Gear for Electric Burglar Alarms. Lichtenfield Burglar Alarm Co. & S. Litchfield. July 15th.

17,811. System for the Generation of Electric Currents. C. F. Benitez. July 28th.

18,143. Electrical Conduit Systems. M. J. Railing & T. Taylor. July 31st.

18,801. Valve-operating Mechanism for Elastic Fluid Turbines. British Thomson-Houston Co. (General Electric Co.) August 18th.

19,433. Means for Producing Oscillating Currents of High Frequency. A. H. Cohen. September 4th.

21,488. Automatic Cut-outs for Electrical Installations. A. H. Midgley & C. H. Vandervell. October 24th.

22,435. Electric Switches. T. E. Barnum & W. E. Date. November 12th. (November 13th, 1913.)

22,915. Electrically-heated Shaving Pots. A. J. Miller & G. A. Miller. November 23rd.

1915.

[illegible]25. [illegible] Switching Apparatus for Electrically-illumined Signs and the like. E. Savoye. January 18th. (January 20th, 1914.)

3,521. Portable Electric Battery Lamps. M. Goodfellow & New British Ever-Ready Co. March 4th.

[illegible]672. [illegible] Cigarette Lighters. G. A. Vandervell. Ma[illegible]

THE
ELECTRICAL REVIEW.

VOL. LXXVII. JUNE 18, 1915. No. 1,960.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: June 18, 1915. [No. 1,960.
Page
British Manufacturers and the Carriage Problem ... 845
The Mobilisation of Science ... 846
Professional Conduct ... 846
Lead ... 847
Trade with "Neutrals" ... 847
War and Quackery ... 847
Battery-Bell Signalling Systems in Mines (*continued*) ... 848
New Electrical Devices, Fittings and Plant (*illus.*) ... 849
Correspondence—
  The Telephone as Nursemaid ... 850
  Cab Signalling ... 850
  Electrical Industry in Belgium ... 850
  Poilsh Refugee Students ... 850
Legal ... 850
War Items ... 852
The Practical Result of the Point Five Tariff, by A. S. Blackman and T. Roles ... 853
A Battery Amalgamation ... 855
Business Notes ... 855
Notes ... 860
Reviews ... 860
City Notes ... 864
Stocks and Shares ... 867
Share List of Electrical Companies ... 868
Electricity in Farming.—III. (*illus.*) ... 869
Economic Operation of Electric Ovens, by P. W. Gumaer (*illus.*) 871
The Report of the Ontario Hydro-Electric Commission (*illus.*) 873
New Patents Applied for, 1915 ... 876
Abstracts of Published Specifications ... 876
Contractors' Column ... Advertisement page xviii

THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. *Established 1872.*
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

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WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

1915 EDITION
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BRITISH MANUFACTURERS AND THE CARRIAGE PROBLEM.

IN view of the much discussed problem of the capturing of German trade and the cultivation of a higher standard of efficiency with which to combat the keener competition expected from Germany after the war, manufacturers and others interested in this question are regarding with no small concern the ever-increasing menace to trade caused by the carriage problem in this country at the present time.

At no period in the history of railways in this country do the interests of the trader appear to have received the careful attention they deserve. On the contrary, the attitude of the railway and shipping companies towards the development of trade has been for the most part selfish and antagonistic in effect. Whereas in Germany the question of freight charges is one of the minor considerations with manufacturers and others when quoting competitive prices, in this country it is one of the most important, and not infrequently the very item which precludes our successful competition in the open markets. It is no exaggeration to say that, taking a fairly general view of the carriage and freight rates in force in this country at normal times in comparison with those of Germany, the British manufacturer is saddled with an expense as much as 200 per cent. heavier all-round than that which his keenest competitor has to bear. While in normal times the rate for transport of cutlery from Sheffield to Hull has been 20s. per ton, in Germany it would work out at 6s. 7d. per ton. Similarly the charge for carrying hardware from Birmingham to Newcastle (207 miles) has been 25s. per ton: from Dortmund to Rotterdam (153 miles) it would be 10s. per ton. "One of the largest works in Germany, situated more than 150 miles from a shipping port, could reach Antwerp by rail for 3s. 6d. per ton of finished iron or steel. Similar products transported from works in the Midlands to London or Liverpool, equal distances, are charged about three times as much by the English railway companies."

Nor is the position any better from the travellers' point of view. The railway contract charges in this country for commercial travellers, &c., are at all times a formidable item, and a direct discouragement to manufacturers and others to look after customers far afield by personal attentions. In Belgium a third-class season ticket available over 3,000 miles of railway for five days costs about 10s. 1d., and for a year £14 17s. 6d. The rate in this country over nearly all the leading railway companies' lines for similar distances would be at least three times that figure. One may travel long distances in Belgium for three or four days for considerably less than the cost of the journey from London to Dover and back. For less than 3d. a day a workman in Belgium can travel $37\frac{1}{2}$ miles; a weekly ticket available for six return journeys of 20 km. ($12\frac{1}{2}$ miles) costs 1·50 fr., slightly under 1s. 3d., or for 30 km. ($18\frac{3}{4}$ miles) a weekly ticket costs 1·75 fr. (1s. 5d.). In Switzerland it is possible to travel over the whole State system of railways for 45 days for £3 8s. Thus, in Switzerland, for 12 months' travelling available over 3,000 miles of railways, including lake steamers, the cost would be less than £27. In this country the yearly third-class contract between Manchester and London alone is £55 5s.

The feature, however, that appears most inequitable of all is the preferential rates allowed by English shipping companies for goods exported, for instance, from Hamburg to New Zealand, with transhipment at London, a procedure which is cheaper than from London direct. "In Australia there is a widespread belief that German and American manufacturers are helped by lower rates than those obtained by their British competitors." The explanation in the case of New Zealand is the desire of English shipowners to prevent the establishment of Continental lines to New Zealand, but the method adopted cannot commend itself to British manufacturers. In other instances there is not even this explanation.

When it is considered that the British manufacturer has to contend against such serious disadvantages as these, harassed as he already is by stone-wall tariffs and unfair competition from within and without, it is hardly surprising that he sometimes becomes disheartened. The traditional high reputation of British manufactures all the world over has invariably been the chief selling point against the heaviest odds, but even this great asset cannot hold good for ever against the growing menaces from within as well as from without. Whereas in Germany, France, Switzerland, and practically all the chief European competitive countries, the railway and shipping systems are the auxiliaries and agents of trade, in this country they are the chief drawbacks to trade. One of the first reforms that ought to be insisted upon by British manufacturers and others after peace is restored is the settlement of this carriage problem, which promises, if allowed to continue to exist, to develop into nothing less than a grave injustice to the trading community.

The Mobilisation of Science.

Some weeks ago we hailed with pleasure and relief the announcement of the Government, that it had been decided to establish an Advisory Council on Industrial Research, composed of scientific men, who should make it their business to develop and organise the scientific resources of this country, in preparation for the fierce and unscrupulous competition which may be expected from the Germans in the future. The new scheme was introduced in the House of Commons by Mr. J. A. Pease, the then President of the Board of Education, in an admirable speech, which indicated that he had fully grasped the needs and possibilities of the situation, and was anxious to put the work in hand at the earliest possible moment. No further information has been forthcoming, and since then, unfortunately, owing to the reconstruction of the Government, Mr. Pease has been replaced by a gentleman whose experience and knowledge of the subject cannot be compared with his. We hope, however, that so excellent a proposal will not be allowed to drop or to be postponed, for some such movement is absolutely indispensable to our future welfare—the pity is that in spite of incessant adjurations the Government has hitherto turned a deaf ear to the demands of science for an opportunity to lead the way. Even if the scheme outlined by Mr. Pease is carried out, there is a great risk that the Government, strong in its ignorance of the scientific world, will nominate the wrong men for the work, and thus endanger the success of the new policy at the outset. We earnestly hope that the most expert advice will be obtained lest any such fatal error be committed.

But it is not only in connection with industry that a scientific Council is required; an even more pressing need, if that be possible, is the organisation of science to aid in the prosecution of the war to a successful finish. Our enemies, who neglect nothing that will tell in their favour, have from the first—aye, and long before the outbreak of war—availed themselves of every device that science could evolve to assist them in the subjugation of Europe by fair means or foul, and their scientists have not shrunk from the base uses to which their knowledge has been prostituted. As Mr. H. G. Wells points out in a striking letter to the *Times* of Friday last, modern war—as conducted by Germany—is essentially a struggle of gear and invention. It is a war of surprises, which always emanate from our enemies and against which we have had to improvise means of defence too late to prevent terrible losses. For some of their foul measures, indeed, we have as yet developed no adequate counterstroke. "Throughout almost the entire range of our belligerent activities we are to this day being conservative, imitative and amateurish when victory can fall only to the most vigorous employment of the best scientific knowledge of all conceivable needs and material." Mr. Wells calls for "an acting sub-Government of scientific and technically competent men for this highly specialised task."

The correspondence thus initiated has elicited a number of useful suggestions, such as the formation of Boards of Investigation and Experiment, which should consider ideas submitted to them and put to the test those which appeared to promise useful results; the offer of large money prizes for solutions to military problems; and the utilisation of the resources of our Universities for scientific investigations and tests. Dr. J. A. Fleming states that not only has no use been made of the knowledge and ability of scientific men, but even in some cases steps have been taken to inhibit their activities, as, for instance, in the field of electric waves. Since the war began hundreds of scientists and engineers have pressed their services upon the Government, without success, and young men of the greatest promise have enlisted and laid down their lives, whose expert knowledge and initiative would have been of immense value to their country, if properly utilised. It is even reported that when war broke out orders were given for all experimental work in naval and military departments to cease. We possess a magnificent asset in our scientific and technical experts, of which we have up to now made practically no use; yet there never was a time when their services were so urgently required by the nation. The Government, composed of lawyers and politicians, knows nothing of the nature and resources of science, and it is most necessary that every effort should be exerted to enlighten it and compel it to take immediate steps to organise this body of men who are burning to serve their country, and are, above all others, endowed with the knowledge and ability of which we stand in need, and without which we can hardly hope to bring this terrible war to a speedy and successful conclusion.

Professional Conduct.

A case which recently came before Mr. Justice Neville, in the High Court of Justice, is of interest to all members of the great engineering institutions. As reported in the *Times*, the proceedings were taken by a member of the Institution of Civil Engineers, with a view to obtaining an injunction, pending the trial of the action, to restrain the Council from expelling the plaintiff from the Institution. The Council had drawn the attention of the plaintiff to certain alleged infractions of the rules of the Institution with regard to professional conduct, particularly in connection with the publication of an advertisement by the plaintiff's firm, and, after much correspondence, informed him that he had not discharged the onus of showing that he did not know, or approve, of the advertisement, wherefore he had been guilty of a breach of the regulations, and his name would be erased from the register of membership. The plaintiff at once took legal proceedings against the Council, and applied for an interim injunction, but Mr. Justice Neville, while expressing no opinion as to what the trial of the action might disclose, decided that there was no irregularity in the judicial proceedings of the Council, and refused to make an order.

We have, of course, nothing to say at this stage with regard to the merits of the case, but we welcome the action of the Council in so far as it demonstrates that, recognising the futility of ponderous threats, it has at last decided to take effective proceedings against recalcitrant members of the Institution. It is of the utmost importance to the advancement of the status of engineers that no member of their profession shall be permitted to act otherwise than in accordance with the laws laid down to regulate their conduct. Whether or not those laws are the best and wisest that could be devised is immaterial to the principle at stake. Discipline must be maintained. We see in the medical and legal professions how stern a view is taken of infringements of the rules, and how promptly steps are taken to bring an offender to book; and unless an equally strict *régime* is followed by the engineering profession, it will never attain to the status which they have acquired.

Lead.

The excitement which has been seen in other metals, more especially in copper and spelter, has proved contagious, and lead has within the last week or so been in a fever of excitement. In May prices of prompt lead were down as low as £19 15s. It was pointed out at the time that the level then reached appeared to be a tempting one, and the forecast has been amply justified by the course of events, for prices have been rushed upwards in startling fashion with a very big business passing. It is decidedly puzzling, however, to ascertain the exact basis of the movement. The market has been filled with predictions that a big movement in an upward direction was in store, and to this extent, the improved tendency took nobody by surprise. Early this week £30 was paid for September, but there has since been a sharp reaction.

What is really astonishing, however, is the extent to which the advance has been carried with so little actual foundation apparent for the movement. There is, of course, a steady and regular business going on in lead, but the main impulse for the buying which has brought about so dramatic an upward movement was entirely speculative, the main portion coming from the United States. It is possible, of course, that something may have happened across the Atlantic justifying the altered tone, and warranting the phenomenal rise in prices in New York, where they are many pounds a ton above those ruling in the United Kingdom.

There is something very suspicious about the entire course of the market, and although it can be admitted frankly that consumption is very large, it is none the less incomprehensible how a rise of pounds in a week is to be justified on trade conditions. It is doubtful, indeed, whether there has been any material increase in the world's actual consumption during the past month or two, although during the same period production has been, if anything, increasing. The import returns into this country show a remarkable growth, last month's figures being as follows, in tons :—

	May. 1914.	May. 1915.	Jan.-May. 1914.	Jan.-May. 1915.
Spain	6,547	9,354	36,400	43,858
U.S.A.	2,233	12,537	7,935	27,847
Mexico	154	—	1,312	250
Australia	5,415	9,118	34,122	32,005
Other Countries ...	3,065	223	14,910	8,207
Total	17,414	31,232	94,679	112,167

Not only are consumers very well supplied with lead, but there have been instances, although these may not be typical, in which consumers have been actually reselling a portion of their holdings, but, on the other hand, the excessive price to which spelter has risen may quite possibly result in the substitution in certain quarters of lead for spelter, as a coating for steel sheets to protect them from weather influences. An interesting criticism on the lead position has been issued by Messrs. James Forster & Co., in the course of which they point out that both Germany and Austria are self-contained so far as lead is concerned, and can probably produce as much as they want. Of the other producers, America has in the last two years probably increased her production of native lead by 150,000 tons per annum, and for the first time in this generation she has sent large and increasing quantities of native lead to Europe. Australia is producing more lead, and Spain is not falling behind in her shipments. There is indeed no lack of lead, and importers have been warehousing considerable quantities. In spite of this, however, the rise has been engineered with persistency, and the market is now undoubtedly very fully committed on the bull side, and looks none too safe, though manipulation of a powerful character may push it higher yet.

Trade with "Neutrals."

Under the circumstances which now obtain, still greater circumspection is desirable in placing orders abroad than under peace conditions, and though an advantage in price may be advanced as an adequate justification for accepting a foreign tender in normal times, it by no means follows that the same argument holds good now. Trading with the enemy may assume various disguises, which may not be easy to penetrate, and we must not be unmindful of the ubiquitous ramifications of German trade interests, which like a gigantic octopus have laid their grip on industry in every part of the world. It is, therefore, most important to exercise the utmost caution in all transactions with firms that are in a position to deal with both parties, and that may be more or less under German control. We do not reproach such firms or accuse them of any wrong-doing; they are acting within their rights, but it is for us to be wary.

In view of what we have said above, the folly of placing British orders for electrical plant with them must be apparent. The fetish of the lowest tender which obsesses the minds of British municipalities, and blinds them to the true national interests, still holds sway in certain places, even when we are at death-grips with our foes! We desire to enter the strongest possible protest against all such contracts that present the possibility of advantage and support to our present enemies.

War and Quackery.

As an electrical journal, it does not very often lie directly within our province to discuss matters relating to the public health. There are, however, exceptional reasons, in days of general anxiety, why we should sound a note of warning against some of those various forms of quack "remedies" to which, as experience has proved again and again, the public is ready to fly for relief. We hold no special brief for the qualified medical man, but we do hold one against those who, with the aid of newspaper advertisement and pseudo-scientific pretences, are ready to take unfair advantage of the opportunity to batten on the earnings or savings of poor and rich alike.

Consider a few of the conditions that obtain at the moment, and will almost inevitably become the more acute the longer the war lasts. The number of returned wounded British soldiers probably runs into six figures, many of them having no medical claims under National Insurance; hundreds of thousands of men and women are in anxiety for their relatives with the Forces; professional men and families have been reduced in circumstances; the number of doctors is depleted, and those at home are overworked; the hospitals cannot handle ordinary non-urgent cases as expeditiously as a year ago, war cases rightly having preferential treatment. In conjunction with these conditions, bear in mind that the working classes have more money to handle, and are too ready to spend it, and we see the possibilities of a rich harvest for those who make a business of playing upon the feelings of people suffering either genuinely or imaginatively from neurotic and other disorders. We speak with a ripened experience of the methods employed in the past by sharks of the kind referred to; we know something of the lengths to which they can go, the profits that they make, and the receptivity of the easily deluded mind, when we express a hope that the powers in authority will keep a careful watch over this matter. Pills and potions, and such-like, are not our commodity, and we may properly leave them to others, but where electro-medical "remedies," devices and appliances are in question there is a need for warning from those who recognize the dangers. Such warning is not only necessary in the interests of the uninitiated public, but also in the interests of legitimate electro-medical and electro-therapeutic science and practice. Properly applied, electricity has boundless possibilities for promoting and restoring health, but some of our older readers will remember how in days gone by an extensive traffic in electrical nostrums, which failed to cure, gave a serious set-back to legitimate effort. Genuine electro-therapeutics have advanced wondrously in recent years in our hospitals and elsewhere, and hundreds of thousands of sufferers have benefited from the boon thus placed at their disposal when applied by experienced men. There is a danger that at such a time as this, these and others may confuse the genuine and the spurious.

BATTERY-BELL SIGNALLING SYSTEMS IN MINES.

Home Office Report on the Danger of Ignition of Fire-damp Air Mixtures.

(*Continued from page 816.*)

In carrying out these experiments an 8 per cent. methane-air mixture was used throughout, and the make and break of the electric circuit were adjusted so as to give the most favourable conditions to produce a spark or flash to ignite the mixture. "These conditions represented the worst possible from the point of view of ignition by the break-flash," and were rather more stringent than those adopted for the experiments carried out at Senghenydd.

"Using a battery of dry cells, and with only the resistance due to the magnet coils of the bell (10 ohms) in circuit, ignition of the mixture was obtained by the break-flash with 2 cells, the voltage being 3·0 and the current on closed circuit 0·3 ampere. Ignition was also obtained when the current was reduced to 0·22 ampere by the introduction of 3·5 ohms (non-inductive) resistance, but not when the current was reduced below 0·21 ampere. One bobbin of the magnet was now removed, the resistance of the remaining bobbin being 5 ohms. Ignition was now obtained only when the current at 3·0 volts was increased to 0·34 ampere. The single-bobbin magnet was found to actuate the bell readily with two dry cells with an additional 8 ohms resistance in circuit, the current on closed circuit then being 0·21 ampere, *i.e.*, well below the minimum igniting current."

Six layers of wire were then unwound from this bobbin, reducing the resistance to 3 ohms, when the minimum igniting current was found to be 0 61 ampere at 3 volts. The bell rang well with an additional 7 ohms resistance in circuit, with a current of 0·2 8ampere. Six more layers of wire were then removed, leaving three layers only, with a resistance of 0 5 ohm, and no ignition could be obtained with the full current obtainable from the two dry cells employed, viz., 2·4 amperes, while the minimum igniting current was found to be 2 65 amperes. Thus it was shown that by removing one bobbin and reducing the number of layers of wire on the remaining bobbin it was possible to reduce the self-induction due to the magnet-coils, thereby increasing the current required for ignition by the break-flash, without destroying the ringing power of the bell.

By reducing the amount of wire in the bell, however, its resistance was reduced so that the current passing round the circuit was greater. Thus the full current obtainable on closed circuit from the two dry cells employed, with only the resistance due to the magnet coils of the bell, was (*a*) original bell with two bobbins each of 5 ohms resistance, 0·30 ampere; (*b*) bell with one bobbin having only three layers of wire, 2·40 amperes. Increased safety at the break-flash due to decreased self-induction is, therefore, to a certain extent negatived by increased danger due to the greater current available. To overcome this objection the dry cells were replaced by wet Leclanché cells (quart size), and a battery of two such cells, owing to the higher internal resistance, was incapable of giving a current of more than about 0·8 ampere at 3 volts when short-circuited across the terminals, while with 10 cells the current did not amount to more than about 1·4 amperes at 15 volts. Against this it is to be noted that a battery of two dry cells gave over 4 amperes, and one of 10 cells over 12 amperes, when short-circuited across the terminals.

Probably most colliery electric signal bells are operated by Leclanché cells, hence the reason for high-resistance magnet coils on most of the bells in use. It is due to the demand for a bell that will give a loud signal with a very weak current, to allow for the drop in voltage of the battery when run down. Hence, as was to be expected, "it was found that with a battery of 10 wet Leclanché cells no ignition could be obtained when the single-bobbin bell, with diminished winding, was included in the circuit . . . since the minimum igniting current at 3 volts had been found to be 2 65 amperes, and increase of voltage to 15 does not materially affect the igniting power of the spark." On the other hand, though "the bell rang well with the full current from the 10 Leclanché cells, very little additional resistance, such as would be given by about half a mile of signal wire, served to put it out of action."

Experiments were made with another bell of better construction than the one used previously. The magnet had two bobbins, each with 20 layers of 28-gauge silk-covered copper wire wound on a soft iron core 2 in. long and $\frac{11}{32}$ in. diameter. A battery of 10 Leclanché cells was used with a voltage of 15. The results are given in the following table :—

Condition of magnet.	Resistance of magnet. (1)	Current (bell only in circuit.) (2)	Resistance required to prevent bell ringing. (3)	Current (bell and resistance in circuit). (4)	Minimum igniting current. (5)	Resistance required to reduce current to minimum igniting current. (6)
(*a*) Two bobbins	30 ohms	0·36 amp.	220 ohms	0·05 amp.	0 115 amp.	80 ohms
(*b*) One bobbin	15 „	0·55 „	230 „	0 05 „	0 17 „	55 „
(*c*) One bobbin. Four layers of wire removed	11 „	0·65 „	210 „	0·05 „	0 23 „	40 „
(*d*) One bobbin. Four more layers of wire removed	8 „	0 78 „	156 „	0 08 „	0 33 „	25 „
(*e*) One bobbin. Four more layers of wire removed	5 „	0·95 „	100 „	0·12 „	0·55 „	11 „
(*f*) One bobbin. Two more layers of wire removed	4 „	1·00 „	70 „	0·165 „	0 95 „	1 „
(*g*) One bobbin. One more layer of wire removed. Five layers remaining	3·5 „	1·05 „	50 „	0·18 „	No ignition obtained using full current from 10 Leclanché cells.	

With regard to the last experiment, in which no ignition was obtained, it is to be noted that with 10 dry cells (15 volts) an ignition was obtained with 1·30 amperes with an additional 7 ohms resistance in circuit. Hence it is seen that provided not more than 10 wet Leclanché cells form a battery it is impossible to ignite the most sensitive mixture of methane and air, and a good ringing bell can be constructed to operate from such a battery provided it is kept in good order. "The reason for the impotence of the break-flash in the last case (*g*) lies in the greatly reduced self-induction of the circuit due to the removal of so many layers of wire. The extent to which the self-induction of a circuit wound on an iron core is reduced by reducing the number of layers of wire is illustrated by the following determinations made for Dr. Wheeler by Prof. Thornton with the companion bobbin removed from the bell."

Fully wound	0 0950	henry with a current of	0·17 amp.
With eight layers of wire removed ...	0·0325	„ „ „	0·33 „
With four more layers of wire removed ...	0 0118	„ „ „	0 55 „
With two more layers of wire removed ...	0·0053	„ „ „	0·95 „
With one more layer of wire removed, five layers remaining ...	0·0028	„ „ „	1 30 „

If columns 3 and 6 be compared it will be seen that in each instance there was a considerable margin between the resistance that could be added to the circuit before the ringing power of the bell ceased, and the resistance necessary to reduce the current available at the break-flash below the minimum igniting current. Thus with the bell as ordinarily arranged with two bobbins, and with a battery of 10 wet Leclanché cells, ringing just ceased when 220 ohms extra resistance was included in the circuit: while the minimum igniting current of 0·115 ampere was obtained when 80 ohms resistance was added. Hence, if there were added as an integral part of the bell a non-inductive resistance of, say, 90 ohms, the break-flash would be harmless in the most sensitive explosive mixture—provided, as previously mentioned, that not more than 10 Leclanché cells were used —leaving 130 ohms resistance for signal wires, which would be equal to about 10 miles of No. 8 galvanised iron wire, before the bell would cease to ring. It appears, therefore, that the resistance of the signal wires should be measured, and the difference made up with some form of adjustable resistance attached to the bell.

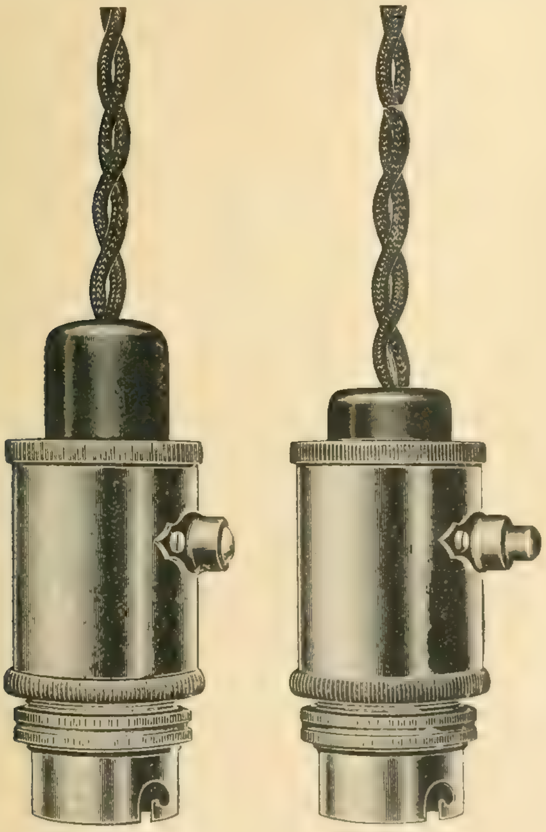
(*To be concluded.*)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

H.O. Switch Lampholder.

Messrs. G. St. John Day (Patents), Ltd., of Oldham, have recently introduced a new patent switch lampholder, H.O. pattern, of unusual design, styled the "Daybreak." Briefly, the action is such that "switching on" moves the plunger contacts down on to the lamp cap, while switching off causes them to be withdrawn by a spring movement.

The central portion of the holder, which projects at the top, fig. 1, containing the wiring and plunger contacts, is pressed down to the position shown in fig. 2 to switch on, and is held in that position by a spring catch at one side of the holder. Incidentally, the lamp (then lighted) is locked in the holder. Pressing the side button releases the catch, allowing the central portion to be forced up (by a spring under compression) and this withdraws the plungers from the lamp cap, thus breaking the circuit. The holder can be taken to pieces by unscrewing a milled ring at the top of the case.


Switch open. Switch closed.

Figs. 1 and 2.—"Daybreak" H.O. Switch Lampholder.

Among the meritorious features claimed by the makers, are that the lamp cannot be removed when lit, nor fixed when the switch is on. The holder is absolutely shock-proof; the circuit is broken at each pole; and the switch can be operated by one hand. The holders are made in the usual standard types and finish.

New Tucker Tumbler Switch.

A new pattern "quick make" and "quick break" tumbler switch, fig. 3, has just been introduced to the market by **Messrs. J. H. Tucker & Co.**, of King's Road, Hay Mills, Birmingham, to fill the demand of consulting and other engineers for this particular switch movement.

A positive action is obtained in the initial opening and closing of the switch; the contacts are of special design; micanite insulation is used throughout, and the base is of vitrified porcelain. In conformity with the firm's custom, this switch movement has been carefully tested, having been mechanically operated over two million times without breaking down.

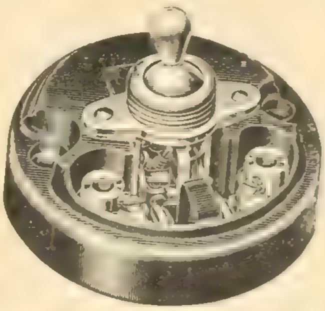


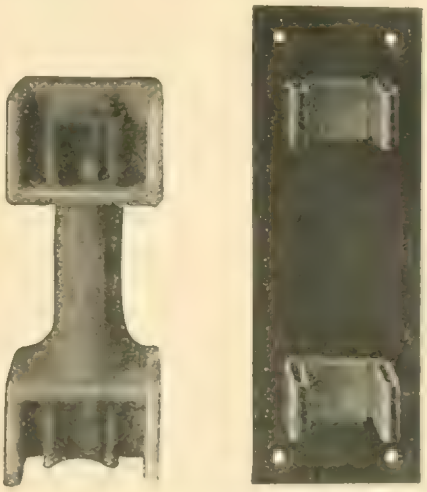
Fig. 3.—Tucker "Quick Make" and "Quick Break" Switch.

The ordinary one and two-way patterns with china or brass covers are made uniform in external appearance with the Tucker flat-type switches.

"Witton" Handguard Cut-Outs.

We illustrate in figs. 4 and 5 the "Witton" handguard cut-outs, which has been introduced by the **General Electric Co., Ltd.**, Witton, Birmingham, as an improvement on existing designs.

The handle and carrier is composed of one porcelain block designed to enclose the contacts of the fuse carrier and the clips on the base. The fuse possesses a self-aligning contact, which is mounted on the porcelain carrier by means of a stud projecting horizontally into the porcelain and held by a nut, the recess for which is seen from the front of the carrier, and is closed by a porcelain cap cemented in. The contact is not held tightly; a spring washer gives the contact a small amount of freedom in every direction without interfering with its general rigidity. This freedom is adequate to enable the contacts to adjust themselves to meet any want of alignment in the clips.



Figs. 4 and 5.—Contacts on Carrier, and Clips on Base of "Witton" Handguard Cut-out.

A further feature of the handguard cut-out is its adequate ventilation. As will be seen, each contact is cut away at the base so that ample facilities are provided for the access of air to the fuse wire. The latter is carried in the usual asbestos tube which passes through the tubular carrier.

The cut-out is made in a number of sizes, ranging from 15 to 600 amperes.

Standardisation of Electric Motor Vehicles.—The Standards Committee of the American Society of Automobile Engineers, which is stated to be acting in conjunction with the Electrical Vehicle Association of America, has recently devoted considerable attention to the standardisation of certain components of electric motor vehicles. For example, it is proposed to encourage the reduction of practice to two voltage ranges for such vehicles, namely, 80-85 volts and 60-66 volts. For the lead-acid type of accumulator, a standard of 42 cells is to be recommended, while for the nickel-iron-alkaline battery, 60 cells are proposed. Among other recommendations contained in the first report of the Standards Committee are speed and mileage ratings, motor voltages, standard name-plates for electric motors, and the efficiency of solid tires for electric vehicles.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Telephone as Nursemaid.

Three years ago our little boy, only a few months old, was despaired of by our doctor, who recommended open-air treatment as the only hope for his life.

The busy mother could not spare time to be always out with baby—nor could she be continually running out to look after him.

Thus the writer was driven to the idea of fitting a telephone transmitter in the pram. The transmitter was placed inside a cigar-box, which also contained a small American clock (fig. 1).

Baby then spent all his sleeping hours outside, 20 yards away from the house, while the mother could listen in the intervals of work, knowing that so long as she could not hear baby crying but could hear the clock ticking, all was well. The clock was necessary to provide a constant assurance that the telephone was in order.

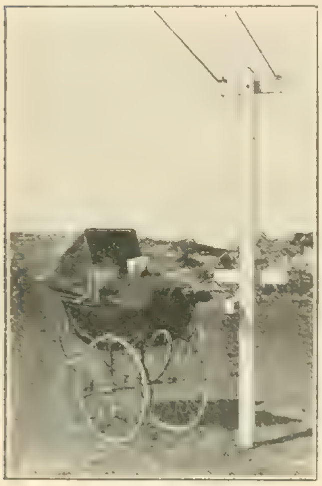


Fig. 1

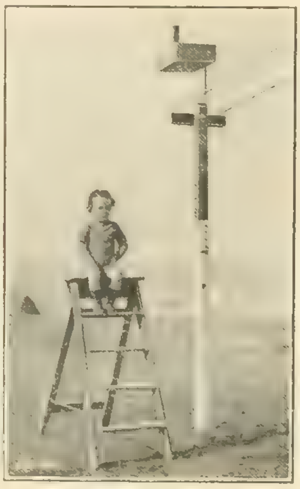


Fig. 2.

Before our doctor went to the Front he made a thorough examination of our boy, and was pleased that open-air treatment, with other care, had removed all traces of his early weakness.

Birds will not approach our house owing to cats, so the old baby's telephone post was utilised to provide a cat-proof feeding tray for birds.

This was frequented chiefly by robins and finches. The idea then occurred to fit a telephone transmitter above the tray so that the birds could be listened to in the house (fig 2)

This experiment would be still more successful if the telephone transmitter could be concealed among the branches of a tree, in a glade frequented by nightingales, for instance. Here, alas, we have no trees.

The photograph (fig. 2) shows the telephone baby as he is to-day.

It may be noted that after months of winter use outdoors, protected from rain only by an inverted tin, open at its lower end, the telephone transmitter remains in perfect order.

Edwin O. Catford.

Platte Fougère Lighthouse, Guernsey.

Cab Signalling.

Allow me to say that you are performing a much needed public service in permitting the publication of the truth concerning the culpability of the railways and the Board of Trade.

Your correspondents, with the exception of Mr. Von Kramer, have written most clearly and logically about facts that ought to be given the widest publicity at the present time. The extent to which some technical journals have misinformed their readers on this subject makes it all the more important for an electrical journal of the highest standing to allow the exact truth of the whole matter to be told in its columns.

The signalling of our steam railways is a national disgrace. We are many years behind America in track circuiting, and France in cab signalling, although we have all along needed both of these electrical improvements as badly as America or France has needed them. Worse still, even in the little our railways have done in the way of adopting or playing with cab signals, they have, without a single exception, given preference to the inferior types. I say "played with," because the word "test" is a misnomer when applied to the wireless foolishness on which the Midland and the London and South-Western Railways have wasted so much valuable time.

Messrs. Acfield and Sayers *know* that the Dimmond cab signal is by far the best that has ever come before the British public, or else they know less about this signalling subject than hundreds of persons who, like myself, have no interest in any signalling mechanism, but have had sufficient technical training and experience to judge of the merits of such things. Like these hundreds of other technical men who have carefully studied this subject, I want to know why the Midland Railway Co. has discriminated against the best cab signal that has yet been produced, and in favour of two that are decidedly the inferior of the former. In the meantime, as others have aptly said, "The Board of Trade still snores on."

L. Warburton.

Manchester, *June 14th*, 1915.

Electrical Industry in Belgium.

We notice in the article on "Anglo-Belgian Electrical Co-operation in Belgium," in your issue of June 4th, page 786, mention is made of the "Z" lamp of Belgian manufacture.

It has occurred to us that an impression might, through this, be conveyed to the trade that the lamp sold by us is of Belgian manufacture. This, of course, is not the case, the "Z" lamp which is so extensively used here being manufactured throughout at our factory at Southfields, London, S.W.

We should be obliged if you would have a notice inserted in your next issue to obviate any misunderstanding as above suggested.

"Z" Electric Lamp Manufacturing Co., Ltd.,
J. Scrivener, *Sales Manager.*

London, E.C. *June 14th*, 1915.

Polish Refugee Students.

May we ask the hospitality of your columns for a few words in the cause of the Polish refugee students, who, being at the point of completing their studies, were surprised by the invaders in Belgium and Northern France, and who, with their Belgian and French fellow-scholars, took shelter in this country?

Among them are chemists, electricians, and mechanics, and several eligible for commercial, literary, clerical, and educational situations. Their number is comparatively small, and it is this happy circumstance that makes us hope that they all may find engagements and prove useful and desirable employés in the British industrial and educational circles.

As to their respectability and recommendations, may it suffice to mention that they have been found worthy of the temporary protection and assistance of the Polish Refugee Fund (Patron, The Earl of Selborne, K.G.), whose appeal on their behalf we heartily second.

Any employers desirous to avail themselves of their services are requested to apply and write for particulars to

The Polish Information Committee,
Wm. Repphan, *Hon. Gen. Sec*

2, West Street, London, W.C.
June 12th, 1915.

LEGAL.

H.M. Postmaster-General *v.* Southwark Borough Council.

After a long hearing, which occupied many days, Mr. Pollock, one of the High Court Referees, on June 10th concluded and gave judgment in this case, which arose out of the necessity to relay the telegraph and telephone cables consequent upon the construction by the Borough Council of a subway beneath the cross-roads at the Elephant and Castle.

Mr. Holman Gregory, K.C., and Mr. Branson appeared for the Postmaster-General, and Mr. Hudson, K.C., with Mr. Frank Dodd, for the Southwark Borough Council.

Mr. Holman Gregory, in the course of his comments at the close of the hearing, said that in all his long experience he had never come across a more unfortunate, or, he might say, a more scandalous piece of litigation, the amount in dispute being only £259, while the costs incurred could not be less than £3,000. The Council, however, said that they had overpaid the Postmaster-General, and as they were going to try and get some of the money back they were not fighting for the £259 only.

The action was brought by the Postmaster-General to recover under the Telegraphs Act of 1878 the balance of certain money which had been expended in relaying the cables rendered necessary by the works of the Borough Council. Under the Act the Postmaster-General claimed the right to make alterations in the telegraph line, and to charge the Borough Council with the cost, or to call upon the Council to do the work. In this case the Postmaster had done the work and had charged the Council with it, the total sum being £1,640. Of this all had been paid with the exception of the balance now claimed, as to which the Council contended they were not liable, as the cost had been increased by the Postmaster-General laying additional ducts. The question was whether more money had been spent in laying 22 ducts than would have been spent in laying the original 13 ducts, and the Council said that under the circumstances the Post Office should bear 9/22 of the cost as representing the additional nine ducts and the Council 13/22 as representing the original 13 ducts which had to be re-laid. The Post Office engineers contended that so far from increasing the cost, the laying of the nine additional ducts would be a saving in cost, as the boring would have to be the same size for 22 as for 13 ducts, and the additional nine would occupy space which would otherwise have had to be filled up with cement. There was no suggestion in the defence that the designs were wrong or wasteful, but it was alleged that the charges were excessive and unreasonable. On the other hand, it was contended that the question of design and the amount of work necessary to be done were entirely in the hands of the Postmaster-General. The only point, said Mr. Holman Gregory, was whether the Postmaster-General had incurred extra costs by making provision for 22 ducts instead of only 13, and he submitted that the evidence showed that the cost had not been increased thereby.

The Official Referee, in giving judgment, said he quite agreed that the case was a most unfortunate piece of litigation, and it looked to him as if some people desired to show that their opinion was better than someone else's, and having given their opinion were prepared to substantiate it at the cost of the ratepayers. It was clear that the cost of litigation was enormous as compared with the small sum in dispute. By the order of Mr. Justice Lush he was directed to ascertain what would be the cost of the work upon the basis of 13 ducts, and what would be the cost on the basis of 22 ducts. Early in the year 1910 it was known that the Borough Council was going to construct the subway having a centre near the Elephant and Castle, and notice was given to the Postmaster-General in regard to the matter. The Postmaster-General thereupon decided upon what work was necessary in relation to the alteration in the telegraph lines, and he decided that that work should be carried out by the Post Office. The alterations consisted of the abandonment of two underground telegraph lines containing 13 ducts and the construction of a new line, comprising an underground conduit, the construction of a new manhole, and the enlargement of the existing manhole. While carrying out the work the Postmaster-General increased the number of ducts to 22, which necessitated an increase of a foot in the length and a foot in the width of the new manhole, an increase of one foot in the width of the trenching and of a foot in the existing manhole over and above what would have been necessary if the conduit laid had contained only 13 ducts. A correspondence took place between the Postmaster-General and the Borough Council's engineer, and after some discussion a plan was adopted, showing the general outline under which the Postmaster-General proposed to carry out the work. Some small question was raised as to the date at which those who were doing the work became aware that some alteration was going to be made in regard to the subway which affected the direction of the telegraph lines. In his view the truth lay with those who gave evidence on behalf of the Postmaster-General. The plan was submitted to Mr. Harrison, and no alteration was made in it until they came upon the water which they met with while carrying out the work. The Postmaster-General's officers in carrying out the work began upon the assumption that the subway was as close as possible up to the point where the new manhole was to be constructed, and that necessitated carrying down the manhole to a considerable depth so as to get below the subway. Originally a plan was put forward by which it was proposed that the manhole should actually be under the subway, but the engineers came to the conclusion that it was almost impossible to carry out such a plan as that, and it was decided that the second plan was the better. Mr. Harrison was acting as engineer to the Borough Council, and was aware of the work which was going on. It was competent for him to have gone to Mr. Noble, who was doing the work for the Postmaster-General, and point out that he was doing more than was necessary. But he did not do anything of the kind. The work having been carried on was completed towards the end of the year 1911, when application was made for payment of the account. When that application was made certain objections were raised, and it was suggested that the Postmaster-General had not done the work merely for the purpose of altering the position and direction of the work for 13 ducts, but had done all the work with a view to enabling the Postmaster-General to carry 22 ducts, and Mr. Harrison suggested that it would be reasonable that the Postmaster-General should pay 9/22nds of the costs. That would strike one as being a taking proposition, but it was one which would be absolutely improper, because it was clear that the extra provision would not necessarily increase the cost of the work in proportion. The Postmaster-General had behaved handsomely in giving up some of the extra maintenance, as it was one of the incidental expenses for which he was entitled to be paid had he insisted upon it. Then came the question as to what were the extra expenses consequent upon the increase in the number of ducts; but as to that no evidence had been given. There had been, however, suggestions that there were faults in the design which had increased the cost of the work, and, in support of this, a number of expensive models had been produced in evidence. The question then arose as to who was the proper person to decide as to the proper manner of carrying out the work rendered necessary by the construction of the subway. He did not intend to take upon himself the duty of saying what was right and proper under the circumstances. In fact, by the Act of Parliament he was precluded from doing anything of the kind. The Act said that the alteration was to be made as the Postmaster-General might deem necessary and expedient. That being the statute, and the work being done under the statute, when the matter came into Court, it was said that the Postmaster-General had deemed the work necessary and expedient. No denial of this had been put forward in the defence, and therefore he could only deal with the matter as it came before him. He must deal with it as having been admitted by the defendants that the Postmaster-General deemed the work necessary and expedient. Various questions had been raised in defence, but they were questions as to whether the expenses were such as ought to have been incurred, having regard to the fact that the Postmaster-General had considered the work necessary and expedient. That rendered it quite unnecessary for him to go into the elaborate estimates and calculations made on behalf of the Borough Council. Mr. Noble and Mr. Hardy had been called on behalf of the Postmaster-General, and they gave evidence in support of the view that the work was in substance necessary for the 13 ducts. Mr. Noble said it was necessary to carry down the manhole to the depth to which they did carry it, in order to carry the pipes under the subway. He said that when they got down to a certain depth they met with a considerable quantity of water which rendered extra work necessary. He (Mr. Noble) also said that in carrying the hole down to the greater depth it was necessary to make it larger, having regard to the health of the men who worked in it. It was therefore useless to suggest that the Post Office authorities had made the manholes deeper than was necessary. It had been suggested that Mr. Noble was wrong when he said it was necessary, and he (the Referee) had to consider what was the extra cost, if any, in making the conduit for a greater number of ducts. It was obvious that in making the manholes deeper they must be made larger, and then they would be available for the larger number of ducts. The Postmaster-General had taken the trouble to correspond personally upon the matter, and he (the Referee) came to the conclusion that those who advised him had advised him properly. When it was said that the work was necessary and expedient he was not in a position to contradict it in any way. He was satisfied upon the evidence of Mr. Noble and Mr. Hardy that the work was properly done, and that it was necessary and expedient—that it was work properly done on the basis of 13 ducts. When the Postmaster-General said that the work was necessary he could not in any way interfere. There must be judgment for the Postmaster-General for £259 10s. 5d., with costs.

Judgment was entered accordingly.

A House Wiring Dispute.

In the Marylebone County Court, on June 4th, before his Honour Sir W. Lucius Selfe, Messrs. Watson, Marsh & Co., electricians, High Street, Brondesbury, sued John Morris Goodwin, owner of South Mansions, Streatly Road, Kilburn, for £3 7s. 6d., balance of an account for work done. In support of the claim, Mr. Marsh said his firm had received instructions to fit up No. 16 flat in these mansions with electric light, to suit a new tenant. The amount of the work and materials was £9 5s. Defendant had paid a sum on account, and left the balance now claimed. Defendant said that the work to be done in this flat was similar to that in one of the flats below it, and the charge there was just over £6, the amount he had paid as sufficient.

Plaintiff: The work was the same, except that there was additional main to be run from the Willesden Council service, and there was an additional point, and these accounted for the extra cost in this flat. The actual cost of the work was £6 14s. 7½d., and the balance was for office expenses, insurance, and masters' changes.

Mr. Goodwin: But the lines were put in wooden casing in No. 14, and in this one in tubing.

Defendant: Some were in casing and some in tubing.

His Honour: How much was the additional tubing?

Plaintiff: About 30s.

Mr. Goodwin: They need not have put in the tubing; they can take it away whenever they like.

His Honour gave judgment for £2 5s. [illegible]d. and costs.

German Electric Pocket Lamps.

In the City of London Court, on June 15th, before his Honour Judge Rentoul, K.C., Messrs. Millard Bros., Ltd., electrical engineers' agents, 123, Houndsditch, sued H. Fox, ironmonger, New Market, Houghton-le-Spring, Staffordshire, for £3 8s. for 1,000 German pocket electric lamps supplied. Defendant did not dispute the claim; but he raised a counterclaim for damages for non-delivery of other electric lamps ordered.

Mr. Austin Farleigh, plaintiffs' counsel, said that the goods in dispute were Millbro batteries. They had been in the habit of coming from Germany. There was a peculiarity about the present contract, as there was a condition printed upon it which said that the plaintiffs were not to be held responsible in damages "for failure or delay on their part in delivery, resulting wholly or partially from strikes or combinations of workmen or employés, or from any unavoidable total or partial stoppage of works, or from any other cause whatever." Plaintiffs were only the agents for the importation of goods. They were not able to get the goods owing to the war, in time to deliver on August 1st, as promised. But the contract exculpated them from any responsibility for non-delivery. The goods were on the quay at Hamburg still and could not be got over to England.

Defendant stated that the goods were to have been delivered on August 1st, and if the plaintiffs had made their arrangements in time, that could have been accomplished, in spite of the war, which was not declared by England until August 4th. The breach of contract occurred on August 1st.

Mr. Farleigh: There was an embargo on the goods, and mobilisation was going on before August 1st. The order was given in May, but if we had sent them over then they would have died before delivery. It is a chemical production, and the batteries were only guaranteed to last for six months. They cannot be re-charged.

Mr. Willoughby, plaintiffs' secretary, said their output of the lamps was 500,000 a year, and they had to disappoint a great many firms. There were still 17 cases, containing 5,000 lamps each, on the quay awaiting shipment at Hamburg.

Judge Rentoul held that the condition of the contract exempted the plaintiffs from any liability, and he found for the plaintiffs for the amount claimed on the claim and counterclaim, with costs.

Beck Engineering Co., Ltd.

A petition to wind up this company compulsorily, presented by the Sloan Electrical Co., Ltd., was before Mr. Justice Neville on Tuesday. Mr. Harrison, for the petitioners, however, announced that the matter had been settled, and he asked that the petition should be dismissed, without costs. His Lordship dismissed the petition accordingly.

Workmen's Compensation Case.

In the Bow County Court on Tuesday, before his Honour Judge Smyly, K.C., and a jury, the resumed hearing took place of a claim under the Workmen's Compensation Act, in which Arthur Edwin Attwell, an engineers' fitter, asked for an award against the West Ham Corporation electricity department. It appeared that the applicant was engaged in cleaning out transformer substations in connection with the electricity department. The electricity was generated at the main station at a pressure of 6,000 volts, and these transformer sub-stations reduced it to a pressure of 200 volts. The defendants had to regulate the working of these sub-stations in accordance with the regulations laid down by the Secretary of State under Act of Parliament, and to have these dangerous places safeguarded so that no accident could occur. The applicant was not an expert electrician, only a workman, and it was therefore more than necessary that they complied with the Act. On April 6th, 1914, the applicant was dusting the incoming main cable when he received a shock and was rendered unconscious. For some time it was thought he had been killed right out. The applicant gave evidence, and said that his hand was badly burned and charred. In his opinion, there was a defect in the insulation. He was paid full wages 37s. 6d. a week for 10 weeks, and then it was suggested that he should do light work. He did do a little walking round with the men, but was unable to do any of his former work, and his money was stopped. He was asking for an award of half wages. He was 31 years of age, and had no technical knowledge of electricity. His duties were the cleaning of transformer chambers, and he knew nothing of insulation. This chamber was 5 ft. square, with a barrier to keep one away from high-tension switches. When the accident happened he was dusting the porcelain where the main cable was connected with the transformer. His left hand became like a piece of bad meat. He now suffered with suffocating pains in the chest. After the accident he was asked to say that he was burnt by the lead that enclosed the wire, and not the porcelain, as if he said porcelain there would have to be a Local Government Board inquiry. He had never been supplied with rubber gloves to work in. He never saw a notice stating that high-tension switchgear might not be touched unless one wore rubber gloves, or stood on the insulating stool or mat. Copies of time sheets were put in to show that the man had been used to high-pressure work, but he said somebody was always with him. Other sheets produced suggested that he had been working since the accident, but he denied this, and said he only walked round with the men, making out the time sheets as he was told. The defence was that the man had never really been "shocked," only burned, and was capable of working. A mass of medical evidence was called to that effect, and the hearing was again adjourned.

WAR ITEMS.

London Works and War Munitions.—It is announced in several daily papers that as the result of a private meeting held recently at the Institution of Civil Engineers in London a Committee has been formed for the purpose of utilising workshop and other suitable accommodation in the metropolitan area for the production of munitions of war. The presidents of the Institutions of Civil, Mechanical, and Electrical Engineers are on the Committee, as are also the leading engineers associated with public works. It is proposed to bring under one central control, such accommodation in workshops and stations of lighting, gas, power and water companies. Mr. F. J. Walker, managing director of the St. James's and Pall Mall Electric Light Co., Ltd., is honorary secretary of the Committee. In the first instance information is being collected as to the engineering plants in the metropolitan area that are available. The *Times* states that the proposal was due to Mr. W. A. Harper, of Messrs. Harper Bros. & Co., consulting engineers, and that the Munitions Committee at the War Office has given its approval. The *Westminster Gazette* says it is estimated that amongst public authorities alone 100 workshops will be available.

Coal-Mining and the War.—The Departmental Committee's report on the effect of the war on the coal-mining industry shows that up to the end of February 191,170 persons from coal mines had joined H.M. Forces. It is considered that the time has arrived when very full deliberation should be given to the question as to whether further recruiting among miners should be encouraged. The loss in production for the year commencing from the outbreak of war will, unless means are taken to reduce the loss, probably amount to 36 million tons. Against this is put a reduction of 24 million tons in exported coal, leaving a net shortage, without further enlisting, of 12 million tons. Among other matters referred to by the Committee is the effect of the Eight Hours Act, and a conference between owners and workmen to determine to what extent, if at all, the Act should be suspended in individual districts, is recommended. The Committee in mentioning the importance of economy in the use of coal by the public says :—"Savings which at once occur to the mind are economies in public and private lighting, whether by gas or electricity, and the manufacture of luxuries which require coal."

Greece.—In a report, shortly to be issued, by H.M. Consul at Piræus, on the trade of that district in 1914, it is stated :—"As compared with imports from the United Kingdom, Austria-Hungary has imported into Greece more than twice the amount in value of the following goods :—Electro-technical appliances, electric conduction apparatus in boxes, electric motors, dynamos, transformers, switch and contact devices, mounted fuses, &c., and also electrical fittings, electric lamps, high-pressure cable and transmission lines, and electrolytic copper.—*Board of Trade Journal.*

Board of Trade Inquiries.—The list of inquiries received for the week ended June 5th for sources of supply of goods, contains the following items :—

Electrical flash lamp cases with switches.
Insulated brass conduit tube to compete with Bergmann tube.
Pea lamps with cord and adapters attached.
Motor lorries, electrically driven.
Tachometers.

Personal.—Mr. Roland J. Prankherd, formerly assistant charge engineer to the Hackney electricity works who, as already announced, joined the 9th East Surreys some months ago, obtained his commission as Second Lieut. in the 22nd Batt. N.F. (3rd Tyneside Scottish), on May 14th. His present address is at "A" Camp, Alnwick.

We learn from Messrs. W. Canning & Co., of Birmingham, that their chief chemist, Dr. W. E. Hughes, M.A., B.Sc., lately serving as a private with the U.P.S. at Epsom, has been granted a commission and been gazetted to the Leicesters. One of their chemical workers, T. Muggeridge, serving with the Worcesters, is a prisoner at Ohrdruf. James Casson, a chemical warehouseman, has been killed in action with the Royal Berks, leaving a widow and three children.

Mr. Gilbert Rosenbusch, M.I.E.E., Assoc.M.Inst.C.E., &c., who is an American citizen born, has changed his named to Gilbert Rowe. In making this announcement, Mr. Rowe desires to dissociate himself from everything German, and expresses his horror and disgust at the methods employed by the German army and navy, which culminated in the *Lusitania* atrocity.

Mr. J. Bissett, of the British Westinghouse Electrical and Manufacturing Co., Ltd., Trafford Park, has been appointed secretary to the Manchester Munitions Committee.

Roll of Honour.—Private C. I. Macdonnell, who has been on service with the 6th West Yorkshire Regiment, is now lying at the First Eastern General Hospital, Cambridge, having been shot in both legs. He was an electrical engineer working in Bradford prior to the outbreak of the war, and is 28 years of age.

Amongst those who are suffering from the use by the Germans of asphyxiating gases is Captain Austin Graham, of Barnard Castle. connected with the 4th Yorkshire Regiment (T.). He is at present in Lady Eveline Mason's Hospital in London. Captain Graham is an electrical engineer.

Private Peter Tolland, of the 2nd Battalion Black Watch, who has been awarded the D.C.M., was prior to the war in the service of the Greenock and Port Glasgow Tramways Co.

Private J. Kilby, of the 1st Northants Regiment, formerly employed by Northampton Electric Light Co., was killed at the Front on May 9th. He was 25 years of age and enlisted in August, going to France in January.

Private A. Meecher, of the Royal Field Artillery, who was engaged on the Hull tramways, has been killed in action.

Intelligence has reached Stockport of the death from wounds received in action in the Dardanelles of Petty Officer Mechanic Oswald New, who was formerly with Messrs. McClure & Whitfield, electrical engineers, of Stockport. He joined the Royal Naval Division last autumn, and went to the Dardanelles in March with the Armoured Car Squadron attached to the Royal Naval Division. He was in his 31st year.

The heavy losses in the East Lancs. Division in the Dardanelles include the name of Major E. L. Baddeley, of the 8th Batn. Lancs. Fusiliers, who died in action June 5th. He was second in command, and held a long service with the battalion, taking field rank in January last year. He was secretary of Messrs. W. T. Glover and Co., Ltd., Trafford Park.

Canfield Tape.—The Canfield Rubber Co., of 27-28, Noble Street, E.C., have brought to our notice their "Canfield" black insulating tape—a strong material impregnated with an adhesive rubber compound which will not dry out; white, gray and red tape is also made. Tests carried out at a well-known laboratory on a single thickness of the tape showed that the pressure required to produce a puncture averaged 970 volts, and the net length of tape per pound was 164 ft.

THE PRACTICAL RESULT OF THE POINT FIVE TARIFF.

By A. S. BLACKMAN and THOS. ROLES.

(*Abstract of Paper announced for reading before the* Incorporated Municipal Electrical Association, *June 17th*, 1915.)

The following is a list, in chronological order, of the undertakings which have adopted the Point Five Tariff, together with the dates upon which the same was put into force:—

Poplar, 1909; Southampton, 1910; Luton, 1910; Bradford, 1910; Sunderland, 1912; Barnes, 1912; St. Marylebone, 1912; York, 1912; Carlisle, 1912; Wrexham, 1913; Accrington, 1913; Sheffield, 1913; West Hartlepool, 1913; West Ham, 1913; Wolverhampton, 1913; Ilford, 1914; Blackpool, 1914; Wakefield, 1914; Worcester, 1914; Ipswich, 1914; Leeds, 1915; Chester, 1915.

The majority, if not all, of the earlier undertakings to adopt the Point Five Tariff did so as a result of independently coming to the conclusion that no substantial progress could be made in the supply of electricity for heating and cooking purposes in their areas at any rate exceeding one-halfpenny per unit.

To the Metropolitan Borough of Poplar belongs the honour of being the first electricity supply authority to adopt such a tariff. The fixed charge at Poplar is varied in the case of the different premises supplied in accordance with the number of kilowatts installed for lighting, heating, cooking, and other purposes, and includes a service charge and charges for the hire of wiring and consuming devices in cases where the two last-mentioned items are supplied by the undertaking on the hire system.

Southampton, the second town to adopt a Point Five Tariff, makes the granting of a halfpenny rate for heating and cooking purposes conditional upon the consumer installing a certain minimum number of lights charged for at ordinary lighting rates.

Luton, the next town to institute a Point Five Tariff, supplies current for heating and cooking purposes at a flat rate of one-halfpenny per unit without any fixed charge or conditions as to lights being installed on the premises supplied.

Bradford, the fourth town on the list, decided to confine its Point Five Tariff to domestic premises, and to base it on the "Norwich" or rateable value system of charging which, with a secondary charge of one penny per unit, had already proved its utility in a number of towns; and practically the whole of the undertakings which have since become converts to the Point Five principle have adopted this system.

So far as the writers are aware, the two methods cited above of arriving at the fixed charge (where made) are the only ones which have been adopted up to the present in connection with Point Five Tariffs, and the difference between these methods is but one of convenience in the working of the tariff, the fixed charge per kilowatt being more strictly correct in individual cases, whereas the apportionment upon the size of the house is an average result which has been found to be a sufficiently close estimate for all practical purposes, and to possess the great advantage of uniformity and simplicity in application.

It should be recognised that the rateable value basis is only made use of as a means which is ready to hand of determining the fixed charge approximately in accordance with the electricity consuming capacities of the premises supplied, and any other readily available basis might be adopted. This method of charging was initiated and put into use by Mr. F. M. Long, of Norwich, over eight years ago.

In most towns in which a Point Five Tariff, based on the rateable value system, has been instituted, the rate is restricted to the supply of electricity to private houses, as this method of determining the fixed charge does not so readily lend itself to the more widely varying conditions of other classes of supply. The percentage of the net rateable value decided upon varies in different towns, being usually between 10 per cent. and 15 per cent. per annum. In at least one case (Sunderland) the percentage is varied between 10 per cent. for a house rated at £50 to 15 per cent. for a house rated at £70 and upwards, the reason for this being that a large house generally furnishes a worse load factor than a small one.

In the case of both Bradford and Sunderland the tariff adopted has been left to justify itself, and no scheme of hiring out heating and cooking apparatus is in existence in either town. Had such hiring schemes been inaugurated, and energetic and sustained publicity campaigns been instituted by the two undertakings, the results shown in this report would have been still more favourable.

In the application of a Point Five Tariff, based upon rateable values, a discretion should be exercised in favour of the consumer who, in consequence of living in a house with an abnormal amount of ground attached to it, is rated out of proportion to the size of the house.

A marked advantage of the rateable value basis is the facility with which an accurate estimate of a consumer's bill can be prepared. Once the fixed charge for a house has been ascertained, a wide error may be made in assuming the number of units that will be used, and the estimate still remain reasonably correct. This facility for estimating has been found in practice to be a very useful asset to the canvassers in towns where a cheap supply of gas has to be competed against. It likewise follows that the importance of any error in metering is correspondingly lessened.

Numerous other advantages have attended the adoption of a Point Five Tariff based on the rateable value system, amongst which the following may be cited:—

When charged under the ordinary flat rate for lighting purposes it was, as a rule, found that residential consumers only introduced electric light into the best rooms, leaving the servants' quarters, etc., which possess a better load factor, illuminated by gas. The fact, however, that on the rateable value basis, once the fixed charge is assessed, all current required for lighting, as well as for heating and cooking purposes, is supplied at the low price of one-halfpenny per unit, has in most cases induced private house consumers to light the whole of their premises electrically, with a consequent improvement in the load factor of the installations.

Further, carelessness on the part of members of households in leaving lights burning while rooms are not in use does not result in the amounts of the accounts being unduly inflated.

In addition to this, under a flat rate of charge the lighting of most houses using electricity compared unfavourably with that of houses illuminated by gas, especially where the mantles in the latter were kept in good condition. The reason for this was that, on the score of economy, lamps of only small candle-power were generally in use. The making of the fixed charge in a house of any given rateable value quite independent of the number and size of the lamps installed, coupled with the supply of current at a cheap rate, has resulted in consumers using lamps of considerably higher candle-power, thus obtaining an illumination at least equal to that of gas-lighted premises. It is now usually quite easy to determine whether or not a house is on the Point Five Tariff by the brilliancy of the light proceeding from the windows of premises taking a supply under this rate.

Taking this class of supply altogether, the additional expenses to the Undertaking consist of the cost of increasing the capacity of the generating plant—which can now be done at far cheaper rates than in the days when the flat rate for lighting purposes was decided upon—and the provision of extra feeder cables.

In both Bradford and Sunderland it has been found that the majority of new domestic consumers adopt the rateable value tariff; houses are, as a rule, wired from cellar to attic; the domestic load factor has improved; the illumination of rooms has in almost every case been considerably increased; and no complaints are now received as to the inefficiency of electric lighting as compared with lighting by means of gas.

Prior to Point Five Tariffs being put into force, electricity was used for heating purposes by a number of consumers in the towns mentioned in this Report at prices varying from the ordinary lighting rates to one penny per unit, the heating medium usually being a one-kilowatt four-light radiator. Much dissatisfaction was, however, expressed at the amount of heat given off by radiators of this capacity and at the expense attached to their use. Since current has been supplied at one-halfpenny per unit, however, not only has the number of electric heaters increased to a tremendous extent, but the capacity of the individual heaters has also increased, so that fires taking three and four kilowatts are now quite common; in fact, in several Point Five towns the three-kilowatt radiator has become a standard. The result is that instead of electric radiators being used to warm the occupants of rooms by radiant heat, the air temperature of the rooms being but little affected, the temperature of the apartments is kept practically constant throughout, and the occupants are under no necessity to remain within the direct rays of the heaters.

The Electricity Supply Undertakings under the management of the writers are both situated in industrial towns, so that the house supply load is not as important as in some areas where it is the chief source of revenue. In Bradford the units sold to private houses are only 3 per cent. of the total [illegible] and in Sunderland [illegible] per cent.

Bradford Results.

No better testimony to the popularity of the Point Five Tariff in operation in Bradford can be furnished than the fact that at the 31st December last [illegible] private house consumers were connected to the supply, whereas prior to the introduction of this method of charging on the 1st July, 1910, the number of such consumers was but 511, representing the result of nearly twenty-one years' working. It will thus be seen that during the four and a half years the Point Five Tariff has been in force the number of domestic consumers has increased by [illegible] per cent. [illegible] hundred and three [illegible] of these consumers have elected to be charged on the [illegible] rate, the [illegible] [illegible] [illegible] Five Tariff and the year ended 31st December, 1914.

Based on the total kilowatts installed the average load factor of the [illegible] consumers in question has increased from [illegible] per cent to [illegible] per cent, equivalent to an increase of [illegible] per cent

UNITS SOLD FOR A COMPLETE YEAR.

Under old Tariff	93,880
Under Point Five Tariff	182,872
Average per house under old Tariff	680
Average per house under Point Five Tariff	1,325
Increase	94.9 p.c.

REVENUE.	£ s. d.
Total under old Tariff	1,566 0 0
Total under Point Five Tariff	1,358 0 0
Average per house under old Tariff	11 5 6
Average per house under Point Five Tariff	9 16 10
Average price under old Tariff	3.98d.
Average price under Point Five Tariff	1.78d.

The following table gives details in the case of all domestic consumers connected for the complete twelve months ended 31st December last:—

Tariff	4d.	.5d.
Number of consumers	340	566
Total units sold	124,742	612,502
Average number of units per house	367	1,082
Total revenue	£2,005	£4,312
Average revenue per house	£5 18 0	£7 12 4

The particulars given below illustrate the effect the Point Five Tariff has had on the diversity factor, the periods compared being the twelve months ended 30th June, 1910, and the twelve months ended 31st December, 1914.

Twelve months ended	June 30, 1910.	Dec. 31, 1914.
Maximum load on L.T. feeders for residential areas only	158 KW.	290 KW.
Total kilowatts installed in private houses	420 KW.	853 KW.*
Diversity factor	2.65	2.94

* This is the total for which application has been made. It has, however, been found since the introduction of the Point Five Tariff that heating and cooking apparatus, particularly the former, has been connected in private houses to a considerable extent without the Electricity Department being notified. Consequently the figure given is very much on the low side, and this naturally reflects on the diversity factor, which is undoubtedly greater than 2.94 as stated.

In conjunction with the above table, it may be mentioned that the 420 kilowatts of consuming devices installed at the 30th June, 1910, in private houses in the residential areas dealt with were almost exclusively for lighting purposes. As at that date the number of consumers affected was 233, an average of 1.8 kilowatts per house is obtained.

At the 31st December, 1914, the consuming devices in connection with the installations in these particular areas had increased to 853 kilowatts and the number of consumers to 367, giving an average of 2.32 kilowatts per house. Of the total of 853 kilowatts connected, 545 were for lighting purposes and 308 for heating and cooking purposes, the average per house being 1.48 and 0.84 kilowatts respectively.

The annual percentage of the rateable value debited to a consumer in Bradford adopting the Point Five Tariff is 15, and it is estimated that such percentage, coupled with a charge of one halfpenny per unit, brings in a revenue equivalent to what would be earned for an average supply of current for lighting purposes at a flat rate of 4d. per unit. All energy required for heating and cooking purposes is under these conditions obtained at the halfpenny rate.

Although in Bradford domestic consumers have not been approached individually for the purpose of explaining the advantages they would enjoy by changing over from the flat rate to the Point Five Tariff, more than half of such consumers have elected to be charged on the latter system, and have introduced electric heating or cooking apparatus. This is all the more remarkable when it is borne in mind that no general attempt has been made to induce consumers to install heating and cooking apparatus, the staff of the business-development department having been fully occupied in dealing with power supplies.

In addition to this, an agreement has been in existence between the Gas and Electricity Departments that in thoroughfares in which electricity mains are already laid the Electricity Department's canvassers shall not call upon gas consumers with a view to persuading them to take an electricity supply. Furthermore, the Gas Department have been exceedingly active during the past few years in advocating the use of gas for heating and cooking purposes.

The following extract from a letter received by one of the writers from Mr. P. Collinson, the Honorary Secretary of the Bradford Branch of the Electrical Contractors' Association (Incorporated), is of interest as expressing the views of the Bradford Wiring Contractors on the Point Five Tariff in operation in that city:—

"The Domestic Tariff is one that is popular among your consumers in that it is quite simple and easily understood: in this it differs materially from your Maximum Demand System of charging, which I find to be quite beyond the grasp of the average lay mind and which further is looked upon with some degree of suspicion.

"By enabling one set of wires to be used for both heating and lighting, the Domestic Tariff simplifies the wiring of a house and, therefore, reduces the initial cost of the installation, and by so doing tends to popularise the use of electricity. In addition to this I find that extensions of wiring are easier and not so costly as when the house is wired in duplicate for both heating and lighting.

"I find that where the Domestic Tariff is in operation it is much easier to persuade the user to extend both his lighting and heating installation than is the case when the user takes his energy at the old Flat Rate; the argument that the additional load will only add so much electricity at ½d. per unit to his bill usually proves irresistible. The large increase in the number of radiators installed in Bradford during the past few years is undoubtedly a direct result of the Domestic Tariff, and I believe that it is only under this system of charging that electric cooking will make appreciable headway.

"Looking at the Domestic Tariff from a Contractor's point of view, I am satisfied that it is a system of charging which makes for increased business, and as it appears to give satisfaction to the user, it has my emphatic approval, coupled with the hope that the principle may, at an early date, be extended to those of your consumers who are occupiers of shop, warehouse, and other business premises, and who are at the moment excluded from the scope of this tariff.

"In conclusion I may add that the opinions expressed in this letter are not my personal opinions only, but are the opinions of the bulk of my confreres in this city."

SUNDERLAND RESULTS.

At the introduction of the Point Five Tariff there were 337 private houses connected to the supply, the majority partially lighted only, as the result of sixteen years' working. Since the tariff was introduced upon the 1st of January, 1912, three years' working has resulted in 162 more private houses being connected; 100 of these elected to be put on the Point Five Tariff and are lighted throughout, and 62 upon a flat rate of 3.6d. per unit.

Of the 337 houses that were on the supply at the 1st January, 1912, 105 have changed over from a flat rate of 3.6d. per unit to the Point Five Tariff, and of these 105 houses 87 have, owing to there being no change of tenancy, been taken for the following comparison, the periods being the year preceding and the year following the adoption of the Point Five Tariff:—

The average of consumers' load factor on kilowatts installed has been increased from 2.44 per cent. to 4.05 per cent., an increase of 66 per cent.

UNITS SOLD FOR A COMPLETE YEAR.

Under old Tariff	44,827	
Under Point Five Tariff	93,327	
Aver. per house under old Tariff	512	(354)
Aver. per house under Point Five Tariff	1,073	
Increase	109.5 p.c.	(203.1 p.c.)

REVENUE.	£ s. d.	
Total under old Tariff	672 0 0	
Total under Point Five Tariff	616 0 0	
Aver. per house under old Tariff	7 14 5	(£5 5s. 9d.)
Aver. per house under Point Five Tariff	7 1 7	
Aver. price under old Tariff	3.6d.	
Aver. price under Point Five Tariff	1.58d.	

For the purposes of comparison it must be remembered that the units and money values underlined refer almost entirely to carbon lamp conditions, and our experience with pure lighting installations that have remained upon our mains unaltered over a term of years, save for the transition from carbon to metal filament lamps, shows that for purposes of comparison under modern conditions the figures in brackets should be substituted for those underlined, and this has been done for the purpose of the following comparison.

The comparative results obtained from alternative tariffs for all private houses connected for the year ended 31st December, 1914, are as follows:—

Tariff	3.6d.	.5d.
Number of consumers	212	286
Total units sold	75,032	298,563
Average number of units per house	354	1,044
Total revenue	£1,121	£1,803
Average revenue per house	£5 5 9	£6 6 11

The following table shows the effect of the Point Five Tariff upon the diversity factor, the periods being "A," just before the introduction of the tariff, viz., December, 1911, and "B," December, 1914.

	"A."	"B."
Maximum load on L.T. feeders for residential areas only	141 KW.	227 KW.
Total kilowatts installed in private houses	461 KW.	1,152 KW.
Diversity factor	3.25	5.00

It will be noted that the results shown in the two foregoing tables as between the 3.6d. and the Point Five Tariff, and as between the periods "A" and "B" are very considerable.

A number of tables are appended to the Report

A BATTERY AMALGAMATION.

[Pritchetts & Gold and Electrical Power Storage Co., Ltd.]

In our last issue we published in our report of the speech of Mr. James Gray, chairman of the Electrical Power Storage Co., Ltd., some particulars of the scheme for amalgamation of the business of that company with that of Messrs. Pritchetts & Gold, Ltd. We are now enabled to give some information respecting the arrangements that have been made for the future.

The capital of Pritchetts & Gold, Ltd., at present stands as follows :—

5 per cent. cum. pref. shares, £1 fully paid ...	£24,907	£44,907
Ordinary shares, £1 fully paid	20,000	
No debentures.		

The paid-up capital of the E.P.S. Co. is thus : —

5 per cent. debentures	£10,000	£103,290
Ordinary shares. £5 fully paid	92,960	
Founders' shares, 66 of £5 each...	330	

The E.P.S. Co., as already announced, will go into liquidation, and the Pritchetts & Gold, Ltd., will change its name to that given at the head of this article. It will also increase its capital and alter the status of the shares. A further 20,000 5 per cent. preference shares of £1 each will be registered ; and the existing 20,000 ordinary shares will become ordinary "A" shares, non-cumulative, and entitled to a dividend of 15 per cent. There are also to be created 20,000 "B" ordinary shares of £1 each, non-cumulative ; 14,000 1s. deferred shares (£700) ; also 5 per cent. first mortgage debentures of a total not exceeding £20,000.

The terms of purchase are : £10,000 debentures, 18 658 ordinary "B" shares, and 4,000 deferred shares. The balance of the purchase consideration being dependent upon the valuation of stock-in-trade, &c., at the end of the year (June 30th), cannot yet be stated, but it is to be paid either in preference shares or in debentures, but not exceeding £10,000 in debentures, making the total thereof £20,000. The E.P.S. Co. will take 4,000 of the 1s. deferred shares, leaving 10,000 to be subscribed for by the present ordinary shareholders of Pritchetts & Gold, Ltd. The proportion of profit will thus be five-sevenths to the shareholders of Pritchetts & Gold, and two-sevenths to the shareholders of the E.P.S. Co.

In regard to directors, the boards of the two concerns will be amalgamated. Mr. G. E B. Pritchett will continue in the chairmanship, and Mr. James Gray will be deputy-chairman. The other directors will be :—Sir James Pender, and Messrs. A. G. Gold, F. C. Graham Menzies, T. W. Pritchett, C. R. D. Pritchett, and David Willock. Messrs. G. E. B., T. W., and C. R. D. Pritchett will continue to act as managing directors. The principal members of the E.P.S. works and secretarial staffs will hold office under the amalgamated concern. The E.P.S. works at Milwall will be closed as soon as is practicable, and the works of Pritchetts and Gold, at Dagenham Dock, which have only been working for a year, and are laid out on most modern lines, are being much enlarged so as to accommodate the operations of the two businesses. The company has four acres of land there. It is interesting to note that the company, which has hitherto taken its supply of energy from outside sources, is now building a power-house of its own which will render it both independent and able to deal with the greatly increased power demand that the larger business to be handled will involve. The offices of the E.P.S. Co., at 4, Great Winchester Street, E.C., and those of Pritchetts & Gold, Ltd., at 58, Victoria Street, S.W., will be closed at the end of the month, and the company's office operations (estimating, secretarial and general business, in fact everything excepting actual manufacturing) will be concentrated at new offices situated at 82, Victoria Street, S.W.

The amalgamation of two well-known English battery manufacturing concerns is an event of no small interest to the electrical industry. "E.P.S." are household letters known all over the world—many electrical men learned them as part of their professional alphabet long years ago—and they will not now disappear. Pritchetts & Gold, too, is a popular name among engineers and battery users generally. It is nearly 30 years since Mr. G. E. B. Pritchett first began the manufacture of batteries. In 1890 his work was continued under the name of Pritchett Bros., and in 1892 as Pritchetts & Gold, at Woolwich. Five years later the business was removed to Feltham, and in 1901 the concern was formed into a limited liability company as Pritchetts & Gold, Ltd. Thirty years ago the late Mr. G. E. Pritchett—father of the three gentlemen who have enterprisingly built up the business now in mind—showed, though not an electrical engineer, a very keen appreciation of, and belief in, electrical matters when he founded, in conjunction with his son, Mr. G. E. B. Pritchett, the business of G. E. Pritchett and Co., which owned an electric light station at Blackhorse Yard, Rathbone Place—which is now a part of the Marylebone electric supply system. To his sons, in conjunction with those who have been closely identified with the operations of the Electrical Power Storage Co., Ltd., it has now fallen to carry through a business operation which indicates a keen appreciation of future possibilities, and augurs well for economical and otherwise successful manufacture along lines which will ensure for the amalgamated concern a leading place among the battery makers of the United Kingdom, and will enable it to make a good stand against foreign competition in all parts of the world when things industrial begin to return to the normal—if they ever do so.

BUSINESS NOTES.

Advance in Prices.—Messrs. Kelvin, Bottomley and Baird, Ltd., of Glasgow, announce that owing to the recent rise in cost of both material and labour, due to the present war conditions, they are compelled to increase all prices by 10 per cent. as from June 1st. The new prices are present list prices less schedule discounts, plus 10 per cent. advance.

Private Arrangements.—A. C. Bird, general and electrical engineer, 22, Regent Street, Hinckley.—The creditors interested herein were called together recently, when a statement of affairs was submitted which showed liabilities of £920, all of which was due to unsecured creditors. The assets were estimated to realise £422, from which had to be deducted £17 for preferential claims, leaving net assets of £405, or a deficiency of £515. It was reported that the debtor started the present business a little more than a year ago. Prior to that date he had been in partnership with another man. He had little or no capital when he started the present business. The liabilities included cash claims of £214, while the bank were creditors for £172. The bank held a guarantee for £100. In consequence of pressing creditors, a deed of assignment had already been executed with Mr. Millman, I.A., Leicester, as trustee. The creditors, after a short discussion, decided to confirm the deed already executed.

Catalogues and Lists.—Messrs. Drake & Gorham, Ltd., 1, Felix Street, Westminster Bridge Road, London, S.E.—8-page illustrated pamphlet (No. 233) giving prices and particulars of their "Phœnix" electric fans, including desk, oscillating, ceiling, porthole, and box-blade types.

British Thomson-Houston Co., Ltd., Rugby.—Descriptive list No. 6,500 (20 pages) giving very full particulars with illustrations of their steam, water and air-flow meters of various types, their principle, construction and installation.

Messrs. British Insulated & Helsby Cables, Ltd., Prescot.—4-page illustrated and priced circular giving particulars of the Prescot twin house-wiring system (cables and joint-boxes).

Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—Illustrated pamphlet No. 73, describing their cellular type switchboards (2,000—6,600 volts, A.C.) ; also single units for controlling the H.T. side of motor-generator and independent exciter control pillars.

Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.—Publication No. 223, giving illustrated particulars and prices of their "Equipoise" telephone arm ; also illustrated price-sheet of loud single-stroke bells for railways, mines, &c.

Book Notices.—"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXXI, Part 2. June, 1915. Newcastle-on-Tyne : The Institution. Price 5s.

"Modern Boiler Room Practice and Smoke Abatement." By J. T. Hodgson. London : "The Railway Review." Price 3s. 6d. net.

"A.B.C. of Electricity." By W. H. Meadowcroft. London : Harper Bros. Price 2s.

"A Treatise on Hand Lettering." By W. J. Lineham. London : Chapman & Hall, Ltd. Price 7s. 6d. net.

"Circular of the Bureau of Standards."—No. 49, "Safety Rules to be Observed in the Operation and Maintenance of Electric Equipment and Lines." No. 54, "Proposed National Electrical Safety Code." Washington : Government Printing Office.

Electric Vehicles.—The latest addition to the list of manufacturers of electric motor vehicles is Electromobile (Leeds), Ltd., whose works are at 32, Neville Street, Leeds. Pleasure cars as well as industrial vehicles, with carrying capacities ranging from 7 cwt. to 5 tons, are being turned out.

Electric Clocks.—The Synchronome Co., Ltd., state that the industry of electric clockmaking has felt the pressure of war time, and this has made it easier for them to spare no less than 50 per cent. of their staff, who are now serving H. M. Forces in some capacity or another. Rapid extensions of their circuits of electrical impulse dials have, however, been required in munition factories and shipyards, and in many buildings now used as war hospitals. They are also extending the electric time circuits in Euston station for the L. & N. W. Ry. Co., at Waterloo for the L. & S.W. Ry., and at Port Sunlight for Lever Bros., Ltd., and providing new installations of electric clocks in the Civil Service Commission, Burlington House, for the Office of Works, the new offices of the Western Union Telegraph Co., Ltd. ; Messrs. Pilkington's Glass Works, St. Helens, &c.

Bankruptcy Proceedings.—[illegible] R. [illegible], 30, Hans Place, Chelsea.—The first meeting of creditors was held on Monday at the London Bankruptcy Court under this failure. Mr. E. Leadam Hough, Senior Official Receiver, reported that it appeared from the debtor's statements that he qualified as an electrical engineer in or about 1890, but had never carried on business on his own account. When he came of age he became entitled to about £5 000 under the will of a relative, and had lost it all in investments in certain public companies. In 1900 he formed the British Electrical Manufacturing Co., Ltd., with registered offices at 37, Walbrook, E.C., and works at Putney Bridge Railway Arches. The object of the company was to purchase from the debtor, as a going concern, the business of J. D. F. Andrews & Co., Ltd., electrical engineers, which he had at that time purchased with his own money for £[illegible]

The nominal capital of the company was £10,000 in preference and ordinary shares. Under his agreement with the company the debtor received, in consideration of the transfer of the business, £2,000 4 per cent. debentures, 250 preference and certain ordinary shares. He was appointed director at £4 per week, inclusive of fees. He subsequently put a further £500 into the company, but about two years after its formation the company went into voluntary liquidation, and the debtor altogether lost £3,000 in the concern. In 1905 he purchased £200 worth of shares, and subsequently a further £200 worth, in the Dauxphone Manufacturing Co., Ltd., of Newton Abbot. That company carried on business for about two years and then went into voluntary liquidation, the debtor losing the £400 he had invested in it. He had been interested as director or otherwise in a number of other companies, over which he lost money, and no statement of affairs had been lodged, but the debtor roughly estimated his liabilities at £1,370, and did not admit insolvency. The meeting was adjourned.

A. Whiteley, electrical and mechanical engineer, Llandudno.—A first and final dividend of 6s. 10½d. in the £ is payable on June 25th, at the Official Receiver's office, Crypt Chambers, Eastgate Row, Chester.

Liquidation.—Pintsch's Electric Manufacturing Co., Ltd.—This company is winding up voluntarily, with Mr. H. W. Kirby, of Bassishaw House, Basinghall Street, E.C., as liquidator.

For Sale.—Bolton Corporation has for disposal four 270-h.p. engines; four 200-kw. Ferranti single-phase, 83-cycle alternators, 2,000-2,200 v.; three 30 ft. by 7 ft. 6 in. Lancashire boilers and superheaters. Particulars are given in our advertisement pages.

Trade Announcement.—Messrs. J. P. Strange and P. G. Hobbs, trading as the Electrical Installation Co., of 42, Monson Road, Tunbridge Wells, give notice that, having been called up for service in H.M. Forces, they find it necessary, at any rate temporarily, to close their business. They have appointed Mr. Percy Wickenden, chartered accountant, 1 and 2, The Broadway, Tunbridge Wells, receiver of the partnership assets, to whom all accounts should be sent for payment.

Catalogues Wanted.—Mr. E. Pogson, who has recently taken charge of the electric power installation at Ripon Camp, invites manufacturers to send him catalogues of engine-room stores, overhead-line material, switches, fuses, meters, cables, lamps, &c.

LIGHTING and POWER NOTES.

Argentina.—The first electric furnace in South America is about to be installed at Buenos Ayres. It will, says *La Electricidad y la Maquinaria*, be capable of smelting mêtals on a large scale, and will be installed in "our laboratory," presumably that of the Instituto Sudamericano de Electricistas y Mecanicos, of which that paper is the official organ.

Ashton-under-Lyne. — Street Lighting. — The restrictions on public lighting have been relaxed, but it is not considered desirable to go back to arc lighting, as the half-watt lamps which have been introduced give twice the light at half the cost.

Barnsley.—Year's Working, &c.—The electricity department made a profit on the year's working of £1,115, which it was decided to carry to reserve account. The Works Sub-Committee has decided to increase the wages of stokers and drivers employed at the electricity works from May 20th, overtime to be paid for in future in accordance with local conditions and all broken time to be stopped, and no further payments to be made during absence through ill-health. The Electricity Committee has decided, owing to the increased price of coal, increased cost of labour, &c, to raise the price for current as from July 1st, 1915, by 1½d. per unit for lighting purposes, and by 15 per cent. for power purposes. The coal contracts for the next 12 months had recently been let at an advanced price of £2,400.

Barton-on-Humber.—Restricted Lighting. — On account of the suspension of street lighting the Electric Supply Association has agreed to forego half the balance of the sum due for the year on account of public lighting.

Beckenham.—Price Increase.—On account of the enormous increase in the price of coal, and the advance in the cost of materials and wages, the U.D.C. has decided to increase the price of current for the ensuing quarter by 15 per cent.

Berwick-on-Tweed.—The T.C. has decided to have the Council Chamber lighted by electricity, and has accepted the offer of the Electric Supply Co. to fix four ceiling fittings with 100-c.p. lamps.

Bidford-on-Avon.—E.L. Scheme.—After considering a proposal by Messrs. Pullan & Best, of Bradford, to provide an E.L. installation for the district through a local company to be formed, the P.C. has passed a resolution stating that it is favourable to the proposed scheme.

Bispham.—The working of the Council's electricity undertaking for the year ended March, 1915, shows a deficit of £399, as against £616 in 1914. The estimated deficit for 1916 is £650.

Bradford.—L.G.B. Inquiry.—Last week an inquiry was held into the application of the Corporation for sanction to borrow £2 977 for the reconstruction of cells at the destructor works, Sunbridge Road.

Carnarvon.—The Electricity Committee reports that as the result of further representations, the L.G B. has agreed to consider the application for borrowing powers for the extension to Bryn Seiont.

Chesterfield. — Plant Extensions. — The T.C. has received a letter from the Chesterfield Tube Co. stating that, as the Corporation was meeting the present demand for power, it did not consider that the expenditure of the £5,000 which the Corporation found necessary need be undertaken on its account alone. The Council has decided to purchase an alternator, boiler, superheater, mechanical stoker and economiser, at a total cost of £2,706, and it was stated that it was hoped in the near future to complete the scheme which the Electrical Committee brought forward in February, 1914.—*Nottingham Guardian.*

Continental. — France. — Work has recently been completed on the new hydro-electric power plant near Bramis, in the Valley of the Rhone, for the Société d'Aluminium de Neuhausen. The water power of the River Borgne is utilised, the water being taken in the Eriny Valley and piped to Bix, whence to the power plant—which is equipped with turbines of a total capacity of 30,000 h.p.—a fall of nearly 400 ft. is obtained. The current generated is being used in the Neuhausen Co.'s works at Chippis, where a total of no less than 100,000 h.p. is now available.

Darwen.—Increased Prices.—The Corporation has decided to increase the charges for electricity for public and private lighting by 10 per cent., and for power purposes by 20 per cent., apart from sealed contracts and tramways.

Great Harwood.—E.L. Scheme.—The proposed electricity scheme has been deferred in consequence of the war. Application is to be made to the B. of T. for a renewal of the Electric Lighting Order.

High Wycombe.—Price Increase.—The Electricity Co. has increased the price of current for power, lighting and heating by 10 per cent. as from July 1st.

Hexham.—Increased Prices.—The Hexham and District Electric Supply Co., Ltd., has given notice that the charge for current for lighting purposes will be increased from 5d. to 6d. per unit from July 1st; terms, discounts, &c., remain unaltered.—*Newcastle Daily Journal.*

Heywood.—Loan Periods.—The L.G.B. is to be asked to fix an equated period for the borrowing of £6,355, sanctioned on March 26th last, for the electricity undertaking.

Ilford.—The proposed new tariffs have been referred to a small sub-Committee to consider in detail and report. The Electricity Committee has deferred, for the present, a report of the electrical engineer on the question of providing mechanical stokers for two boilers at the works. The electrical engineer is in communication with a firm of accumulator manufacturers respecting a supply of current for their projected new works.

Kilkeel (Co. Down).—Proposed E.L.—The Council has decided to apply to the Irish L.G.B. for powers for the electric lighting of the town.

King's Lynn.—Year's Working.—The annual accounts of the Council's electricity undertaking for the 12 months ended March 31st last show that the income amounted to £7,992, as against £8,519 in 1914; the expenditure was £6,642, as compared with £6,742 in the previous year, leaving a profit of £1,350, as against £1,776. It was decided that the whole of the surplus should be applied in reduction of capital money borrowed for electricity purposes. The total number of units sold was 615,803, as compared with 669,874, and the average price obtained was 2·76d. per unit, as against 2·66d. The Electricity Committee has decided to reduce the charge for public lighting for the year by £300, owing to the restricted lighting.

Kirkcaldy.—Financial Estimates.—The Corporation Electric Lighting and Tramway Committee has submitted the estimates for the ensuing year. Owing to the rise in the price of coal, the deficiency in the electricity department is estimated at about £3,000, to meet which it has been decided to increase the price charged for private lighting and power by 25 per cent., and for tramway supply by ⅛d. per unit. To meet the loss on the tramways it was decided to abolish all overlapping of ½d. stages.

Long Eaton.—Electricity Charges.—The following revised scale of charges for current has been adopted by the U.D C.:—Domestic lighting, 4d. per unit, less 5 per cent.; factories, 3½d. per unit for the first 2,000, and 2½d. beyond; public lighting, 2d., less 5 per cent.: power, 1½d. for the first 1,500 units, ·85d. beyond, less 5 per cent.; heating and cooking, 1d., less 5 per cent.

Linton.—Workhouse Lighting.—Owing to the heavy rates payable to the County Council, the Board of Guardians has decided that it cannot incur the expense of the proposed electrical installation at the workhouse premises.

London.—Fulham.—The linking-up scheme of the boroughs of Battersea, Hammersmith, and Fulham provides for the laying of connecting mains between the generating stations, and the provision of suitable transforming plants at each station. The cost of the mains and their maintenance is to be shared equally by the three Councils, the work to be carried out under the supervision of the Fulham Council. Each Council will bear the cost of its own transformer station and transforming plant. It is proposed that the agreement giving effect to the scheme shall be for a period of 25 years, and that each Council shall extend its plant, in rotation, as and when the combined generating plant is insufficient to meet the combined maximum demand in the three areas of supply concerned, Fulham to be the last to extend. The charges to be made have been provisionally agreed and are mutual, and subject to revision every five years. The estimated cost of the connecting mains is £17,441, of which the Fulham Council will be responsible for one-third or £5,813, and the estimated cost of providing the transformer room and transforming, &c., plant at the Townmead Road station is £2,562, making a total of £8,376. It is anticipated that only part of the connecting mains provided for in the above estimate will be laid in the first instance. The Electricity Committee recommends the Council to approve the scheme subject to the agreement being approved by the Law and Parliamentary Committee, and that application be made to the Board of Trade and the L.C.C. for sanction to its adoption, and to the Treasury for sanction to the necessary loan to carry out the work.

Woolwich.—An agreement has been sealed with the Secretary for War for the supply of electricity to the Bostall Heath Camp. The Electricity Committee reports that, up to the present time, no meter rents have been charged to customers, except in special circumstances. Having regard to the fact that it often happens that more than one meter is required in a private house, and two or more, per service, in a business house, it has been decided to charge 1s. 6d. per quarter for additional meters when more than one is required for a private house service, and more than two are required for services to business premises.

Marylebone.—The B.C.'s Finance Committee recommends application to the L.G.B. for sanction to a loan of £5,450, to cover expenditure on mains, including this year's expenditure.

The E.L. Committee has arranged suitable accommodation for, and come to an agreement with, Edison Accumulators, Ltd., whereby the latter for five years will carry out the charging of all vehicles brought to the Council. The company agrees to take 100,000 units during the first year, and not less than 250,000 units a year subsequently, excluding energy used at premises other than the generating station, Blandford Street and Rathbone Place. The prices quoted by the Council vary from ½d. to ¾d. per unit.

Hammersmith.—The Electricity Committee in reporting on the proposed linking up scheme with Fulham and Battersea B.C.'s., points out that the Battersea B.C. must meet certain large additional demands for electricity in the immediate future, and this can only be done, the Committee is informed, by an extension of the Battersea existing station or by putting into operation at an early date the proposed linking-up scheme.

The Committee recommends approval in principle of the scheme subject to the necessary consents being obtained and to a satisfactory agreement being entered into.

Market Drayton.—Public Lighting.—The U.D.C. has decided to ask the local Electric Lighting Co. for its terms for lighting High Street and Shropshire Street, and converting the lamps.

Melton Mowbray.—The Electricity Co. has applied to the B. of T. for permission to use 200-volt overhead lines in the town.

Middlesbrough.—The L.G.B. has sanctioned borrowing powers to cover expenditure for laying electricity mains to works engaged on making munitions, but not for supplying electricity to ordinary consumers.

Rawdon.—E.L. Scheme.—The D.C., after considering the report of the conference of the local Wharfedale authorities regarding the provision of electricity for the district, has decided not to join in the scheme.

Restricted Lighting.—The following additional regulations regarding lighting appeared in the *London Gazette*:—

The Secretary of State may order that all lights shall be extinguished or obscured between any hours, and within any area, and if no police constable is available to see that the order is obeyed, "any soldier or sailor on sentry patrol, or other similar duty," may enter premises, or stop and seize any vehicle to extinguish or obscure the lights.

No coloured lamp may be carried on any vehicle other than a locomotive or railway carriage without lawful authority, unless such light is already authorised by law. Lights carried in vehicles are not to be capable of movement "independent of the movement of the vehicle."

St. Annes-on-Sea.—Price Increase.—The U.D.C. has decided to increase the price of electricity for private lighting by one halfpenny per unit, and to add 10 per cent. to the price of current for all other purposes except cooking.

Salford.—Proposed New Plant.—The question of the supply of a 5,000-kw. turbo-alternator at the Frederick Road electricity station, at an estimated cost of £16,200, is under consideration.

Sheerness.—L.G.B. Inquiry.—An inquiry was held on June 8th into the application of the U.D.C. for a loan of £5,000 for the extension of the refuse destructor. There was no opposition.

Shipley.—Price Increase.—From July 1st the charge for electricity for lighting purposes will be 4¾d. per unit, and for power purposes the present charges are to be increased 10 per cent.

Slaithwaite.—E.L. Scheme.—The Council has decided, owing to the fact that the L.G.B. has intimated that it is not prepared to sanction any loans for public works during the war, and on account of the abnormally high prices of labour and materials, that the electric lighting scheme for the district should be temporarily suspended.

Stratford-on-Avon.—The Electricity Co. has asked the T.C., in view of the increased cost of coal, labour, &c., to allow it to charge a maximum of 6d. per unit for current instead of 5d. as per an agreement with the Corporation, although it was proposed at present to charge consumers only 5½d. The Council has referred the matter to a Committee, who will go into the agreement and report.

Teignmouth.—Prov. Order.—The B. of T. has issued a prov. order for E.L. to Messrs. J. W. and A. Purves, and the U.D.C. has decided not to oppose the confirming Act.

United States.—The *Daily Chronicle's* New York correspondent says a wide conspiracy exists to destroy plants in event of trouble between Germany and America, and the American Government has warned munition manufacturers to have their factories heavily guarded. Some have already electrically-charged wire fences 6 ft. high erected around them.

Walsall.—Year's Working.—The accounts of the Corporation electricity undertaking show a profit of £1,385; a sum of £1,012 is transferred in respect of obsolete plant. The Electricity Committee recommends that this profit should be applied in reducing the debt on switchgear and plant to be superseded on the completion of the new station, and also to carry forward £639.

New Power Station.—In view of the slow progress at the Birchills power house, together with other circumstances consequent upon the dislocation caused by the war, the Electricity Committee has considered the question of how to meet the demand during the coming winter, in the event of the new plant not being ready. The Committee has decided that no further plant be provided at the Wolverhampton Street works.

Warminster.—E.L. Scheme.—Mr. J. H. Edwards, promoter of the E.L. scheme, has informed the U.D.C. that the parties interested in the matter are not able at present to decide definitely as to the site for the generating station, and are unwilling to bind themselves in any way at the present time.

Watford.—Price Increase.—The U.D.C. has, owing to the enormous increase in the price of coal, advanced the price of current for lighting by 12½ per cent., and for power, &c., by 10 per cent.

Wimbledon.—In regard to the B.C.'s application for permission to supply electricity to 18 houses in the parish of Cuddington, and in the Epsom Rural District, the B. of T. is not prepared to make an order under the section in respect of such a large number of premises, and suggests that the Corporation should apply for a prov. order to extend its present area of supply.

Yarmouth.—Year's Working.—The annual accounts of the Corporation Electricity Department for the year ended March 31st, 1915, show a gross profit of £9,250. After payment of interest and oustanding charges of £8,630, £188, the final instalment of the cost of the mechanical stokers and the alteration of the system of street lighting, there was a net profit of £432, which was carried to the appropriation account.

The Electricity Committee has reduced by one-third the charge of £591 for street lighting.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Year's Working.—The total revenue for the past year of the Corporation tramways was £[illegible] and the increase, as compared with 1913-14, was £2,722. The number of passengers carried was 22,[illegible]761, as against [illegible], an increase of 1,900,367, allowance being made for soldiers' free tokens. The miles run numbered 1,907,377, against 1,832,587.

Bolton.—In connection with the movement of local tramway workers to secure advances of wages, the men have decided to ask the Tramways Committee to grant an advance of a ½d. an hour in July, and a further ½d. on January 1st next

Bolivia.—According to information published by the newspapers of Bolivia, the construction works will shortly be taken in hand of the electric tramway from Yungas to La Paz.

Continental.—Italy.—A concession has lately been granted for the construction and working of an electric tramway between Turin, Sassi and Superga.

Dartford.—Messrs. Balfour, Beatty & Co., Ltd., have applied to the B. of T. for the time for the completion of the tramways under the 1911 order, to be prolonged until August 18th, 1918.

On the advice of the engineer-in-chief, the Metropolitan Asylums Board has approved of the installation of certain points and crossings for a projected siding of the tramway system at the Joyce Green Hospital.

Hove.—Railless Traction.—The T.C. is recommended to agree to an extension of time for completion of the through railless system until two years after the termination of the present war, and that the conditions resulting from the Brighton and Hove Acts of 1912 be extended over the period named.

London.—The L.C.C. Highways Committee is giving careful consideration to the case of those employés who remained loyal during the strike. During the four weeks ended June 2nd, the number of passengers carried was 25,789,651, as against 42,025,436 in 1914, a decrease of 16 235,785. Traffic receipts amounted to £109,547, as compared with £178,848, showing a decrease of £69,301.

The Select Committee of the House of Commons has passed the L.C.C. scheme for extending the existing tramways from the Aldgate terminus, down Mansell Street, and across Tower Bridge approach to Tower Hill, terminating by a loop round Trinity Square.

The Highways Committee recommends that the arrangement made in July, 1913, that any surplus from the working of the Council's tramways should be paid into the renewal fund, be extended for a further period of two years from April 1st, 1915; also that the basis of the provision to be made be reconsidered at the end of that period.

Quarry Bank.—The Quarry Bank and District Light Railways (Transfer) Order, 1912, expires in August, and Messrs. Balfour, Beatty & Co. have informed the U.D.C. that circumstances have rendered it impossible for them to proceed with the scheme, and that in view of present conditions it is inadvisable to apply for an extension of time in view of the unlikelihood of them being able to deal with the matter in the future. The Council has referred the matter to the Brierley Hill, Quarry Bank and Rowley Regis Light Railways Joint Committee.

Northampton.—Year's Working.—The accounts of the Corporation tramway undertaking for the year ended March 31st show that after the payment of interest and instalment of loans there was a credit balance of £1,581, of which £651 has been placed to the reserve fund. The sum of £5,000 is to be debited to the reserve fund, now standing at £11,420, and credited to the unexpired loans for the original Kingsthorpe system prior to the Kingsthorpe and Far Cotton extensions.

Sunderland.—The reserve, renewals and compensation funds of the tramways department now amount to £45,044, the sum of £4,054 having been added during the year. There has been a falling off in the receipts during the last two months of £503, equal approximately to £3,018 per annum. Altogether 83 of the employés have left to join the military or naval service or to engage in war work.

Tottenham.—It has been suggested that the D.C. should enter into an agreement with the Metropolitan Electric Tramways, Ltd., as to the repair and maintenance of the tracks in Tottenham under the jurisdiction of the company. The General Purposes Committee of the Council has instructed the clerk to negotiate with the Tramways Co accordingly.

Walsall.—The Corporation Tramways Committee recommends the purchase for £900 of land adjacent to the Corporation tramways depôt from the Birchall's Estate Co., as a site for a depôt for the motor-'bus service.

Yarmouth.—Year's Working.—The report of the Corporation tramway undertaking for the year ended March 31st last, shows a gross profit of £5,706, as compared with £8,631 in the previous year; loan charges, &c., amounted to £7,041, leaving a deficiency of £1,234.

TELEGRAPH and TELEPHONE NOTES.

Adriatic Cables Cut.—On June 5th the cables uniting the Continent to the islands of the Dalmatian Archipelago were cut by the Italian Navy.

Argentina.—A new company which has just acquired the generating station at Jujuy intends to reconstruct and extend the telephone network in that province. The capital town is to be placed in communication with the departments to the east and west, affording connection with Perico del Carmen, San Pedro and Ledesma.

France (Algeria).—The Chamber of Commerce of Algiers has been authorised to lend a sum of £2,976 to the Government-General of Algiers, in order to establish a telephone system between Warnier, Malakoff, Masséna, Lamartine, Beni-Indel and Bou-Caid.—*B. of T. Journal.*

Illicit Wireless.—A school teacher named W. R. Walker was charged at Castle Eden Police Court, Durham County, on Saturday last, with being in possession of wireless telegraphic apparatus at Trimdon Grange. The defendant, who had informed the Post Office in August last that he had wireless apparatus (which was dismantled at the outbreak of the war), was fined £5 5s.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—Aug. 11th. One 1,000-kw. d.c. generator complete, liquid starter, &c., for City Council. See "Official Notices" June 4th.

Adelaide.—July 14th. Galvanised-iron wire, for P.M.G.'s Department. See "Official Notices" June 4th.

Sydney.—July 19th. City Council. Fuses and fuse-boxes. City Electrical Engineer (10s. 6d.).

Basingstoke.—Installation of electrical plant, including engines, dynamo, battery, cables, &c., at Park Prewett Asylum. See "Official Notices" to-day.

Bolton.—June 23rd. Corporation. 30,000 tons of bituminous engine slack, nuts, or peas, for the Electricity Committee. Forms of tender from Mr. W. J. H. Wood, Borough Electrical Engineer.

Brighton.—June 22nd. Electrical fittings, for the Board of Guardians. Particulars from Mr. H. Burfield, Clerk, Princes Street.

Dublin.—June 21st. Installation of electric light at the Technical Schools, Rutland Square, for the Education Committee. Particulars from Mr. J. Clark, Technical Institute, Bolton Street.

Eastbourne.—June 26th. 160 ft. of 14-in. cast-iron circulating water piping and valves. See "Official Notices" June 11th.

Edinburgh.—June 21st. Two 5,000-kw. turbo-alternators and condensing plant, for Portobello supply station. See "Official Notices" May 21st.

Erith.—July 5th and 19th. U.D.C. One water-tube boiler with superheater, economiser, automatic stoker, steel chimney, induced-draught plant, steam valves, steam pipes, and all auxiliaries. One 2,000-kw., h.p. turbo-alternator, with condensing plant, switchgear, and all accessories. See "Official Notices" to-day.

Exminster.—June 29th. Electrical appliances for a year, for Devon County Lunatic Asylum. Mr. H. E. Morgan, Clerk.

Glasgow.—June 19th. School Board. Installation of electric light at Springbank Public School, Henshaw Street. Specification from the School Board offices, 129, Bath Street.

Halifax.—July 1st. Corporation. One 5,000-kw. turbo-alternator complete with condenser; two natural-draught chimney-type cooling towers; one water-tube boiler, superheater and mechanical stokers. See "Official Notices" to-day.

London.—Metropolitan Asylums Board.—June 30th. Lighting installation at the Grove Fever Hospital, Tooting Graveney, S.W. See "Official Notices" June 11th.

Fulham.—June 30th. 11,000 tons of coal, for the Borough Electricity Works. See "Official Notices" June 11th.

Nottingham.—June 24th. Twelve months' supply of coal for the Corporation generating stations. Mr. H. Talbot, Electrical Engineer.

Rangoon.—August 11th. Installation of a system of fire-alarms, for the municipality. Specification (10s.) from Messrs. Ogilvy, Gillanders & Co., 67, Cornhill, E.C.

Rochford.—The B. of G. is recommended to invite tenders for the installation of a system of electric bells, indicators, &c., at the infirmary.

Salford.—June 28th. Supply of stores, including cable, &c., for the Electricity Department. See "Official Notices" to-day.

Spain.—The Spanish Ministry of Posts and Telegraphs, Madrid, is inviting tenders for the establishment and working, during a period of 20 years, of telephone exchanges in the towns of Monforte de Lemches (Province of Lugo), Guadix (Granada), Betanzos (Coruna), Durango (Vizcaya), Cabeza de Buey (Badajoz), Haro (Logrono), Tudela (Pamplona), Vinaroz (Castellon), and Baza (Granada).

Tenders have lately been invited by the municipal authorities of Pinille del Toro (Province of Zamora) for the concession for the electric lighting of the town.

July 31st. The Spanish Ministry of Public Works in Madrid is inviting tenders for the concession for the construction and working of an electric tramway between Mongat and Tiana (Province of Barcelona). An application has already been made for the concession, but, in accordance with the usual custom in Spain, the project is being put up to public tender.

Tasmania.—Launceston.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Walsall and West Bromwich.—July 5th. Lighting; heating apparatus; drainage and septic tanks, for Unions Joint Committee. See "Official Notices" to-day.

Warrington.—June 18th. E.H.T. cable, for Electricity and Tramways Committee. See "Official Notices" June 11th.

Wigan.—June 21st. Corporation. Two water-tube boilers with mechanical stokers. See "Official Notices" June 11th.

CLOSED.

Australia.—Sydney.—According to the *Sydney Sun*, the City Council received the following tenders:—

Incandescent lamps.—
Aust. General Electric Co.—Vacuum, £868 15s., nitrogen, £3 15s. 3d.
Do. do. —Alternative A Vacuum, £918 15s.
Lawrence & Hanson.—Vacuum, £957 5s. 10d.; nitrogen, £2 12s.
British General Electric Co.—Vacuum, £1,119 10s.
Aust. General Electric Co.—Vacuum, £1,343 15s.

British General Electric Co.'s tender recommended for acceptance for vacuum lamps; Aust. General Electric Co.'s tender for nitrogen lamps recommended for acceptance.

Coal schutes.—

W. Elder & Co ..	.. £260	Watt & Murdoch	. £436
Storey & Keers ..	.. 312	James Connolly	582

W. Elder & Co.'s tender recommended for acceptance.

The following contracts have been placed:—

N.S.W. Railways and Tramways Department.—
Quadruple turntable for White Bay power house, £549.—H. Vale & Sons.
Metropolitan Board of Water Supply, Sydney, annual contracts.
Electrical conduit.—W. G. Watson & Co., Ltd., 32½ per cent. below schedule.
Electrical sundries.—Lawrence & Hanson Electrical Co., Ltd., 15 per cent. below schedule.
Electrical wires and cables.—W. T. Henley's Telegraph Works Co., Ltd., 7½ per cent. below schedule.
South Gippsland (Vic.) Creamery & Butter Factory, Ltd.—
Generator, three-machine booster, switchboard, 140 amp. hour Chloride battery of 125 cells, cables, &c., £751.—Sutherland & Ashman.

—*Tender*.

Barnet.—In connection with the installation of electric light at the Nursery, the Guardians have accepted the tender of Messrs. Baxter & Caunter for the supply of the necessary material, at £35. The actual work is to be entrusted to the Board's engineer.

Barnsley.—The Electricity and Lighting Committee has accepted the following tenders for coal:—Mr. R. E. Williams, 3,250 tons; Messrs. J. Wilby, Ltd., 3,250 tons.

Carlisle.—The T.C. has decided to renew for a period of 10 years, at £55 per annum, the agreement with the Tudor Accumulator Co., Ltd., for the maintenance of the lighting battery at the electricity works.

Chesterfield.—The T.C. has accepted the following tenders for plant for the electricity works:—

British Westinghouse Co., Ltd.—100-kw. alternator, &c., £877.
Babcock & Wilcox, Ltd.—Boiler, £997; superheater, £195; mechanical stoker, £280.
Clay Cross Iron Co., Ltd.—Economiser, £359.

Croydon.—The Lighting and Electricity Committee recommends that contracts be entered into with the following firms:—

J. H. Gilman & Co.—3,000 tons Kingsbury Rider beans, 24s. 10d. per ton; 2,500 tons Mapperley small nuts, 25s. 6d. per ton; 3,500 tons [illegible] and Linby slack, 23s. 6d. per ton.
Cleeves & Co.—3,000 tons of Shipley peas, Manners peas, Mapperley small nuts and Manners small nuts, 2[illegible]s. 6d. per ton.

Darlington.—The T.C. has accepted the following tenders for the electricity works:—

Cochrane & Co., Ltd.—Condensing water pipework.
British Thomson-Houston Co., Ltd.—H.T. switchgear.
Musgrave & Co.—Induced-draught fan.

Gosport.—The contract for the installation of the electric light at the new Girls' Hostel, Milton, has been secured by Messrs. W. N. Walters, of Gosport.

Gravesend.—As the Western Electric Co. is unable to supply cables under the schedule contract prices, the T.C. has decided to obtain quotations from that company and from Messrs. Henley's, Ltd., and to accept the lowest.

Heckmondwike.—The U.D.C. has sealed a contract with Mr. F. E. Moss for 2,000 tons of coal for the electricity works.

London.—Bermondsey.—The Electricity Committee recommends the purchase of 2,000 tons of Mansfield nutty slack from Messrs. Usher & Co., at 19s. 9d. per ton, and 1,200 to 2,000 tons of Shipley nuts from Messrs. Myers, Rose & Co., at 22s. 6d. per ton.

Hammersmith.—The Electricity Committee reports that up to the present the Council has authorised the Committee to purchase and store up to a maximum of 6,000 tons of coal; orders to the amount of 3,850 tons have been placed. The Committee is of opinion that full advantage should be taken of the coal-storage facilities now in working order at the generating station by maintaining a more adequate reserve than the present authority permits, in order to avoid possible contingencies, and recommends the Council to accept the following offers:—

Cory Bros. & Co., Ltd.—2,000 tons of Gedling ¾-in. High Hazel slack, at 17s. 9d. per ton.
Harrison.—3,600 tons of the coals submitted, at 1[illegible]s. 7d. [illegible]

G.P.O.—The tender of the Edison & Swan Co. for a six months supply of "Royal Ediswan" (tungsten) drawn-wire lamps has been accepted.

The tender of the Alpha Manufacturing Co. has been accepted by the Metropolitan Asylums Board, at £32, for installing electric radiators at the head office, Embankment, E.C.

Lowestoft.—The E.L. Committee recommends the acceptance of the tender of Messrs. Bradbury, Son & Co., Ltd., for the supply of 500 tons of coal, at 19s. 2d. per ton; also that of Messrs. Kaye, Son & Harper for 2,000 tons, at 19s. per ton.

Manchester.—The Corporation has placed an order with Messrs. Ed. Bennis & Co., Ltd., for four complete chain-grate stokers, each 8 ft. by 14 ft., for the new B. & W. boilers recently installed in the electricity station.

Meter Contracts.—The Stoke-on-Trent Council has placed a portion of its contract for D.C. meters for 12 months with the Electrical Apparatus Co., Ltd. Messrs. Chamberlain and Hookham, Ltd., have also received a contract from Stoke-on-Trent for meters for the coming year.

Salford.—The T.C. has accepted the offer of the British Westinghouse Co. for a 5,000-KW. turbo-alternator at the electricity station, Frederick Road, for £16,200. At a special meeting held on Wednesday it was stated that last October the Council authorised the acceptance of an offer of a 5,000-KW. turbo-alternator from a Rugby firm, but the latter had since intimated their inability to complete the contract in time for next winter's load. It was necessary that plant should be obtained, and that was why the present proposal was made.

Southend-on-Sea.—In reference to the tender recently accepted by the Council for an overhead travelling crane required for the new sub-station, the contractors having stated that they are unable now to supply these cranes at the amount of their tender, the Committee has decided that only the one crane required at the Leigh sub-station be purchased at the present time. The tender of Messrs. F. Carrick & Sons, at £167, is to be accepted. The Corporation is recommended by the Light Railways Committee to accept the tender of Messrs. Edward Le Bas for a half mile of overhead trolley wire, at 11[illegible]d. per pound.

Swansea.—The tender of the British Westinghouse Electric and Manufacturing Co., Ltd., has been accepted by the Electricity Supply Committee for a 250-KW. rotary converter, transformer and switchgear, at £970.

The offer of Messrs. J. R. Davies & Co. to supply coal to the electricity station at 20s. [illegible]d. per ton, for a period of [illegible] months has been accepted.

Wolverhampton.—The T.C. has accepted the following tenders:—

Underfeed Stoker Co., Ltd.—[illegible]
[illegible] Ltd.—Fuel for the electricity works.
Brerton & C[illegible]

FORTHCOMING EVENTS.

Incorporated Municipal Electrical Association.—[illegible]

North of England Institute of Mining and Mechanical Engineers.—[illegible]

Physical Society.—[illegible] by Sir J. J. Thomson [illegible]

REVIEWS.

Electric Mine Signalling Installations. By G. W. L. Paterson. London: Constable & Co. Price 4s. 6d. net.

The author's aim is to provide a book useful to practical men engaged in mine signalling work. Bearing this in mind, we believe he has devoted too much space to very elementary matter and not enough to types of apparatus, their installation and maintenance. Nothing is said concerning the avoidance and treatment of "troubles," but these topics are of prime importance to the practical worker. The first half of the book might profitably be condensed, leaving more space available for the treatment of complete signalling circuits and equipment. In Chapter II, the internal construction of the enclosed ringing keys and tappers should be illustrated in the interests of students or beginners, to whom this and the following chapters will chiefly appeal. The action of bells, signal alarms and relays is described very fully in Chapter III, which is admirably illustrated. The average colliery electrician can hardly need such detailed treatment of this elementary topic, and would surely prefer to see more space given to the special methods, problems, and apparatus of mine signalling. Some of the indicators mentioned in the earlier pages of Chapter IV cannot be considered suitable for present-day use, and the description of some of the more modern types should be amplified. Chapter V dealing with electric generators, transformers, rectifiers, and accumulators for mine signalling circuits is very satisfactory, but the next chapter, on primary cells, occupies 29 pages and should be shortened considerably, particularly since the use of these cells is becoming less common in up-to-date installations. In Chapter VII the author describes and illustrates clearly the different arrangements of signalling circuits available, but does not sufficiently emphasise the fact that visual shaft signalling is now compulsory in this country. The rule on this point is given in the appendix, but its effect in restricting the choice of apparatus is overlooked. Several very reliable signalling systems complying with the latest rules are not mentioned. The chapter on engine plane signalling is very useful, as, too, are those on shaft and engine plane signal wiring. The collection of English and American Rules in the appendix, and of symbols for mining map circuits, &c., deserves mention. The production and indexing of the book are excellent, and by curtailing the elementary sections and amplifying those of more "special" nature, the author could easily convert this into a manual indispensable to the colliery electrician. At present the book is rather dear.

Model Answers to Test Questions in Wireless Telegraphy. Series 1 and 2. London: The Wireless Press. Price 1s. each set (net).

Series 1.—This little book of answers is a thorough and painstaking attempt to get the very best out of the series of test cards that we reviewed in our issue of January 8th.

The answers are very full, and although a little conversational in places, there can certainly be no better answer to the question: "What happens when a piece of rubbed sealing wax is brought near some small pieces of paper?" than "Try for yourself; you may find out something which is not mentioned in any text-book."

The Model Answers to Series 1 naturally suffer on account of the defect noted in the cards, viz., a lack of sequence. This inevitably leads to repetition in the answers, and results in such anomalies as the reference to T and L aerials on page 40, and their description and illustration on page 72. There are also a number of minor errors. π is used instead of λ, and there is a muddle in the variations of the $v = n\lambda$ formula on page 31; "97" should read "96" on page 32, and in the answer to question 102, "frequency proportional to 1 $\sqrt{\text{length}}$" should be "frequency proportional to $1/\sqrt{\text{length}}$." The diagrams are in some cases microscopic. The best answers are those on Changes of Energy, on page 59; Magnetic Detectors, on page 71; and Aerials, on pages 71 to 75.

Series 2.—The answers to this series are insufficiently illustrated; the only section to which this does not apply is that on Aerials. There is too much reference to Hawkhead's Manual for diagrams, and there are futile attempts to describe such apparatus as Wimshurst machines, electroscopes, and cells without the aid of any diagrams at all. The sections on Resistance, &c., and the more technical answers to Cards 22 to 47 are, however, much more satisfactory.

The student who writes conscientious answers to the test questions and then refers to these Model Answers, cannot fail to gain a sound knowledge of wireless telegraphy. At the same time, he will learn how to express himself clearly and scientifically—a by no means small achievement.—P. H. S. K.

NOTES.

Water-Power Utilisation in Sweden.—The annual Year Book of the Swedish Chamber of Commerce in London, just issued, contains an article on the subject of the utilisation of water-power in Sweden. It is based partially on an article by Mr. W. Borgquist, which recently appeared in the *Teknisk Tidskrift*, and partly on a pamphlet issued by the Swedish Water-Power Association.

According to the Swedish Board of Trade statistics, water-power was estimated in 1912 at 60-65 per cent. of the total effective power, but as water-power is used, on an average, for a longer period than steam power, the actual value may be put at 80 per cent. The figures show its importance in the question of power economy in Sweden, and the extent to which the country has made itself independent of imported fuel.

It is only during the last 10 or 15 years that water-power has been brought largely into use, *i.e.*, since the technique of power transmission became more generally known. The newly-established electrochemical and electrothermal industries are practically dependent upon an ample supply of electrical energy generated by water-power. Among the most important power stations in Sweden, from south to north, are the following:—

	H.P.
South Swedish Water Power Co.	27,000
Hemsjo Water Power Co.	10,280
Yngeredsfors Water Power Co.	16,250
Trollhattan (State-owned, to be extended to 110,000-120,000 H.P.)	80,000
Gullspang-Munkfors Water Power Co.	16,950
Guldsmedshytte Co.	6,750
Virsbo-Ramnas Water Power Co.	3,045
Untra Water Power Works (still under construction, belonging to the City of Stockholm) ...	42,000
Alfkarleby Water Power Works (State-owned; to be completed during the present year)	45,000
Horndals Ironworks Co.	8,000
West Dal River Water Power Co.	19,200
Graningeverkens Co.	9,150
Klabbole	4,525
Finnforsen	9,400
Sikfors	5,000
Porjus (State-owned)	50,000

As regards water-power plants erected exclusively for industrial purposes, the following may be mentioned as being amongst the largest:—Uddeholms Co., in Vermalnd Province, about 35,000 H.P.; Stora Kopperbergs Bergslags Co., on the Darlecarlia River, about 50,000 H.P.; Stockholms Superfosfat Co., on the Ljungan River, at Wansbo, about 30,000 H.P.; Alby Waterfalls Co., on the Ringdalsforsen River, and at Alby, about 15,000 H.P.

Among the new plants recently completed and at present in course of erection, it may be mentioned that the first turbine at the Porjus station was started in October last, and during the following month the first ore train was driven through the Lapland fields by electrical energy supplied from the Porjus station. The State-owned Alfkarleby Water Power Works, in the North of Sweden, is rapidly approaching completion, two of the large turbines being ready at the end of the past year. As regards the well-known Trollhattan plant—the largest in the country—the Government last year decided to increase this to the extent of a further 30,000-40,000 H.P.; when the new work now in hand is finished, the water-power utilisation plant in Sweden will represent an aggregate of 915 000 H.P., or approximately 15 per cent. of the total resources of the country. About 2,500,000 H.P. can be obtained from falls in Northern Sweden, which is, however, but sparsely populated. The falls in that part of the country are, therefore, proportionately more expensive to harness than those in Central and South Sweden.

So far as the new plants actually completed in 1914 are concerned, these represent a total of approximately 40,000 H.P., divided as follows:—Iron and mining industries, 15,000 H.P.; timber, wood pulp, and paper trades, 15,000 H.P.; textile industry, 1,000 H.P.; various other industries, 9,000 H.P.

Municipalisation of Electricity Works in Russia.—The *Novoie Vremya*, commenting on the repeated discussions in the Petrograd Town Council respecting the proposed purchase by the town of the electric enterprises, observes that two sittings have already been devoted to this question, and that it still remains in obscurity. A special Committee has considered it, and the opinions of its members are divided. The conclusions of the experts are also divided. Prof. A. V. Wolf believes it advantageous to buy up all three concerns; Engineer M. N. Lovitsky thinks it undesirable to buy out the Belgian company and the former Helios company, because their construction and equipment do not correspond to the level of efficiency reached by the industry at the present time. The best technical installation is that of the 1886 company, and if that is bought out—is it Swiss? Notwithstanding the divergent views of informed and competent authorities, one group is decided on the purchase of all three concerns, and apparently no words of the independent members will move them from their decision, or to make fresh inquiries. Prof. Zagorsky, whom they support, insists on the purchase of all three. According to him, the competition of the town with poorly equipped electrical companies will be unprofitable—not for the companies, but for the town.

The paper quoted says that the inhabitants require cheaper electrical energy, and advantage must be taken of the opportunity, though it would be unprofitable to buy out all three companies. The town should rather extend its own electric station, but this, in the opinion of the present majority of the town Duma, is equivalent to the renunciation of cheap electric power in the coming years. There remains only one issue—to buy the best equipped concern, the 1886 company. The question of the acquisition of this concern may be simplified in the near future. If the mask of Swiss proprietorship be torn from the company and the real enemy, Germany, made to appear, the business of the company can be liquidated and the concern be passed into the possession of the town without compensation.

A note from Moscow says that the management of the 1886 Electric Co. has announced to the Moscow Town Council that the Moscow electric station is working exclusively with petroleum fuel, and requires from 13,000 to 18,000 poods of petroleum residue per day. Such fuel had been bought for 1915, and for a considerable part of 1916, but owing to the existing exceptional position of affairs, when both coal and petroleum are scarce, and even wagons for carrying them, the company fears that it will not receive the necessary quantity of liquid fuel to carry on its business. On the other hand, if the station were to cease the use of oil fuel, at all events, there would be a possibility of more for the other industries in the Moscow district that require such fuel. The memorandum points out that even before the war the Electricity Transfer Co., in which the 1886 company is interested, began to work the peat deposits of the Bogorod district in the Moscow Government, and built there a central electric station which, amongst other objects, was intended to supply power for Moscow produced from peat. Up to the present time the company has spent 11,000,000 roubles on its plant, and is exploiting the peat reserves on a large scale.

The supply of Moscow with electric power, generated by means of peat fuel, is both of local and Imperial interest, and the effect of it should be to reduce the price of fuel in the Moscow district. This delivery of energy into Moscow from peat should be of particular importance at present in relieving the pressure on the railways, and the appearance of cheap energy in the district in such a convenient form as electric power delivered by conductors without any call on the railways, must correspondingly further the interests of the Moscow industries and residents.

Hitherto the Moscow Government has contested the right of the company to use current generated from the Bogorod peat for Moscow, because the agreement between the town and the 1886 company does not provide for the purchase of energy from outside. And although the company takes its stand on another point of view—that what the contract does not prohibit may be permitted—it is observed that until the Moscow market had experienced an extreme scarcity of fuel or great difficulties in its conveyance, the company abstained from using electricity generated from the Bogorod peat, but carried out experiments with the object of learning the technical possibility of transmitting current over a distance of 75 versts to the Moscow cable system. The crisis that has arisen in coal, petroleum, and wagons, constrains the management of the company to raise afresh the question of the use of energy generated from the peat of the Moscow district.

The request referred to has met with resolute opposition in the Moscow Town Council. The chief of the town, M. N. Chelnokoff, making use of the company's declaration of its difficulties, agitated once more for the transfer of the station to the control of the town, which he believes is capable of ensuring its uninterrupted working.

Water-Power in New Zealand.—The New Zealand Official Year Book for 1914 contains the following particulars of the water-power available throughout the Dominion. The Public Works Act of 1908 vests the sole right to use the water-power of the Dominion in the Crown, subject to existing rights. The right in the case of local authorities is issued free of royalty, and in the case of private individuals, subject to a royalty of $\frac{1}{5}$d. per unit generated.

A large and comprehensive scheme is now under consideration for the supply of electrical energy in the North Island, with the object of making it generally available, as far as possible, to all the towns and districts throughout the Island, and it is anticipated that advantage will be taken of the facilities offered to work the railways by electricity, and to promote a system of light railways throughout the country districts now suffering from lack of communication because of the difficulty of obtaining stone for surfacing the roads. In all there are 24 different sources of power in the North Island and 48 in the South Island.

The following table shows the actual horse-power in use in the various districts in 1913:—

	1913.
Auckland	13,640
Hawke's Bay	—
Taranaki	2,782
Wellington	389
Marlborough	202
Nelson	[illegible]
Westland	3,662
Canterbury	1,167
Otago	10,617
Southland	1.817
Total	31,956

An analysis of the purposes for which this water-power was employed on July 31st, 1914, shows:—Mining, 3,159 H.P.; electricity supply, 25,989 H.P.; flax mills, 511 H.P.; saw mills, 262 H.P.; flour mills, 412 H.P.; dairying, 783 H.P.; construction work, 721 H.P.; freezing works, 1,200 H.P.; paper mills, 465 H.P.; miscellaneous, 1,454 H.P. Of the 34,956 H.P. of water-power now in use, 11,963 H.P. is distributed electrically for public supply from 13 power stations, eight operated by local authorities, one (Rotorua) by the Government tourist department, three (Stratford, Hawera, and Reefton) by private companies, and one by a private individual.

The details of these installations are:—Dunedin—C.C., 9,000 H.P.; Rotorua—380 H.P.; Hawera—E.L. Co., 400 H.P.; Stratford—E.L. Co., 150 H.P.; New Plymouth—B.C., 1,020 H.P.; Inglewood—B.C., 200 H.P.; Patea—B.C., 200 H.P.; Te Aroha—B.C., 255 H.P.; Akaroa—B.C., 45 H.P.; Taihape—B.C., 133 H.P.; Mangaweka—T.B., 47 H.P.; Brightwater—Private, 53 H.P.; Reefton, E.S. Co., 80 H.P.

The above data include no reference to the Lake Coleridge hydro-electric plant, the first section of which has now been successfully brought into use; ultimately 13,000 H.P. will be developed.—*New Zealand Shipping and Commerce.*

Stowmarket Explosion.—The report of Major A. Cooper-Key, H.M. Chief Inspector of Explosives, on the fatal explosion at a Stowmarket factory on May 10th, gives further particulars with regard to the circumstances. It states:—

"On the morning of the accident cordite M.D. was in course of manufacture. It appears that at the moment of the accident two men in the building were on the point of handing out to two bogie runners the bags of cordite paste for removal to the hand-mixing house. Before being placed on the bogie the bags are wiped down to get rid of the gun-cotton dust, and also to remove to some extent the water from the bottom of the bags due to their having been standing on a wet floor. In order to avoid the use of a loose implement of any kind this operation was done by hand, and not with a brush. It was a fine, dry, cold morning, and the two men in the building were wearing stout rubber overshoes, which would completely insulate them from electric contact with 'earth.' The bags were of rubber-impregnated canvas, a marked dielectric, and in the case at any rate of a man with a naturally dry skin the operation of wiping the bags would undoubtedly have the effect of generating in his person a statical charge of electricity which might well be sufficient to cause a spark to pass as soon as he should happen to 'earth' himself by touching an uninsulated article.

"This may perhaps appear at first sight to be a somewhat far-fetched explanation of the accident, but I am convinced it is the true one. Mr. Duff Grant, the managing director of the New Explosives Co., told me that when on a visit to Canada, where, with the temperature below zero, the air is frequently practically free from moisture, he proved by personal trial that by rubbing the feet on a thick pile carpet the gas could be lit by a spark from the end of the finger, and this not occasionally, but every time. When I mentioned this to the Messrs. Dupré they said that their brother, who has been in Canada for some time, told them that on cold, dry days it was a favourite joke at five o'clock tea parties to shuffle the feet on the carpet before handing a plate of sandwiches, with the result that the person helping himself would receive quite a considerable electric shock."

A case is also mentioned relating to a factory at Ardeer, where a workman wearing rubber shoes fired acetone vapour by a spark from his finger after merely allowing the thin strands of rifle cordite to pass over his hand.

It seems, therefore, that the Inspector's theory is well within the bounds of probability, though at first sight it might appear inadequate. The best safeguard apparently against such accidents would be the thorough ventilation of all buildings to prevent the accumulation of explosive mixtures of gas and air.

Magnetic Elements.—The report of the Astronomer-Royal shows that the mean values of the magnetic elements at Greenwich for 1914 were as follows:—Declination W. 15° 6·3′; horizontal force, [illegible] C.G.S. units; dip 66° [illegible].

Patents and Alien Enemies.—The Board of Trade has granted licences to G. H. Wilson, of the Manchester Armature Repair Co., in respect of patents Nos. 10,457/06, 2,711/10, 20,634/10, 9,941/11 and 27,651/12.

Coal Supplies.—A deputation representing the gas and electrical interests attended at the House of Commons on Wednesday, June 9th, and laid before a meeting consisting of about 200 Members of Parliament the serious difficulties which they were experiencing owing to the shortage of coal. Lord Claud Hamilton presided, and the speakers were Sir Corbet Woodall, Sir John Snell, Alderman Kay, Mr. F. Bailey, Dr. Charles Carpenter, Bailie Irwin, and Bailie W. B. Smith.

Attention was drawn by the various speakers to the seriousness of the shortage, which was due to several causes, among which was mentioned particularly the enlistment in the Army and Navy of a large number of miners. In addition, it was pointed out that a large proportion of coal was sent abroad, but a Committee had been appointed by the Government for dealing with the export of coal, and the effect of the work it had done was already apparent.

The question of the all-round necessity and utility of gas and electricity was urged at length. It was also pointed out that a number of gas and electricity undertakings had so adapted their plant that they were producing materials of vital importance to the Government, and, furthermore, that the residuals were necessary to a great variety of important industries. One large London gas company could increase their supply of these by-products by some 40 per cent. by using coal instead of oil for their gas production, and it was suggested that if the Government realised the importance of this aspect of the question they would help gas undertakings in every way to obtain supplies of coal.

Generally speaking, it was an absolute impossibility to take in sufficient coal during the winter for the winter's requirements, and therefore a large stock had to be accumulated during the summer months when the demand was not so heavy. This year it had, so far, been impossible to carry out this system, and if the stocks were not made up by the middle of October the public undertakings would be unable to continue their supply through the coming winter.

Various means of improving matters were suggested, amongst which were mentioned a limitation of further recruiting of miners, a suspension of the operation of the Eight Hours Day Act in respect of collieries in order to increase the actual output of coal, the fixing of a maximum rate of freight for all interned vessels, further facilities generally for the transport of coal, and a continued limitation of the export of coal. Finally, it was urged that if Members representing mining districts could induce their constituents to work full time, a large part of the difficulty of shortage would be overcome.

The meeting was adjourned till Tuesday last, when a committee was formed to consider the subject, and to formulate recommendations which should be laid before a later meeting. The Committee consists of 12 members, representing the coal-owners, the workmen, the great consumers, and the ship-owners:—

Colliery proprietors.—Sir Arthur B. Markham, Sir Alexander Henderson, and the Hon. H. D. McLaren.

Ship-owners.—Sir Walter Runciman, Mr. R. D. Holt, and Mr. R. P. Houston.

Workmen.—The Right Hon. Charles Fenwick, Mr. T. Richards, and Mr. B. Kenyon.

Consumers of coal.—Mr. W. Joynson-Hicks, Sir Daniel Ford Goddard, and Sir Corbet Woodall.

It is hoped that this Committee will be able to submit recommendations to the adjourned conference next Tuesday.

Automatic-Lift Accidents.—A correspondent using the pseudonym "Leeds" writes (too late for inclusion in our "Correspondence" columns):—"Having read with much interest the correspondence of the last few weeks under the above heading, especially the letter of Messrs. Smith, Major & Stevens, which implies that the lift will not work with the gate open, that is, no doubt, correct as far as starting the lift is concerned; but once it is started, should a fault develop on the controller (which is not an unknown occurrence), putting the switch-handle back to the off position in the cab, and opening a gate, will not stop the lift. It will continue in the same direction, bring out the 'tappet' switch, and finally come to the end of the lift run, and then blow the fuses. Now, it is possible for a person to jump out as the lift is passing one of the floors, perhaps with fatal results, and I contend that the gate locks do not cut off current in this instance. Is it not possible to wire up first to the gate locks and control the current to the motors?"

Anti-German Riots on the Rand.—Our Johannesburg correspondent, writing on this subject under date May 14th, says:—

It would be foolish not to admit that the great leniency shown to enemy subjects by the South African Government probably had a good deal to do with yesterday's outbreak. The spectacle of Germans growing fat on South African trade, particularly in electrical engineering and its kindred branches, while many South Africans are sacrificing their lives and neglecting their businesses in order to fight the Germans, is an exasperating one. It forms a perpetual source of irritation to the public mind. And it is easily comprehensible that this should be the case. The destruction of business premises may be one method of showing detestation of German methods. It is, however, open to the objection that it may inflict, and in one instance here (*i.e.*, that of Siemens) has unfortunately inflicted, equally serious damage on Britishers, who may be actual owners of the premises. On the 11th inst. some little trouble occurred at the Brakpan power station of the V.F.P. Co. In connection with the construction work at present being carried out at this station, there were 16 men employed by Messrs. Reunert and Lenz besides the fixed staff of the V.F.P. Co. On Saturday last the A.E.G. Co. took on four German workmen. It was a significant fact that after the *Lusitania* tragedy became known, six of the German employés knocked off work at 9.30 p.m. instead of midnight, while the British workmen belonging to Messrs. Reunert and Lenz, and another contractor, named A. Stewart, and the V.F.P. Co. completed their full shifts.

It is shrewdly suspected that the Germans left off work in order to celebrate the "most brilliant achievement" of their Navy.

The following evening the British workmen held a "council of war" and resolved that if the Germans still retained their jobs, they would refuse to go on shift. Eventually the whole of the German workmen were dismissed.

As previously mentioned, the Johannesburg branch of Messrs. Siemens, Ltd., was burnt to the ground by the rioters, notwithstanding the fact that the firm is a British one. It is true that before the war the Johannesburg firm of Siemens, Ltd., were the agents for the German firms of Siemens-Schuckert and Siemens Halske, and this probably was the immediate cause of the trouble. The members of the staff of Siemens, Ltd., published in the *Star* a protest against the damage done to the premises of a British firm.

The store of the A.E.G. Co., situated in the "City and Suburban" township, was attacked later and formed a centre of interest for some considerable time. Entering the yard, men and youths started operations by smashing up the doors and windows in a very complete manner. The building, of wood and corrugated iron, was next invaded, and fires were started at several points.

The stock, with petrol, &c., was of a most inflammable description, and the building was soon in full glow. Prior to this lamps were taken from the store and flung against the wall, causing miniature explosions, which afforded much entertainment to the crowd. Here it was useless to think of saving the premises, and they were entirely gutted, although it took a considerable time completely to destroy the buildings.

Russia.—H.M. Consul at Batoum, in a report to appear shortly, says:—"The trade in electrical machinery had very largely, if not entirely, fallen into German hands, but the activity recently exhibited by United Kingdom manufacturers should succeed in gaining a part of the trade for British-made goods."

Electrical Incubator Tests.—*The Aberdeen Daily Journal* mentions that the Poultry Department of the North of Scotland College of Agriculture has recently carried out tests with an electrical incubator and hover (or foster mother), which was supplied by Mr. M. K. Cooper, of Messrs. T. C. Smith & Co., Aberdeen. This incubator—of 50-egg capacity—is fitted with a patent thermostat for regulating the temperature and four 32-C.P. lamps; the hover is fitted with two 32-C.P. lamps. Both are of galvanised metal throughout and simple in construction. In one test 31 chickens were hatched out of 40 fertile eggs, and in another 36 out of 39 fertile eggs. These results are equivalent to 77 and 92 per cent. respectively of chickens hatched from fertile eggs, which represent a comparatively high percentage for artificially hatched chickens. The effectiveness of the hover can be judged from the fact that 65 chicks were reared out of 67; it provides an even distribution of heat, preventing overcrowding of the chickens. To hatch and rear each lot of chickens 41 units were required (at 1d. per unit, cost 3s. 5d.). The raising of numbers of early spring chickens can only be done successfully by artificial incubation.

Educational.—Sir Philip Magnus was recently entertained at dinner by the Association of Technical Institutions, and was presented with an address on the occasion of his retirement from the active direction of the Department of Technology of the City and Guilds of London Institute, after 35 years' service.

The Mobilisation of Science.—The following question was put to the President of the Board of Education and answered on Wednesday, after we had closed our leading columns, in which we refer to this subject:—

Mr. Joseph Pease.—To ask the President of the Board of Education whether he proposes to carry out the scheme recently outlined for the development of research work and the better application of science to industry; and, if so, when will he be in a position to announce the names of the advisory council.

Mr. Arthur Henderson.—I certainly hope to carry out the scheme initiated by my right hon. friend, and I hope to be in a position to announce the names shortly.

Fatalities.—NEWCASTLE.—Two men were killed by electric shock, late on Friday night, at the works of Messrs. Armstrong, Whitworth & Co. A worker, named Thomas Harrison, died immediately; another, named Edward Babbs, did not get the full force of the current, but he died while being removed to the infirmary. Three other men were seriously injured by electric shocks. The workmen were engaged in the electrical department of the works. The inquest was formally opened on the 12th, and adjourned until June 23rd.

LONDON.—At an inquest held into the cause of death of a carman named Rocca, whose van skidded on an L.C.C. tramline while he was driving along Vauxhall Bridge Road, the police evidence showed that the tramrail was in an exceedingly bad condition, being worn away about an inch. The jury, in returning a verdict of "Accidental death," said that the L.C.C. was guilty of negligence in not keeping the line in proper condition.

ALDERSHOT.—An inquest was held by Mr. J. T. Coggins, Deputy Coroner, at Aldershot, on Saturday, on William Sutherland, 40, of Blyth, Northumberland, electrical wireman, employed by Messrs. Saunders & Co., York Street, London, electrical engineers, who died in the hospital on June 10th from injuries received in an accident at Pirbright Camp on June 7th.

The Coroner explained that deceased was carrying out certain work in connection with high-tension wires at the Camp. He was fixing cradles underneath the wires, to reach which he had to use a ladder. The wires were naked, but before any workman commenced performing such duties as those of the deceased, the foreman of the job would telephone through to the power station at Aldershot Camp and get the current cut off. The man might then proceed with the work in safety. It was thought that in some way or other deceased must have touched the wire, for he seemed suddenly to spring or throw himself away from the ladder and fall to the ground.

Charles Williams, foreman of the works, said deceased was working at a height of 26 ft., and the wire would be about 6 in. from the cradles underneath. Their instructions were not to proceed with the work until the current was switched off.

Asked whether he took any steps to let the man know that he had not got through, witness replied that he came out of the call box and put up his hands to show that he could not get through. When he put his hands up it meant stop.

Charles Payne said deceased had definite instructions not to proceed with the work until the current was switched off, and William Fisher, supervising engineer, also gave evidence as to the instructions.

Lieut. A. Ferguson, R.A.M.C., said the cause of death was fracture of the base of the skull. In reply to the Coroner, Witness said he should expect a man who had received an electric shock to be burnt, but he found no signs of such injury. Had deceased received a severe shock he would have been killed on the spot. The Coroner said the voltage was 3,000, but there was no real evidence that deceased touched the wire. It was possible that he might have received a slight shock which caused him to fall from the ladder. The jury returned a verdict that deceased died as the result of fracture of the base of the skull sustained by falling from a ladder.

Volunteer Notes. — ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—On the suggestion of General Sir O'Moore Creagh, V.C., G.C.B., G.C.S.I., an Engineer Volunteer Corps has been raised from members of the engineering profession who are either above military age, or who, being of military age, are prevented by some good reason from serving in the Regular Forces.

The objects of the Corps are :—

1. To train men of military age and to make them useful Royal Engineer recruits if, and when, they are able to enlist.

2. To furnish Engineer units to assist in the completion of the Volunteer organisation.

3. To organise the Corps so that the maximum advantage may be taken of the specialised engineering skill of its members at the earliest possible moment.

Drill takes place through the kindness of Colonel le Rossignol and the officers of the London Electrical Engineers Corps at the Drill Hall, 46, Regency Street, Westminster. The training will be similar to that of the London Electrical Engineering Corps.

Although the first drill only took place on the 2nd inst., already 130 members are enrolled. Membership is not restricted to members of the Engineering Institutions, and application should be made to the Commandant, Lieut.-Colonel C. B. Clay, V.D., at Marconi House, Strand, W.C.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion orders, by Colonel S. G. Grant (Officer Commanding), Thursday, June 17th, 1915.

465. WEEK-END PARADES.

Saturday.—"A" and "B" Companies will parade with North London Platoon at Enfield Railway Station (G.N.R.) at 2.30 p.m. sharp. Train from King's Cross Local (G.N.R.) at 1.41 p.m. Route march, and inter-company Shooting Competition at Enfield Rifle Club.
Order No. 456, in so far as it relates to "C" and "D" Companies, is cancelled. "C" and "D" Companies will parade at Baker Street Met. Station at 2.30 p.m., and proceed by train to Wembley Park.

Sunday.—6 a.m. Reveille.
10 a.m. Church Parade.
10.20 a.m. Battalion Parade.
2.15 p.m. Battalion Parade under Commandant.

467.—ENTRENCHING.—Men who have given in their names for above duty will parade each day at Liverpool Street Station (G.E.R. Low-Level Entrance), at 8.45 a.m.

For names of men detailed for each day see lists posted at headquarters and at Wembley Park. Uniform will be worn. Arms will not be carried. Men will provide their own rations.

A. J. JOINER, *Captain and Adjutant.*

Appointments Vacant.—Shift engineer (£2 15s.), for Fulham electricity department; teacher of Electrical Calculations and Drawing for Wiremen's Classes (10s, 6d. per evening), for Middlesex Education Committee; switchboard attendant for Middlesbrough Corporation; assistant engineer and car-shed superintendent, for Sunderland District Electric Tramways, Ltd.; switchboard attendant for Torquay Electricity Department; works fitter (£2 10s.) for Rhondda U.D.C. Electricity and Destructor Works. Particulars are given in our advertisement pages.

Late Legal.—RICKMAN v. F. W. BERK & CO., LTD.—In the Lord Mayor's Court on Tuesday, before Assistant Judge Jackson and a jury, a claim was made by Thomas Rickman, yardman in the employ of the Electrical Power Storage Co., Ltd., against F. W. Berk & Co., Ltd., manufacturing chemists, of Fenchurch Avenue, E.C., for damages for personal injuries suffered owing to the alleged negligence of the defendants or their servants. Mr. Lever was counsel for the plaintiff, and Mr. Craig Henderson represented the defendants.

Counsel for the plaintiff said his client was employed by the Electrical Power Storage Co. at Millwall. His duties were to look after the yard. On February 11th the defendants sent a load of 20 carboys of sulphuric acid. The carboys were extremely dangerous to handle, and in order to protect persons handling them the mouths of the carboys were sealed with an earthenware stopper and were fixed into the neck of the carboy with plaster of paris. Upon the arrival of the vanload of carboys, the plaintiff and another man went to assist in the unloading. The carboys weighed about 2 cwt. each. A sort of chute was used to unload the carboys from the tailboard of the van. When about half the carboys had been delivered, one was brought forward to the slightly sloping chute. This caused the acid in the carboy to splash up against the stopper, which, if it had been properly sealed in, would have prevented the liquid coming through. Some of the corrosive liquid in splashing against the stopper came through a hole between the stopper and the glass carboy, and splashed on to the plaintiff's face, nose, cheeks and chin. His burns were treated at Poplar Hospital, and from there he was sent to the London Hospital. The plaintiff was unable to continue his work for six weeks, and was during that time attending the Hospital as an out-patient. He had suffered a painful injury, and he now claimed compensation.

The Plaintiff, in his evidence, said that during the six weeks he was attending the hospital he had no wages. He had, however, received loans amounting to £3 10s., for which he gave I.O.U.'s. His standing wage before the accident was 28s. a week. On the day after the accident the wages of workpeople were increased.

Medical evidence having been given, it was stated for the defence that the liability of the defendants was completed when the carboy was put upon the tailboard of the van. As a matter of indulgence, the carman might give a little assistance by putting it on the top of the chute. When the carboys left the defendants' factory they were acid-tight, and had there been any fissure between the stopper and the neck of the carboy the liquid must have splashed on to the carman while he was trundling the carboy along the van to the tailboard. It was while getting the next carboy that the carman heard a shout as though someone was in pain. Upon the carman turning there was a carboy on the ground, and a piece of plaster of paris which was on the neck of the carboy had broken away. Evidence was called by the defendants to show that in loading and unloading carboys they were handled vertically, and whether containing concentrated acid or dilute acid the stoppering was the same. There was a custom of using a leaden cup over the carboy in order to save any accident in case anything went wrong with the stoppers.

The jury returned a verdict for the plaintiff, awarding him £34 12s. damages, and judgment was entered accordingly, with costs.

Trading with "Neutrals."—Since our leading pages went to press the Board of Trade has issued the following warning with regard to trading with the enemy :—

"The Board of Trade direct the particular attention of all manufacturers and traders concerned in the export trade to the need for scrupulous care in the transaction of their business abroad. The Government's reprisals policy, formally announced by the Order in Council of March 11th, 1915, is directed to suppress all enemy trade, whether import or export. The main difficulty in making this policy thoroughly effective arises from the fact that some traders in some neutral countries are making themselves agents for the supply of goods to enemy countries. British firms engaged in foreign trade, therefore, must have regard to these circumstances, and survey with great caution every opening for business which is offered them by neutral importers or exporters.

"Especial care should be taken in opening new accounts in neutral countries, and in relation to any orders or inquiries of an abnormal character. In any case of doubt as to the *bona fides* of particular consignees, business should be suspended pending reference to the Board of Trade. It is unadvisable that any new accounts should be opened by any British trader in neutral countries during the war without the fullest inquiries as to the character of the business proposed to him.

"The Board feel sure that they can rely upon the cordial co-operation of all firms engaged in foreign business to secure the successful working of the reprisals policy.

"It must be added that the proclamations relating to trading with the enemy cover indirect trading with the enemy through neutral agents, and that carelessness in transacting neutral business may involve traders in the severe penalties attaching to trading with the enemy."

It will be noticed that this warning relates mainly to the supply of goods to neutral firms; but the placing of large orders abroad, to which we drew attention, is of at least equal importance, for it may result in providing the enemy with funds.

Inquiries.—Makers of celluloid accumulator boxes and [illegible] covers for switches are asked for

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Electricity Committee of the Woolwich Borough Council has granted permission to MR. H. WOODWARD, general assistant, to enlist, and he has joined the Army Ordnance Corps. Owing to the nature of his work permission to enlist has been refused to MR. E. ANDERSON, assistant engineer at Plumstead Works.

The Barrow-in-Furness T.C. has, by 18 votes to 8, rejected a recommendation by the Electricity Committee that an honorarium of £100 should be granted to the electrical engineer (MR. BURNETT), in recognition of extra services rendered during the past two years. A member suggested that the honorarium was proposed because the Council had rejected a motion to increase Mr. Burnett's salary.

MR. S. CAMERON GIBSON, borough electrical engineer, Nuneaton, has accepted an appointment as Lieutenant Commander R.N.V.R., to take up special duties. MR. H. HODGES has been appointed acting electrical engineer during his absence.

The Walsall Electricity Committee proposes to increase the salary of MR. A. PRENTICE, the station superintendent, from £225 to £250 per annum, and that of MR. C. W. COOKSON, the accountant and collector, by £13 per annum.

With reference to the first item appearing in this section last week, we learn that the statement that MR. JEWELL, mains superintendent, had severed his connection with the undertaking of the Woking Electric Supply Co., Ltd., is incorrect.

Tramway Officials.—The staff of the Northampton Corporation tramways have presented MR. G. H. MARGRAVE, the chief clerk, who has left to take up another appointment, with a marble clock. The presentation was made by the general manager, Mr. J. F. Cameron.

General.—MR. SAMUEL CHARLES LAWS, B.Sc., M.A., Principal of the Loughborough Technical Institute, who has just been appointed to the principalship of the Wigan Mining and Technical College, entered St. John's College, Cambridge, in 1901, in order to carry on electrical research in the Cavendish Laboratory. For his work there he was awarded the Special Certificate for Distinguished Research and the University (M.A.) Degree. He contributed a number of papers embodying the results of original researches, most of which were connected with the modern electron theory of the conduction of electricity in metals.

MR. J. G GRIFFIN, general manager of the Delhi Electric Tramways and Lighting Co., Ltd., is home on short leave. His address is Basildon House, Moorgate Street, E.C.

On the occasion of their silver wedding, MR. and MRS. F. H. TAYLOR, of Catford, S.E., have been presented by the directors of the General Electric Co.. Ltd., with which Mr. Taylor is associated, with a set of silver *entrée* dishes.

MR. JOHN M. M. MUNRO, of Glasgow, has also opened a consulting office at 11, Randolph Place, Edinburgh.

Obituary.—The death has occurred of MR. C. BONNETT, A.M.I.E.E., in hospital in Bombay, of smallpox, on May 8th. He has been in India over 13 years, most of the time in the employment of Messrs. Osler, and principally engaged on their Kabul work. He was a *persona grata* with the Amir, who keenly appreciated his good work there. Our Indian correspondent writes :— "Outside his engineering work in Bombay Mr. Bonnett was known as a charitable worker among the poor and needy, who will seriously feel his sad loss. He was an honest man, of sterling qualities, who leaves a blameless record behind and a good example for others to follow."

The death is announced of MR. FREDERICK LOWE, who had for the past 27 years been with Messrs. Page & Miles, Ltd., electrical engineers, of Brighton. He was 52 years of age.

The death from pneumonia is announced of MR. CHARLES EDWARD HOARE, of Rickmansworth, for many years electrician on the staff of the Metropolitan and Great Central Railway Co. He was in his forty-second year.

NEW COMPANIES REGISTERED.

Fuller's Wire and Cable Co., Ltd. (140,633).—This company was registered on June 11th, with a capital of £25,000 in £1 shares, to carry on the business of makers of telegraph, telephone and electric wires, cables and appliances, drawers, workers and weavers of wires, manufacturers of ropes, cords, twines, cables and hawsers, manufacturers and workers of indiarubber, rubber goods and fabrics, vulcanite, ebonite and similar commodities for medical, motor-car, sport, household and commercial purposes, mechanical and electrical engineers, etc. The subscribers (with one share each) are: G. Fuller, Elm Croft, Hulton, Essex, electrical engineer; G. J. A. Fuller, Badwell Cottage, Draycot Road, Wanstead, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are G. Fuller, G. J. A. Fuller, L. Fuller, and F. J. Gordon. Remuneration, £100 each per annum (chairman £150). Secretary (*pro tem.*): [illegible] Registered office: Woodland Works, Wick Lane, Old Ford [illegible]

Buttevant Electric Co., Ltd. (4,252).—This company was registered in Dublin on June 11th, with a capital of £800 in £1 shares, to carry on at Buttevant and elsewhere the business of an electric light and power company. The subscribers are: C. G. Crofts, Velvetstown, Buttevant, Co. Cork, 240 shares; S. E. Crofts, Buttevant, Co. Cork, electrical engineer, 100 shares; S. Nolan, 2, Anglesea Terrace, Cork, electrical engineer, 230 shares; E. Nolan, Victoria Avenue, Old Blackrock Road, Cork, 230 shares. Private company. The number of directors is not to be less than three or more than five; the first are C. G. Crofts, S. E. Crofts, and S. Nolan. Qualification, £50. Registered office: Buttevant, Co. Cork.

H. Garstang, Ltd. (140,580).—This company was registered on June 7th, with a capital of £2,000 in £1 shares, to take over the business of an electrical and motor engineer carried on by H. Garstang at Mincing Lane and St. Peter Street, Blackburn. The subscribers (with 100 shares each) are: H. Garstang, Mincing Lane and St. Peter Street, Blackburn, electrical and motor engineer; Mrs. M. E. Garstang, Mincing Lane and St. Peter Street, Blackburn. Private company. The number of directors is not to be less than two or more than five; the first are H. Garstang and Mrs. M. E. Garstang (both permanent). Qualification 100 shares. Remuneration as fixed by the company. Solicitor: C. W. Eastwood, 13, Richmond Terrace, Blackburn. Secretary: H. Garstang. Registered office: Mincing Lane, Blackburn.

Barraclough Brothers, Ltd. (140,589).—This company was registered on June 8th, with a capital of £3,000 in £1 shares, to take over the business of electrical engineers recently carried on by Reside & Co., Ltd., at Perseverance Mills, Brighouse, Yorks., and elsewhere, to carry on the same and the business of mechanical and motor engineers, millwrights, tool makers, ironmongers and general merchants, etc., and to adopt an agreement with W. H. Sayers. The subscribers (with one share each) are: W. Barraclough, Eastcliffe, Lightcliffe, electrical engineer; F. Barraclough, Highfield Avenue, Bailiffe Bridge, electrical engineer. Private company. The first directors are W. Barraclough and F. Barraclough. Qualification, 100 shares. Solicitors: B. H. Richardson, 22, Briggate, Brighouse.

Free Wire Light Co., Ltd. (140,578).—This company was registered on June 7th, with a capital of £1,000 in £10 shares, to carry on the business of wiring houses of intending consumers of electric light with the necessary cables, wires, lamps, fittings and appliances, etc.. The subscribers (with one share each) are: F. R. Reeves, Salisbury House, London Wall, E.C., accountant; J. N. A. Houblon, Artillery Mansions, S.W., engineer. Private company. The number of directors is not to be less than two or more than six; the first are F. R. Reeves, J. N. A. Houblon, and E. Reeves. Solicitor: S. H. Brown, 2 & 5, West Street, Finsbury Circus, E.C. Registered office: Salisbury House, London Wall, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Birkdale District Electric Supply Co., Ltd. (70,259).—Capital £50,000 in £5 shares. Return dated May 17th, 1915. 9,200 shares taken up; £5 per share called up on 6,000 and £3 per share on 3,200 shares; £39,600 paid. Mortgages and charges at date of return, £3,000; since issued (May 18th, 1915), £3,000 debs. ranking equally with first £3,000.

British Mica Co., Ltd. (72,187).—Capital, £5,000 in £1 shares (2,000 pref.). Return dated March 18th, 1915. 629 pref. and 2,000 ord. shares taken up, £1 per share called up on 629 pref.; £629 paid; £2,000 considered as paid on 2,000 ord. shares. Mortgages and charges: Nil.

Altrincham Electric Supply, Ltd.—Particulars of £50,000 debentures, created by resolutions of June 7th, 1898, April 18th and October 3rd, 1912, and May 31st, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £3,200. Property charged: The company's undertaking and property, present and future. No trustees.

Atlas Carbon and Battery, Co., Ltd. (34,857).—Capital, £2,000 in £1 shares. Return dated December 29th, 1914 (filed March 26th, 1915). All shares taken up; £8 paid, £1,992 considered as paid. Mortgages and charges: £3,000.

Bastian Meter Co., Ltd. (53,304).—Capital £20,235 10s., in 3,000 pref. shares of £1 each and 68,942 ord. shares of 5s. each. Return dated March 11th, 1915. 2,011 pref. and 39,672 ord. shares taken up; 5s. per share called up on 4,272 ord. and £1 per share on 2,011 pref., £3,082 10s. paid, including £3 10s. paid on 14 shares forfeited; £8,850 considered as paid on 35,400 ord. shares. Mortgages and charges: £1,450.

Beck and Moss, Ltd. (69,298).—Capital, £2,500 in £1 shares. Return dated March 13th, 1915. All shares taken up; £1 per share called up on 525, £525 paid, £1,975 considered as paid on the remainder. Mortgages and charges: £250.

Navaltum, Ltd.—Particulars of £5,600 debentures, created March 22nd, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £5,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees. A memorandum of satisfaction in full on May 22nd, 1915, of debentures dated May 8th and July 3rd, 1914, securing £900, has also been notified.

Carville Site and Power Co., Ltd.—Issue on May 28th, 1915, of £10,000 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Globe Telegraph and Trust Co., Ltd.

THE net revenue for the year ended May, 1915, after deduction of expenses, amounts to £209,165, and makes, with £25,724, brought forward, a total of £234,888. From this there has been distributed £129,122, in interim dividends, leaving £105,766. The directors now recommend final dividends of 3s. on the preference and 6s. on the ordinary, bringing up the total distributions in both cases to 6 per cent. per annum. There then remains £27,655 to be carried forward.

During the year £11,200 Anglo-American Telegraph Company's preferred stock has been sold, and the proceeds have been re-invested in shares of the Great Northern Telegraph Co. and Direct Spanish Telegraph Co. Seventeen certificates of the Submarine Cables Trust, belonging to this company, have been drawn and paid off at £120 per certificate, producing £2,040; most of this has already been re-invested, and the remainder will be placed in suitable securities.

German-Netherlands Telegraph Co.

The report for 1914 of the Deutsch-Niederlandische Telegraphen Gesellschaft, of Cologne, states that the cable station at Yap was placed under the Imperial District Board on August 1st, and the working of the Menado station was taken over by the Netherlands Indian Government two days later, the company's Dutch officials continuing the cable service. On October 7th the island of Yap was occupied by the Japanese, and from that time the company's cable service had to be entirely suspended. The cables, as shown by recent tests, are in good condition. The officials were first conveyed to Nagasaki by the Japanese, but were released after a few days; the German officials are now at Shanghai, whilst the oldest Dutch telegraphist was permitted by the Japanese to remain with a German superior official at Yap to look after the company's property. The accounts show gross receipts amounting to £102,900, as compared with £103,200 in 1913, interest and balance forward increasing the sums to £108,100 and £108,500 in the two years respectively. After meeting general expenses, the amount of £8,750 has been placed to the cable renewal fund, as in 1913, and £14,000 to the cable maintenance and repairing funds, as against £14,800, leaving net profits of £41,600, as compared with £40,300 in the previous year. A dividend at the rate of 6½ per cent. has been declared on the ordinary share capital of £350,000, being the same as in 1913, and £11,900 has been carried forward. The report adds that the agreement with the Great Northern Telegraph Co., of Copenhagen, for the repair of the company's cables in cases of interruption has been prolonged for a further period of 10 years, as from June 1st, 1915, although the annual payment for the service has been reduced by £3,000.

A Swiss Investment Undertaking.

The Motor, A.G. fur Angewandte Electricitat, of Baden, Switzerland, which is chiefly a holding company belonging to the Brown-Boveri group, reports that the influence of the war on the electrical distribution of power varied according to the geographical situation of the undertakings. On the outbreak of hostilities a large reduction in the consumption of power suddenly took place in general, although a renewed demand soon arose, even in the case of works whose area of supply lies within the war area. The most important event of the year was the disposal of the shares held in the Beznau-Lontsch power works to the North-East Swiss power works, in which nine Swiss cantons are interested. Thus there had passed from the company's possession highly remunerative shares in an undertaking which the company had brought to a great level of development in the course of many years, but the directors had been unwilling to adopt a negative attitude towards the proposals put forward by the cantons. On the other hand, the company acquired 40 per cent. of the shares in the Gustav lignite mines at Dettingen-on-the-Main, in order to provide fuel in connection with a comprehensive extension of the works of the Electric Power Supply Co., of Mannheim, which is financially interested in the local Brown-Boveri Co. After meeting the interest charges on the loan capital of £1,827,000, and apportioning £5,200 to depreciation as against £3,400 in 1913, the accounts of the Motor Co. indicate net profits and balance forward totalling £125,000, as contrasted with £115,000 in the previous year. It has been decided to pay a dividend of 7 per cent. on the ordinary share capital of £1,500,000, being the same rate as in each of the two preceding years, leaving £2,800 to be carried forward, as against £1,500 in 1913.

Italian Electrical Companies.

The Societa Italiana per la Fabbricazione dell' Alluminio, of Rome, in which a group at Rome is interested as well as German capital, reports gross profits of £17,500 in 1914. The sum of £12,000 has been applied to depreciation, and £1,000 placed to the reserve fund, the balance being carried forward. As a consequence no dividend is payable on the share capital, which was reduced in 1911 from £120,000 to £18,000.

The Elettricita Alta Italia, of Turin, with which the Swiss Electrical Industry Co. is associated, reports that the transmission line between Montjovet and Bollenzo was brought into operation in 1914, thus enabling the company to derive full advantage from the hydro-electric works in the Aosta Valley. The net profits, after allocating £38,000 to depreciation, as compared with £36,000 in 1913, amount to £62,000, as against £62,200, thus enabling the payment of a dividend of 5½ per cent. on the ordinary capital of £1,000,000 as in the previous year.

The Officini Elettriche Genovesi, which is connected with the Zurich Bank for Electrical Undertakings and affords a supply in Genoa and neighbouring districts, reports gross profits of £159,000 for 1914. After defraying interest on loan capital amounting to £794,000, and setting aside £40,000 for depreciation, the net profits and balance forward are returned at £89,600, as against £89,200 in 1913. It is intended to distribute 10 per cent. on the ordinary share capital of £800,000, being the same rate as in the preceding year.

The report of the *Unione Italiana Tramways Elettrici, of Genoa*, which is closely associated with the Zurich Bank for Electrical Undertakings, states that the conditions of the new contract with the municipal council came into full operation in 1914 for the first time. After devoting £32,800 to depreciation, as compared with £30,000 in 1913, the accounts show net profits of £70,400, as against £76,000 in the previous year. It is proposed to pay a dividend of 8½ per cent. on the share capital of £720,000, as contrasted with 9½ per cent. in 1913, to place £3,300 to the reserve fund, and to carry forward the balance.

German Electrical Companies.

The Concordia, Elektrizitats Gesellschaft, of Dusseldorf, earned gross profits of £24,800 in 1914, as contrasted with £24,000 in the preceding year, and net profits of £12,300, as against £10,000. It is intended to pay a dividend of 10 per cent., as compared with 20 per cent. in 1913, to place £4,000 to a war reserve fund, and to carry forward £2,800.

The Treuhand Bank fur die Elektrische Industrie, of Berlin, which now belongs to the A.E.G.—Carlswerk group, participated, in 1914 for the first time, as a financing institution, for which purpose it was originally constructed in 1909 by the Felten & Guilleaume Co. (Carlswerk). The amount in question is £575,000, the transactions necessitating a further call on the unpaid share capital. As net profits, the accounts record the sum of £21,900, as compared with £14,200, and the dividend is 4 per cent. on the paid capital of £500,000, as contrasted with the same rate on £312,000 in the previous year.

The report of *Meirowsky & Co., of Porz, Cologne*, whose manufactures comprise insulation materials, condensers, etc., records a satisfactory course of business down to the outbreak of the war, when the turnover considerably declined, partly owing to many vetos imposed on exports even to neutral countries. As a consequence of the particular classes of manufactures made, it was impossible to obtain compensation through the production of war material. The gross profits decreased from £63,000 in 1913 to £40,000 last year, and the net profits from £29,000 to £23,000, the dividend on the share capital of £150,000 also falling from 12 per cent. to 9 per cent. in the two years respectively.

The directors of the *Bergmann Elektrizitats Werke, of Berlin*, whose financial results were recorded on May 21st, report that the slackening in the general economic situation, which was in progress in 1914, did not materially prejudice the company's activity until August, when stagnation in the export trade and restrictions in working on peace manufactures took place. But in the final two months of the year, after overcoming the difficulties associated with the adoption of every new method of manufacture, an [illegible] was reached in the departments which were [illegible] for war work, and the number of workers, despite the calling of 1,645 to the colours, was brought at the end of 1914 to the level which prevailed at the close of July. At the general meeting, held on May 29th, it was announced that the orders on hand would provide work for months forward, and that work was being carried on day and night and on Sundays.

The report of *Hartmann und Braun, of Frankfort-on-Main*, states that the earning conditions were greatly influenced by the war, as a considerable portion of the company's manufactures were for export, and hostile countries were mostly concerned in this respect. Although the mechanical workshops were not essentially equipped with the larger machine tools necessary for the manufacture of war material, it was possible for the company, after some time of diminished activity, to return to [illegible] and even to improved working to some extent. [illegible] of £88,000, as [illegible] £100,000 [illegible]. After [illegible] expenses, [illegible] £12,000 for [illegible] profits and balance [illegible] £27,800 in 1913, and a dividend [illegible] declared on the [illegible] with 11 per cent. [illegible]

Rangoon Electric Tramway and Supply Co., Ltd.

The directors report that during 1914 the cars [illegible] 1,482,178 [illegible] passengers [illegible] Rs. 8,82,0[illegible] Up to the outbreak of war the [illegible] Rs. 1,12,82[illegible] would have been [illegible] and the natives of India is gradually being restored, and an improvement in the traffic is now observable. Motor omnibus traffic [illegible] 22 passengers has been maintained, the gross receipts being Rs. [illegible] and the expenses Rs. 12,814. This department [illegible] not [illegible] act as a valuable feeder [illegible] receipts for current supplied [illegible] Rs. 6[illegible] an increase of 11.52 per cent. The working expenses were 43.14 per cent. of the receipts, as against 42.16 per cent. in 1913. The gross [illegible] and supply department were Rs. 1.52.699, and the profit was Rs. 25,343, as compared with Rs. 22.478 in 1913. The gross profits were £62,453 plus £1,168 for transfer fees and interest. This is disposed of as follows:—Interest on debenture stock (£13.119); 4½ per cent. debenture stock redemption provision, £6.100; depreciation on sundry assets in Rangoon, £1,767; reserve for renewals, £12,500; special reserve for cables, etc., £2.000; and other items making £41,600, leaving a net profit of £22,021 plus £1,055 brought forward. After paying preference dividend £15,000 and 3 per cent. [illegible] shares, £2,7[illegible] is to be carried forward. An alteration of the articles is proposed extending the period for the presentation of the accounts. A provident fund of which all employés under written agreements will be compelled to become members has been established. The subscription is 5 per cent. of salary, the company contributing £500 each year in which a dividend is paid on the ordinary shares. Messrs. S. Balthazar, F. Tobin and J. Taylor have resigned their seats on the board. Mr. J. Glynn, of Liverpool, has been elected a director, and Col. A. C. de L. Joly de Lotbinière and Mr. H. D. Dickie are recommended as directors. Sir F. W. R. Fryer, K.C.S.I., formerly Lieut.-Governor of Burma has accepted the chairmanship rendered vacant by the resignation of Mr. Tobin.

Annual meeting, June 23rd.

New General Traction Co., Ltd.

The annual meeting was held on Tuesday at the offices, 8, Crosby Square, E.C. Baron Emile B. d'Erlanger, who presided, said it was a rare pleasure in these days to be able to preside over the meeting of a joint-stock company and to be able to say that the results had been but little affected by the war. Fortunately, that was so in their case, and after paying the same dividend as last year, viz., 4 per cent., they were able to carry forward £7.081, against £6,500 brought into the account. The war had adversely affected the Douglas Southern Electric Tramways, Ltd., in which they held a certain interest. That company had experienced a large falling off in revenue, and had only paid a dividend of 1½ per cent. last year; and he was afraid they could not look forward to any dividend for the current year. Fortunately, their holding in that company was only a small one, and, although they might be deprived of any revenue next year from that source, it would only affect them slightly. As regarded the Norwich Tramways, the receipts had been practically unaffected by the war, although the services had been curtailed through the early closing hours. Last year they obtained a valuable franchise for the extension of the tramways in Norwich, but owing to the difficulty in obtaining labour consequent upon the war the work had been suspended by agreement with the Corporation, and it was impossible to say when it would be resumed.

Mr. [illegible] seconded the motion, which was carried unanimously.

British Electric Traction Co., Ltd.

The report for the year ended March 31st, 1915, states that the progress of the associated companies in regard to tramway and omnibus traffic, and the sale of electricity, continued to be satisfactory up to the declaration of war. The disturbance in the business which then took place adversely affected the receipts of most of the undertakings, especially those which relied upon holiday traffics. On the other hand, the receipts of certain undertakings have increased during the war owing to exceptional activities in the districts in which they operate, and during the last few months many of the other undertakings have shown some recovery. Having regard to the general conditions which prevailed during the greater part of the year, the board have not undertaken new enterprises involving commitments of any magnitude. The existing businesses of the associated companies, however, have been fully maintained and consolidated, and in some cases extended. Negotiations for the improvement in the tenure of certain of the associated companies are in progress. An agreement has been entered into for the sale of the tramway undertaking of the Devonport and District Tramways Co. to the Plymouth Corporation at a price to be settled by arbitration, and is now before Parliament for confirmation. The gross profit amounts to £235,508, as compared with £225,754 for 1913-1914. After deducting the general expenses there remains £209.295, plus £17,130 brought forward. Deducting debenture stock interest (£91,367) there remains £135,057. The revenue account has been debited with £11,191 for additional reserves against sundry assets. The directors recommend the payment of the dividend for the year upon the 6 per cent. cumulative preference stock, and a dividend of 3½ per cent. upon the 7 per cent. non-cumulative preference stock, together amounting to [illegible] dividends at the same rate as those paid for the preceding year. This leaves a balance of £71,399, and in view of the directors' proposal to proceed with the reduction and re-arrangement of capital, it is not proposed to place any portion of this amount to reserve for depreciation, but to carry the whole amount forward. During the year investments of the book value of £59,379 have been sold at a net loss of £117. The revenue from the investments and undertakings amounted to £217,184, as compared with £209,045 in the previous year. The yield for the past year on £4,771,842 was 4.55 per cent., as compared with 4.47 per cent. for the preceding year on £4,672,458. The reserve against depreciation of investments is now £482,162, which is deducted from the amount at which the investments and undertakings stand in the books. There are additional reserves of £61,666 against other assets, and a balance of unallocated revenue amounting to £71,399, which it is proposed to carry forward. The directors are of opinion that, subject to some small modifications, the scheme for reduction and re-arrangement of capital should now be proceeded with, and they propose to call the necessary meetings at an early date. Mr. J. S. Raworth, who has been a director since the formation of the company, has resigned his seat at the board, but his services have been retained by the company as technical adviser. Mr. Alfred Shepherd has been appointed to fill the vacancy.

Annual meeting: June 25th.

Aluminium Corporation, Ltd.

In their report for 1914 the directors state that notwithstanding that the rainfall during the year was not sufficient to enable the works to be carried on at their full capacity during the whole period, together with the adverse conditions created by the war, they record a further increase in gross profits. After providing for debenture interests and other charges, the net profits amount to £7,812, plus £120 brought forward. There is to be applied in writing off depreciation on plant and machinery £3,394, and on buildings account £1,252, leaving £3,286 to carry forward. The contractor having failed to fulfil his contract for the construction of the tunnel to bring the Dulyn water into the Eigiau Lake, the completion of the tunnel has been seriously delayed, but the company has now undertaken the work and satisfactory progress is being made. With a view to providing the necessary capital to extend the company's water power, etc., the directors have considered it expedient to increase the first mortgage debenture stock from £50,000 to £150,000. The chairman of the company (Mr. K. M. Clark) has taken up the increased stock to the extent of £15,000 in satisfaction of his loans to the company, and since the close of the accounts, has also agreed to take up an additional £10,000 of the increased stock in lieu of his second debentures, which became redeemable in April last. It is proposed to offer the balance of the increased debenture stock to the shareholders *pro rata* to their holdings. In accordance with resolutions passed, the rights relative to the participating shares have been revised.

Annual meeting: June 17th.

United Electric Tramways of Monte Video, Ltd.

The annual meeting was held on Monday at Winchester House, E.C., Mr. G. A. Touche, M.P., presiding. The Chairman said he had not a very cheerful story to give, as Uruguay, in common with all South American States, had been passing through a period of adversity. The situation had been one of much difficulty. The commercial depression which made the previous year's operations unsatisfactory was continued and aggravated during the year under review. It could not be attributed to the war, although that accentuated the difficulties. Its origin lay in other causes, partly economic and partly climatic. To meet their financial engagements the Government had found it necessary to create internal debts bearing high interest. Bad times financially were bound to operate unfavourably on their traffics. But misfortune did not come alone, and the elements also conspired to make things unpleasant. Continuous bad weather prevailed, and the country was visited by several violent cyclones, which not only paralysed traffic for hours—in some cases days—but involved expense for repairs to the company's property. The board had also had many anxious questions to deal with from the expense point of view. The traffic receipts for the year were £361,465, a decline of £12,061, or 3.23 per cent. The last three months of the year—the period covered by the war—were accountable for more than two-thirds of the total decrease. The number of passengers carried decreased by 759,841 to 43,862,849. Operating expenses were 60.86 per cent. of the gross receipts, an increase of 1.28 per cent. This was an actual decrease in the amount of expenses of £2,553, but it would have required a further decrease of £4,626 to maintain the same ratio of expenses to receipts. That was impossible of achievement. The year had to bear exceptional expenditure resulting from the storms and cyclones, and the resulting floods, amounting to £3,164. There was an unavoidable additional loss of £745 in the discounting of nickel and silver currency, and an increase in maintenance charges of cars and permanent way of £1,135. Those items, totalling £5,044, represented more than the further decrease of £4,626 required to maintain a steady ratio of working expenses. Every care was taken to counteract the decrease in receipts, and important economies were effected. The principal of these economies was in the consumption of electric current. To accomplish the purpose a very strict system of instruction and supervision of the drivers had been instituted. The net traffic receipts for the year were £141,477, a decrease of £9,508, or 6·30 per cent. The total credits to profit and loss account amounted to £135,858, a decrease of £11,826. The profit and loss account charges amounted to £58,823, an increase of £2,420. This was more than accounted for by the increases of debenture stock interest, viz., £1,920, and income tax £2,440. The net profit for the year was £77,035, plus £12,641 brought forward, making a total of £89,676. This was proposed to be dealt with as follows:—£3,370 had been set aside for redemption of debenture stock, and £2,500 towards redemption of the share capital; £25,000 had been added to the renewals and contingency account, making the total set aside for that purpose to date £155,000, out of which a sum of £15,832 had been written off, leaving a balance of £139,168. For four consecutive years they had paid 7 per cent. on the ordinary shares, so that a reduction to 4 per cent. was disappointing, but not surprising to those who knew the severity of the crisis through which South America was passing. The capital expenditure for the year totalled £50,610, compared with £122,158 in the previous year. In view of the big fall in revenue and the serious outlook, all expenditure of a capital nature had, as far as possible, been rigorously curtailed. The completion of the two substation buildings and the installation of the necessary plant practically accounted for the whole of the expenditure during the year. A considerable sum (about £20,000) would be required for additional rolling stock on order, but not delivered. A further issue of capital would be required in the future (when the British Treasury rules permitted), for the company must look to some continuing expenditure, governed, in part, by the development of the city, and in part by the programme of the municipality, especially as regards paving. Coming to the results for the first six months of the current year, frankness compelled him to tell them that the position was worse. None of the adverse conditions had yet disappeared; financial depression continued; weather conditions throughout the summer season had been bad, four months of the six being classed as rainy, and the remaining two as unsettled. Expenses were increasing; in some directions in an unprecedented degree. The price of coal had risen, and freight had doubled, so that their coal bill—always a heavy item, would this year be exceptionally large. The actual figures for the half-year were: Traffic receipts—1915, £174,655; 1914, £200,181, a decrease of £25,526; net receipts—1915, £68,311; 1914, £88,095, a decrease of £19,784. It was difficult to foresee what would transpire during the second half of the year now current. The worst might be nearly over, for they would soon arrive at a time when the takings would begin to compare with the months of last year that showed the heavy decreases. They were clearly in for a bad year. The tide was still on the ebb, but it might turn before long, and when it did the flow, if not so rapid as the ebb, might be very pronounced. There were several factors making for a return of prosperity. There was the practice of individual thrift, while war conditions had established a steady market at favourable prices for pastoral and saladero produce, such as cattle and sheep, wheat and maize. With diminished expenditure and imports and better prices for exports, gold would flow into the country. Already the improvement in South America was beginning to manifest itself in portions of the Argentine. In some respects Uruguay was a little later than Argentina in feeling the full force of the decline, and she might be later also in experiencing the full benefit of the recovery.

Mr. H. F. Gunning seconded the motion.

Replying to a shareholder, the Chairman said they had been experimenting with oil fuel, and were still doing so, but the trouble was the question of supply at advantageous prices.

The report was adopted.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—As foreshadowed in the chairman's remarks at the half-yearly meeting in June last, it has been decided to abandon the half-yearly meeting, a course pursued by many other companies during the war. In announcing this fact the directors report that the works at Silvertown are very busy in many departments, and it is hoped that the year's results will be favourable, though the prices of labour and coal are considerably higher than last year owing to the war. The cable-ship *Dacia* has had considerable employment, and the board has reason to expect a continuance of it. The French works were closed entirely for several weeks during last year on account of the close proximity of the German Army. As stated in the directors' report for last year, before the war broke out the organisation had been placed on a thoroughly sound basis, and the works, although greatly hampered by the shortage of labour, are now doing a sound and steady business. The directors have decided to distribute a dividend of 5s. per share, less income-tax, on the preference shares, being the half-yearly dividend due on July 1st, at the rate of 5 per cent. per annum, and a dividend of 5s. per share, free of income-tax, on the ordinary shares, being an interim dividend of 2½ per cent.

Shawinigan Water and Power Co.—A dividend of 1¼ per cent. on the common stock for the quarter ending June 30th is announced.

Montreal Light, Heat and Power Co.—The report for 1914 states that the net revenue was 3,085,907 dols. which, after deducting fixed charges (489,164 dols.), leaves the net income 2,596,743 dols. Dividends to the amount of 1,827,500 dols. have already been paid and 10,000 dols. have been appropriated to the officers' and employés' pension fund, leaving 759,243 dols. to be transferred to general surplus. The increases in surplus earnings have accrued mostly from the operations of the earlier part of the year, and while the effects of the disturbed business conditions resulting from the war have not been so serious as for most industries, the effects of the depression have been distinctly felt in the unusually large number of disconnections and the increase in bad debts, the latter of which amounted to more than three times that of any previous year. The outlook for the coming year is not as bright as usual, and is aggravated by the fact that large expenditures for wax taxes on imported raw materials and supplies have to be faced. —*Financier.*

New British Ever-Ready Co., Ltd.—At the annual meeting held at the works, Hercules Place, Holloway, N., on June 7th, the directors reported that for the year ended March 31st, 1915, the profit available for distribution, including £859 brought forward, and after writing off depreciation, balance of preliminary expenses, &c., and transferring £5,000 to general reserve, amounted to £29,958. An interim dividend was declared and paid on the preference shares on December 1st, 1914, amounting to £2,975. The directors now recommended a final dividend on the preference shares at the rate of 6½ per cent. per annum, making the maximum of 10 per cent. for the year, requiring £5,525, and after payment of 10 per cent., and a bonus of 2 per cent. on the ordinary shares for the year, £7,6[illegible] is carried forward.

James Keith & Blackman Co., Ltd.—According to the *Financial Times* the net profit for the past year was £13,302. A dividend of 10 per cent., tax free, on the ordinary shares is to be paid.

Automatic Telephone Manufacturing Co., Ltd.—The share and transfer books will be closed from 17th to 2[illegible]th inst. inclusive, for the purpose of preparing the dividend warrants on the 6 per cent. preference shares for the half-year.

National Electric Supply Co., Ltd.—Interim dividend 2s. 6d. per share, less income-tax, on the ordinary shares for the half-year.

Vulcan Boiler and General Insurance Co., Ltd.—An interim dividend at the rate of 1[illegible] per cent. per annum is announced for the half-year.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets are awaiting news with reference to the next War Loan. That some sort of issue is contemplated in the near future, the House regards as assured; and the debate in the House of Commons to-night (Tuesday), on the Vote of Credit, is expected to [illegible] as to the Government's intentions. Money is plentiful enough, and there is still a demand for good-class stocks paying reasonable rates of interest. Something of a feature is the revival in the rubber share market, in consequence of the steady climb in the price of the raw stuff. Another feature this week has been sharp recovery in Underground Electric income bonds. The stocks and shares connected with the [illegible] companies are [illegible] quiet.

The income bonds of the Underground Electric Railways have recovered 5 of the 6½ points [illegible], and the price rose up to 75 as abruptly as it had dropped from that figure to 70. [illegible] a few buyers [illegible] one and two hundreds, found that their intended operations had a remarkable effect. A [illegible] business is doing in the bonds, and the contention advanced here last week that the fall was [illegible]

[illegible] weak throughout, mainly on account of the fear that coal contracts, which have to be revised at the end of this month, will be effected at prices very different from those ruling previously. An [illegible] fuel bills.

This question of fuel affects, of course, illumination companies as well as the railways, and prices in the gas market are heavy. Amongst electricity shares, no changes have occurred since our last notes appeared; and the buyers who recently have been on the look out for cheap stock are still occupying the same position. It is said that most undertakings connected with the supply both of gas and electricity are being asked to adapt part of their machinery for the purposes of munitions, and it may be that this side-branch will be of useful assistance to the companies during the slackest period of the year. Business is quiet.

The British Electric Traction Co. repeats its previous dividend performance by declaring 3½ per cent. on the 7 per cent. non-cumulative preference stock, and this has caused a demand for all six of the Company's stocks. Prices are nominal, in the sense that there is scarcely any supply to be obtained, holders preferring to keep their investments, and, if anything, wishing to increase rather than to realise them. Therefore the 6 per cent. cumulative preference is up to 70, the 7 per cent. non-cumulative has risen to 35, the preferred and deferred to 10 and 5 respectively. B.E.T. 5 per cent. debenture stock is 87, and the 4½ per cent. second debenture stock, which has not changed hands for over six weeks, is called 75. For 1914, as already observed, the Company paid 3½ per cent. on the 7 per cent. non-cumulative preference stock, which was an improvement of ½ per cent. on the distribution for the previous twelvemonth.

The Victoria Falls and Transvaal Power Company has declared a dividend at the rate of 6 per cent. per annum for ten months on the preference shares, so clearing off all the arrears up to the end of April, 1914. This is a better result than had been expected, and the price of the shares improved to 15s. 6d., while the 5½ per cent. second mortgage debentures are a little better at 88½. The latter price, by the way, is 5½ points above the quotation of the debentures when war broke out; and the preference shares now stand about a florin higher than they did at that time.

Brazil Tractions are a jumpy market, and from 54, on Friday, they fell to 51½ to-day (Tuesday), the price moving in sympathy with the Rio rate of exchange. This touched nearly 1s. 1d. before it reacted a little. Mexican Industrials show a slightly hardening tendency, on the publication of the United States Note to Germany; this has been read as an indication that America has no intention of embroiling herself in the European struggle, and therefore may have the greater inclination to intervene in the cause of straightening out affairs in Mexico.

Anglo-Argentine Trams have improved a little as regards the 1st preference and the 4 per cent. debenture stock, though the Fives are ½ lower. A reassuring statement from the Central Argentine Railway says that the exodus of Italians from the Republic is not considerable, and it is hoped that, even if it increases, prejudicial influence will not be exercised thereby. Upon this, most securities connected with Argentina have braced up.

In the Telegraph market, Westerns gave way ⅛ to 13⅜, notwithstanding the declaration of the third quarterly interim dividend of 3s. per share, as usual. Anglo-American Telegraphs are better, thanks to a marked improvement which has occurred in most issues connected with the United States. The Eastern group is a little dull. Good business is taking place in Marconis, for which optimistic dividend anticipations continue to act as the principal stimulus. Oriental Telephones gained the fraction at 2⅛, while, on the other hand, United River Plate Telephones eased off to 6 on the appearance of a small seller.

Callender's Cable shares have come in, on account, it is said, of a deceased estate; the price weakened ¼ to 11⅞, at which it will be noticed that the yield is the excellent one of six guineas per cent. Henley's have hardened to 14½, which makes the return on their shares £7 18s. 8d. per cent.; so that the previous difference of 42s. in the return is being diminished. General Electric preference gave way to 10. Liverpool is buying British Aluminium ordinary and preference; and although the nominal prices show comparatively little change, the market is a strong one, and there is not much floating supply. British Insulateds are firm at 11¼, and India Rubber shares at 9, while Babcock & Wilcox continue to change hands on the basis of 50s.

In the rubber market, as already indicated, there is noticeable strength and an unusual amount of animation. The price of the raw article is now close to half-a-crown per lb., and company after company shows that it can make highly satisfactory profits at anything like this figure. Attention for the time being is directed principally to the younger companies with large estates at present not wholly in bearing, the argument being that as their prices stand relatively and substantially lower than those of the more mature undertakings, there is considerably more scope for advance in dividends and capital value than the seniors can expect. The buying movement proceeds from the provincial centres as well as from London itself; and so long as the price of rubber keeps good, it is safe to prophesy that the share market will remain robust. Armament shares are quiet, unaffected in any way by the fiery eloquence of the Minister of Munitions. From the purely market point of view, his demand for more shells, and ever more shells, is countered by the knowledge that war profits are not going to be permitted to assume extravagant proportions.

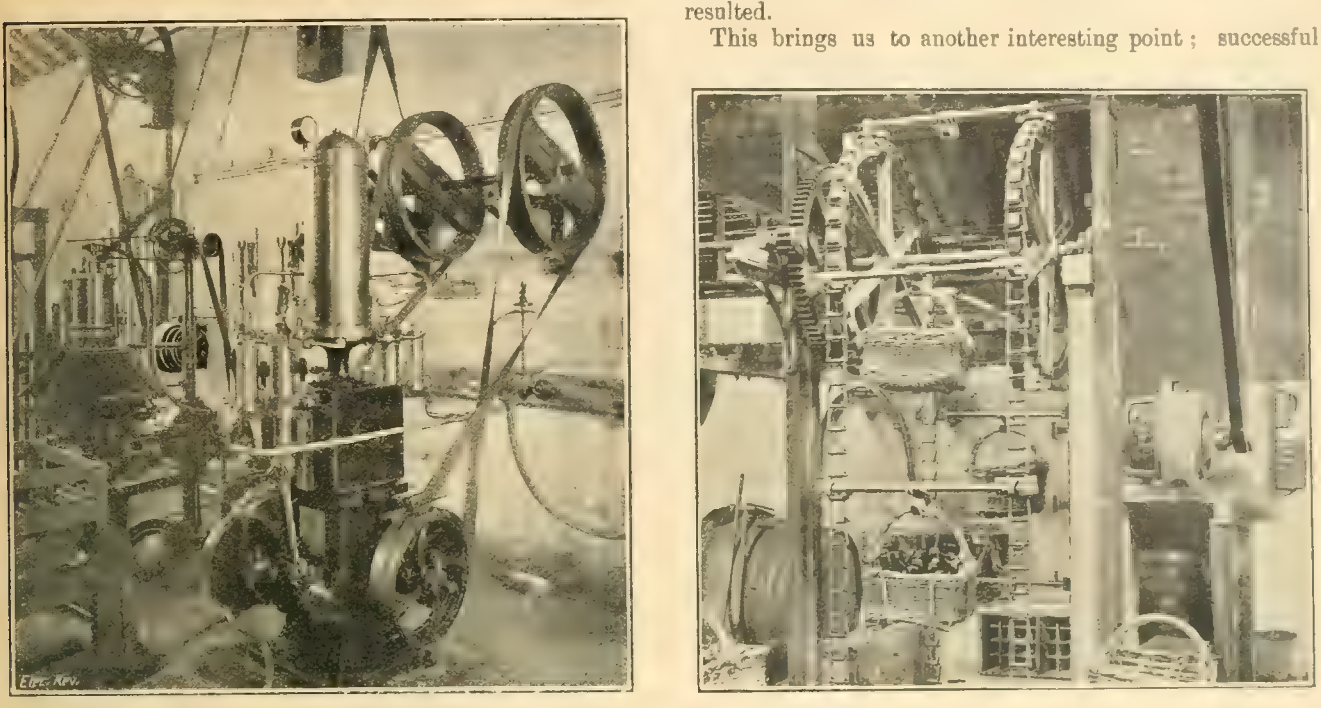
SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price June 15, 1915.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.				
Brompton Ordinary	10	8¼	—	£6 1 3
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4¼	—	5 17 8
do. do. do. 4½ Pref.	4½	4⅛	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	13¾	—	6 11 0
do. do. 6 per cent. Pref.	6	12¼	—	4 18 0
do. do. 5 Deb.	5	112	—	4 9 3
do. do. 4½ Deb.	4½	96	—	4 13 10
County of London	7	11⅜	—	6 3 1
do. do. 6 per cent. Pref.	6	11⅛	—	5 4 4
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	95 xd	—	4 14 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1½	—	8 0 0
do. do. 6 per cent. Pref.	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	3½	3⅛	—	5 12 5
do. 4½ per cent. Pref.	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	74	—	4 12 0
St. James' and Pall Mall	10	7½	—	6 13 4
do. do. do. 7 per cent. Pref.	7	6⅜	—	5 9 10
do. do. do. 3½ Deb.	3½	75	—	4 13 4
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	4⅛	—	6 4 5
Westminster Ordinary	9	7¼	—	6 4 2
do. 4½ Pref.	4½	4¼	—	4 14 9
TELEGRAPHS AND TELEPHONES.				
Anglo-Am. Tel. Pref.	6	106	+ 1	5 13 4
do. Def.	1½	22⅝	+ ⅛	6 12 4
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8½	—	5 17 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	13	—	*6 3 1
do. 4 Deb.	4	91	—	4 8 0
Eastern Tel. Ord.	7	131½	— ½	*6 1 8
do. 3½ Pref.	3½	76	—	4 12 1
do. 4 Deb.	4	91	—	4 8 0
Globe Tel. and T. Ord.	6	11	—	*6 4 9
do. Pref.	6	11¾	—	5 2 2
Gt. Northern Tel.	22	33	—	6 13 4
Indo-European	65/-	54	—	6 0 4
Marconi	20	1⅗	+ 1/32	10 13 4
New York Tel. 4½	4½	97	—	4 13 0
Oriental Telephone Ord.	10	2⅛	+ ⅛	4 14 1
do. Pref.	6	1 3/16	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 3
United R. Plate Tel.	8	6	— ⅛	*7 10 0
do. Pref.	5	5	—	5 0 0
West India and Pan.	1	1¼	—	8 0 0
Western Telegraph	7	13⅜	⅛	*5 19 8
do. 4 Deb.	4	91	—	4 6 6
HOME RAILS.				
Central London, Ord. Assented	4	77	—	5 4 0
Metropolitan	1¼	28¾	— ¼	4 7 0
do. District	Nil	14⅛	—1½	Nil
Underground Electric Ordinary	Nil	1¼	—	Nil
do. do. "A"	Nil	4 6	+ 6d.	Nil
do. do. Income	6	75	+ 5	*9 6 8
FOREIGN TRAMS, &c.				
Anglo-Arg. Trams, First Pref.	5½	4½	+ ⅛	6 2 3
do. 2nd Pref.	5½	8¾	—	7 6 8
do. 4 Deb.	4	84½	+ ½	4 14 6
do. 4½ Deb.	4½	87	—	5 3 6
do. 5 Deb.	5	86½	½	5 15 7
Brazil Tractions	6	51½	—2	11 13 0
Bombay Electric Pref.	6	10⅝	—	5 16 10
do. 4½ Deb.	4½	92	+ 1	4 17 10
Mexico Trams	Nil	33	+ 1	Nil
do. 5 per cent. Bonds	—	53	—	Nil
do. 6 per cent. Bonds	—	80	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	39	—	Nil
do. 1st Bonds	—	48	—	—
Adelaide Sup. 6 per cent. Pref.	6	5 5/16	—	5 18 0
do. 5 Deb.	5	103	—	4 17 1
MANUFACTURING COMPANIES.				
Babcock & Wilcox	14	2½	—	5 12 0
British Aluminium Ord.	5	21/9	+ 3d.	4 12 0
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	11¼	—	6 13 4
do. Pref.	6	6⅛	—	6 0 0
British Westinghouse Pref.	7½	1⅞	—	8 0 0
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11⅞	¼	6 6 4
do. 5 Pref.	5	5	—	5 0 0
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	8¼	—	4 12 6
Edison & Swan, £3 pd.	Nil	12/6	—	Nil
do. do. fully paid	Nil	1⅛	—	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5½ Deb.	5	60	—	8 6 8
Electric Construction	6	13/ xd	—	9 4 8
do. do. Pref.	7	1xd	—	7 0 0
Gen. Elec. Pref.	6	10	—	6 0 0
Henley	20	14½	+ ¼	*7 18 8
do. 4½ Pref.	4½	4⅞	—	4 12 4
do. 4½ Deb.	4½	97	—	4 13 9
India-Rubber	5	9	—	5 11 1
Telegraph Con.	20	87	—	6 9 10

* Allowance made for dividends being paid free of income-tax.

Victoria Falls and Transvaal Power Co., Ltd.—The directors have declared a 10 months' dividend at the rate of 6 per cent. per annum, less income-tax, on the preference shares, thereby making the cumulative dividend paid up to April 30th 1914.

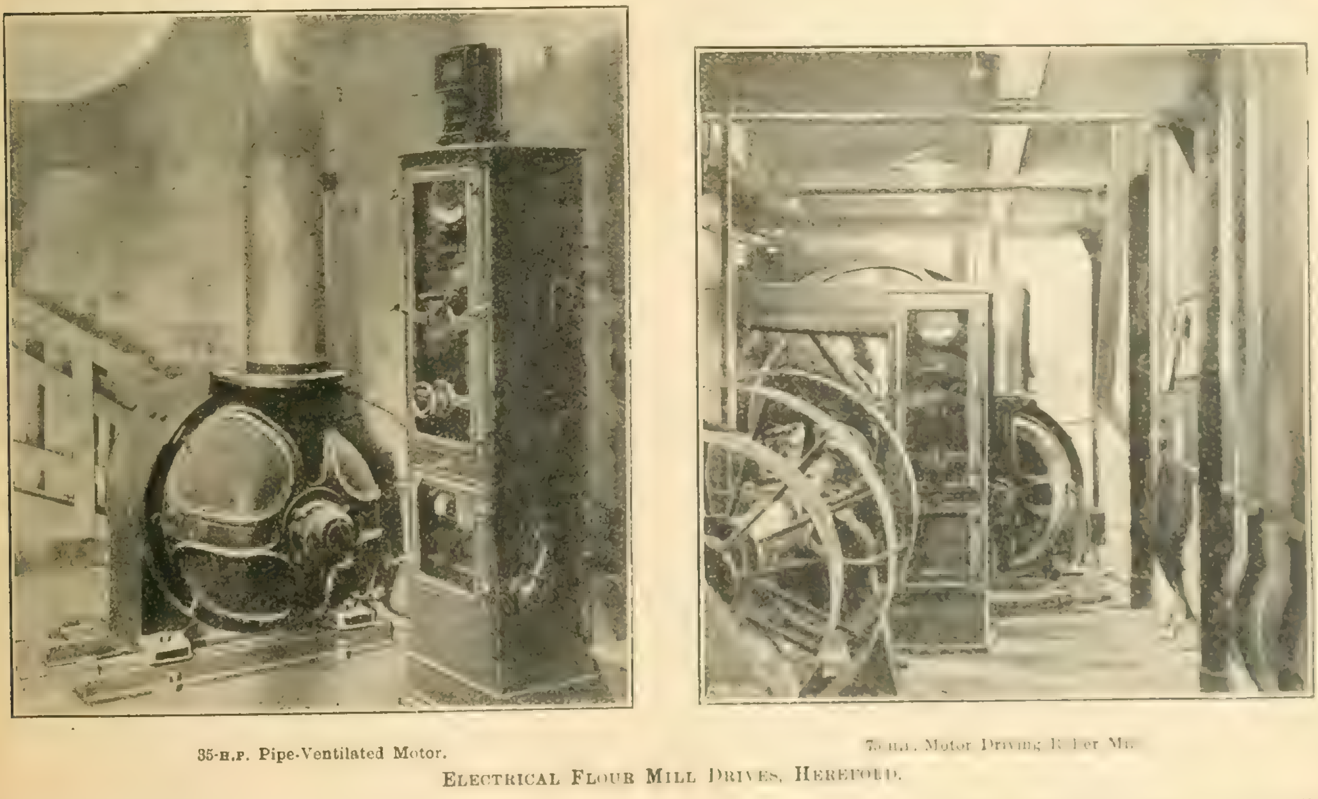
ELECTRICITY IN FARMING.—III.



Aerating Machinery. Bottle Hoist.

Electric Driving in Cider Mill, Hereford.

ALTHOUGH somewhat beyond the scope of this article, we may mention that electric lighting and "other uses" of electricity have made great progress in Hereford, which, as a country and market town, possessing a fine cathedral and historical associations extending back some 800 years, is a favoured residential centre. Practically every public building is electrically lighted; this applies to all the churches and the cathedral, in which the Gilbert Scott lighting fittings have been converted and some 360 lamps are installed.



35-h.p. Pipe-Ventilated Motor. 75-h.p. Motor Driving Roller Mill.

Electrical Flour Mill Drives, Hereford.

As regards "other uses," about 120 kw. of electric heating and cooking apparatus is in use in the city, including about 200 irons; six consumers have adopted electric cooking and heating extensively, but pending improved manufacturing methods in the way of standardised replacements, &c., this branch of the supply business is not being pushed. Still, where used, electric cooking is giving satisfaction, and it will undoubtedly be adopted both in the city and by the larger houses served in conjunction with the farms. The electricity department has also taken the first steps to introduce the electric vehicle in Hereford, by using a light electric truck for its own work about the town, and we gather that inquiries for delivery vans of this type have resulted.

This brings us to another interesting point; successful as have been the initial efforts to supply outlying farms and houses, there is a limit to the load which can be taken on the low-pressure direct-current overhead lines, and the increasing demands for electric power, lighting, cooking by those adjacent to the transmission routes has led Mr. Kerr to formulate a much more ambitious scheme—which is, unfortunately, deferred, owing to the war—by means of which the supply will be available anywhere within a five-mile radius.

This anticipates the installation of a 1,250-kw. three-phase turbine plant to supply current at 3,300 volts pressure by means of overhead transmission in the surrounding districts. It is estimated that the saving in fuel cost alone over the existing plant would justify the departure, and that very many farming and other consumers would become accessible to the undertaking.

Motor and Food-Preparing Machinery on an Altrincham Farm.

We are much indebted to Mr. Kerr for discussing the peculiar supply problems of the Hereford area with us; the results which he has achieved, and the methods adopted to secure them, deserve the careful study of all central station engineers situated in, and mainly dependent on, an agricultural area for future success.

Farm Supply at Altrincham.—The Altrincham Electric Supply, Ltd., has recently given a supply to a local 285-acre farm, where about 30 lights are installed in the house, all farm buildings and yard, and only electricity is used. The entire farm plant, including a corn mill, chaff cutter, root pulper, cake mill, &c., is driven by a $7\frac{1}{2}$-B.H.P. 100-volt single-phase motor fixed in the granary.

The wiring in the farm buildings is generally in porcelain cleats on the surface, and the farm is supplied at 2,000 volts, 80 cycles, through half a mile of concentric cable laid across the consumer's land, at about 2-ft. depth, the pressure being transformed down to 100 volts, and metered at the farm. The consumer pays 6d. per unit for lighting and $1\frac{1}{2}$d. for power, and it is understood that he would have been well satisfied if his first quarter's bill had been three times as large, despite the fact that it was swollen by sundry demonstrations for the edification of neighbouring farmers.

Farmyard Wiring, Altrincham.

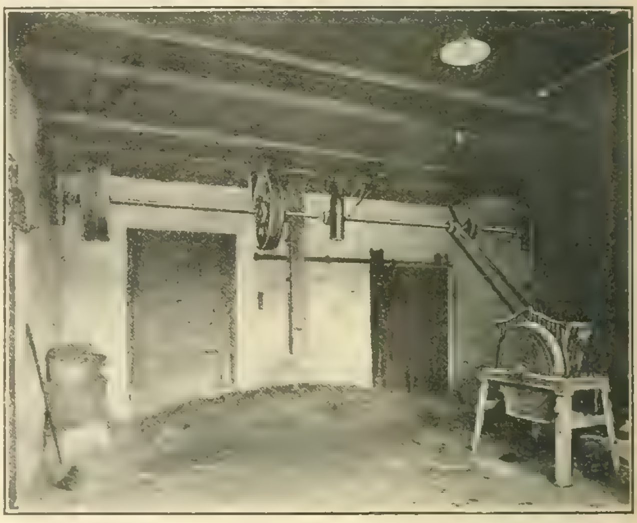
This installation was responsible for another farmer taking a supply for lighting and power from the company within a month.

We are indebted to Mr. Fawcus, the chief engineer of the company, for these particulars and accompanying views; we gather that he also is favourably impressed with the prospects for farm supply in his district.

Sufficient has been said to indicate that this subject has a real interest to a numerous class of supply engineers in this country, who have been, figuratively speaking, "all out of it," in comparison with their more fortunate brethren in factory or industrial centres.

But reverting to an earlier remark, *it is necessary in the first instance to convince the farmer*, whose educational intervals are not numerous, and more particularly confined to agricultural shows.

The steam and oil engine manufacturers make the utmost of these occasions, but we believe that electrical exhibits are conspicuously absent, and a co-operative electrical farming exhibit on American lines, such as that described in our pages on August 23rd, 1912, or that which formed a feature of the Christiania Exhibition, and was referred to in our issue of August 14th last, is a thing unheard of here.



Drive for Pulping Machine: Electric Wiring, &c.

Testimony to the value of the "personal demonstration" comes from far-off New Zealand, where the farmer shareholders of the Tai Tapu Co-operative Dairy Co., as a result of a short experience of its electrical operation—made possible by the advent of hydro-electric power—decided that they must have electric light and power on their own farms, and a scheme for that purpose has been organised.

Almost every house and farm in the district has decided to use electric light, and numerous shearing plants and a dozen milking plants are to be connected, while one farm is adopting electric cooking and heating throughout.

Three overhead lines covering 12 miles of route will couple the factory, which will be a central distribution point, and consumers; the latter average four per mile, and will be charged at fixed rates, no meters being used.

The question of method of charging is important; under the fixed-rate system the farmer knows exactly what his electricity is going to cost him, and this is what a good many English farmers will want to know, although they may have only the haziest idea as to the cost of running a steam plant for similar work.

In this country such rates as 6d. per unit for lighting and 2d. to $2\frac{1}{2}$d. per unit for power are really an attractive proposition to the farmer, but it is advisable to offer a sliding scale down to the 1d. rate, which the farmer may calculate on reaching, even though in practice he never does so.

In conclusion, it seems obvious that good results are almost certain to be obtained by demonstrating to the farmer what can be done by electricity, and arrangements should be made between the agricultural machinery and electric manufacturers to carry out this work at agricultural shows, &c.

We would suggest that this matter is sufficiently important to attract the attention of the I.M.E.A., many of the members of which body are situated in agricultural areas which must of necessity be made to yield some revenue in the future if the supply undertakings are to maintain a reasonable rate of progress. The fact that at least a quarter of the undertakings in the county fall within this category is significant.

ECONOMIC OPERATION OF ELECTRIC OVENS.*

By PERCY WILCOX GUMAER

Even to-day very little is known of the proper conditions of time and temperature to use in cooking various articles of food so as to secure the greatest efficiency. With electric cooking the temperature at which food is cooked makes a considerable difference in the cost of the cooking.

In order to determine the losses of energy in electric cooking and the best methods of preparing various articles of food in electric ovens, tests were made on three commercial ovens and an experimental oven. Each commercial oven was selected as representing a general type of electric oven in use for domestic cooking.

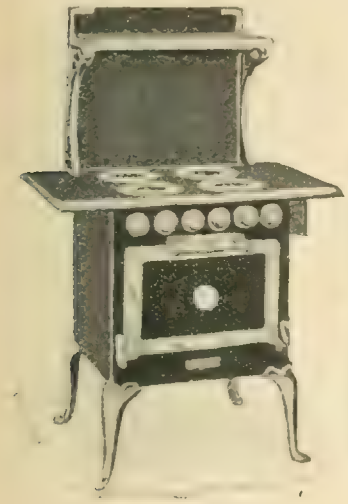


Fig. 1.—Oven No. 1.

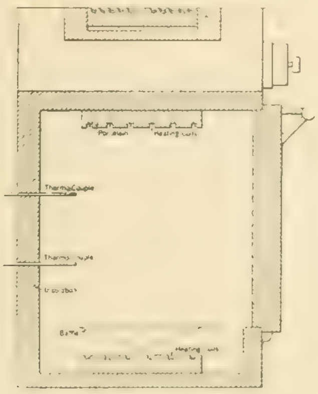


Fig. 2.—Cross-section of Oven No. 1.

Oven No. 1, as shown in fig. 1, is a large range suitable for a good size family. The inside dimensions of the oven are 12 in. by 12 in. by 18 in. Two heating units are used, one in the top and one in the bottom of the oven. Each unit consists of two heating [illegible] on the front of the oven [illegible] 220, 440, or [illegible] watts. From one to two inches of mineral wool is used as heat insulation. The outside surface of the oven is blued steel with nickeled legs and trimmings. The oven door is 12 by 18 in. and 1.5 in. thick. It fits tightly and clamps securely in place when shut. Three heating units are also placed on top of the stove for the cooking which is not done in the oven. Fig. 2 is a cross-section of the oven showing the position of the heating coils and the thermo-couples used to measure the temperature.

Oven No. 2, as shown in fig. 3, is a small well insulated oven suitable for a small or medium size family. The inside dimensions of the oven are 9.5 in. wide, 10 in. deep, and 12 in. high The inside finish is seamless drawn aluminium, and the outside is blued steel with nickeled trimmings. Two and one-half inches of mineral wool is used for heat insulation. An iron-clad heating element is placed in the bottom of the oven, and consumes 500 watts when connected to a 110-volt circuit. The heat cannot be turned partly off, as there is only one heating element. Underneath the oven is an automatic temperature control, which may be set at various values by means of a dial. The dial is graduated in arbitrary numbers from one to eleven. When the handle of the dial is set at a given number a thermostat will open the circuit of the heating element as soon as the inside of the oven has reached a certain temperature; as the oven cools the thermostat must be reset by hand by pushing the handle of the dial. Fig. 4 is a cross-section of the oven showing the position of the heating coil and the thermo-couple.

Oven No. 3 is one of the well-known makes of fireless cookers with a heating element placed underneath the inner lining. The inside dimensions are 10.5 in. deep and 12.5 in. diameter. The inside lining is seamless drawn aluminium, and the outside finish is varnished oak. The sides and bottom are insulated with powdered kieselguhr, while the cover is insulated with granulated cork Fig. 5 is a cross-section of the oven showing the position of the thermo-couple and heating coil. The oven uses 500 watts at 110 volts. There is no [illegible] the oven partly off.

Oven No. 4 was constructed by the author so as to obtain data on the characteristics of an especially well insulated oven. The inside dimensions were the same as oven No. 2. A 220-, 440-, 880-watt heating unit was placed in the bottom of the oven and a 440-watt unit in the top as shown in fig. 6. Sheet iron was used for the inside lining. A 4-in. layer of a commercial brand of diatominous insulating brick was used for insulation. Later 1 in. of cork [illegible] in the drawing. This was put on with cement, and no outside covering was used except on the front and the door, which were covered with wood.

The temperature of the ovens was measured by means of copper-constantan thermo-couples.

In oven No. 1 an extra thermo-couple was inserted for measuring the internal temperature of food.

The effect of heat on the protein of foods is to coagulate it. This change occurs at the comparatively low temperature of 75 deg. C. If the temperature is [illegible] point the protein tends to shrink and harden, and the digestibility of the food is [illegible].

The effect of heat on the [illegible] digestible. The starch is gelatinized at temperatures much below the boiling point of water.

The fat of foods is practically [illegible] degree of heat used in cooking.

The ideal preparation of food for human use requires that the nutriment which it contains [illegible] extent. Not only should the food [illegible] digestive juices can be [illegible] should be properly stimulated [illegible] the taste or flavour of the food.

The present [illegible] cooking which will yield the most in nutrition and flavour with [illegible]

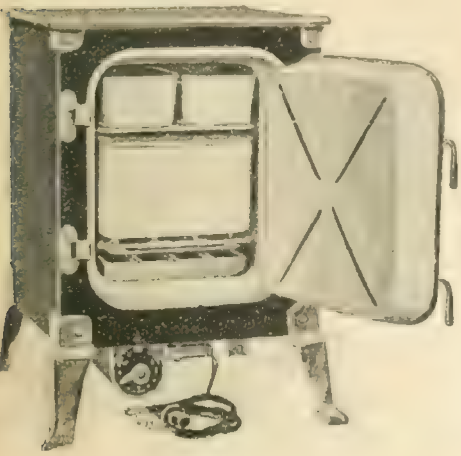


Fig. 3.—Oven No. 2.

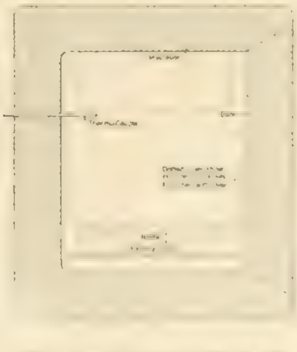


Fig. 4.—Cross-section of Oven No. 2.

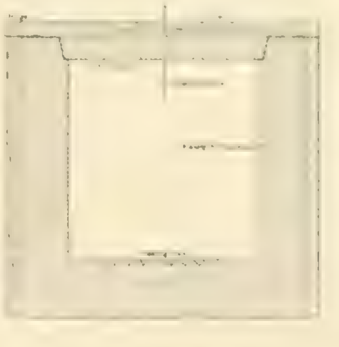


Fig. 5.—Cross-section of Oven No. 3.

[illegible] No. 4

Except in [illegible] delivered at the meter, electricity is more expensive than gas or coal. Hence, it is only by studying carefully the most economical features of design and operation of electric cooking apparatus that [illegible] and coal. A study of the heat losses in cooking is, therefore, of considerable importance to the designer of electric cooking apparatus.

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* From the *Proceedings* of the American Institute of Electrical Engineers. Abstract.

Heat is lost in two ways—by convection and by radiation. The amount of energy radiated depends upon the nature of the surface, the temperature of the surface, and the temperature of the surroundings. It is independent of the shape of the radiating surface. The convection loss, however, depends upon the shape and the position of the surface, as well as the temperature of the surface and the surroundings. It is independent of the nature of the surface.

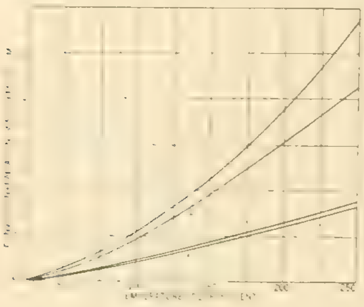


Fig. 7.

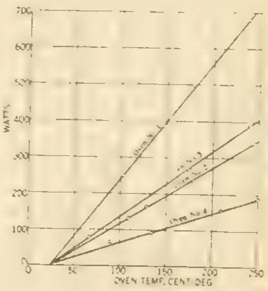


Fig. 8.

Fig. 7.—Total Losses from Heated Surfaces in Air.

1. Black body.
2. Oxidized copper.
3. Pure silver.
4. Convection only.

Fig. 8.—Energy Required to Maintain Ovens at Constant Temperature.

Fig. 7 shows the convection and radiation losses for vertical plane surfaces for temperatures up to 250 deg., the highest used in cooking.

As shown by the curves, the radiation loss from a black body constitutes a large part of the total loss, while the radiation from a polished silver surface forms but a small part of the total loss. For all other surfaces the radiation loss lies between that of a silver surface and a black surface, the convection being the same for all surfaces.

Since the convection and radiation losses depend on the temperature of the outside surface, the losses will be greatly reduced if this temperature can be decreased.

Suppose that enough heat insulation were introduced to reduce the outside temperature from 200 deg. to 110 deg. C., the watts lost per sq. cm. of outside surface would be reduced from 0.37 to 0.12.

Another method of reducing the heat losses would be to silver-plate the outside of the oven. The heat loss would then be decreased from 0.37 watt per sq. cm. to 0.13. By a combination of the two methods the input of the oven for a given internal temperature would be reduced from 1,000 watts to 165 watts.

To silver-plate the outside surface of an electric oven would be too expensive, but a white enamelled surface would be much more efficient than the black surface. A place in which nickel plating could be used to good advantage would be around the edge of the oven door, where the outside temperature of the oven is considerably higher than elsewhere.

The heat losses for the ovens tested were obtained, and curves were plotted between oven temperature and watts input as shown in fig. 8. These curves are very useful in comparing the economy of various ovens for the cooking of any article of food. Since one point of the curve will be zero energy at room temperature, only one determination is necessary to plot the curve for any particular oven.

The heat losses of an electric oven may be separated into the losses occurring before and after the food is inserted in the oven. In many kinds of cooking, such as baking biscuits and cake, the food must be placed in a hot oven as soon as it is prepared. The amount of energy required to preheat an oven to the desired temperature depends on the insulation of the oven, its size and the thermal capacity of the inside, and the size of the heating coils. The amount of energy required to preheat the ovens tested is shown in fig. 9. It will be noticed that, although oven No. 4 was better insulated than oven No. 2, it required more energy for the preheating. This was probably due to the greater heat capacity of the inside lining and the insulation. The effect of too small a heating coil is shown by the curve for oven No. 3; the time required for the oven to reach a baking temperature of 250 deg. C. was 2.5 hours.

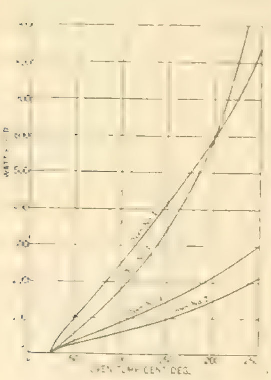


Fig. 9.

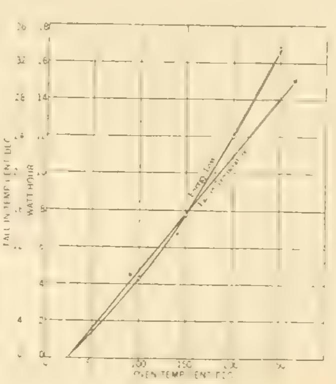


Fig. 10.

Fig. 9.—Energy Required to Preheat Ovens.

Fig. 10.—Effect of Opening Door of Oven No. 1 for 15 sec., with Energy Lost and Fall in Temperature of the Oven.

In preparing food which cannot be placed in a cold oven and heated gradually, there is a loss of heat when the oven door is opened.

Fig. 10 shows the watt-hours lost each time the door of oven No. 1 is opened for 15 seconds, and the fall in temperature of the oven when the door is opened at different oven temperatures.

Experiments have demonstrated that beef can be satisfactorily roasted at an oven temperature anywhere between 100 deg. and 200 deg. C. No difference was discernible in the tenderness of duplicate roasts cooked at the extremes of temperature. The most satisfactory temperature within this interval can be determined only by the consideration of other factors, of which the time of cooking and the cost of cooking are the most important. In order to determine this most economical temperature for roasting a rolled rib roast, a series of experiments were performed on 22 roasts. The meat was freed from bone and tightly rolled and secured with wooden skewers. Samples were roasted at 100, 120, 140, 160 and 180 deg. C. The time required for the cooking and the amount of energy used at each oven temperature were measured. From these values the most economical temperature was determined.

The aim in cooking meat is not to increase its digestibility but to improve its flavour and appearance, by decomposing the red colouring matter called oxyhæmoglobin, which removes the raw appearance of the meat. The inside of the roast should be heated sufficiently to accomplish this without over-coagulating the proteids or removing from the meat those substances which tend to become soluble or volatile upon the application of heat.

In order to secure as much uniformity as possible in the results, a definite internal temperature was taken as the indication of when the meat was sufficiently cooked: 55 deg. C. was used for rare, 65 deg. for medium rare, and 75 deg. for well done.

A copper-constantan thermo-couple was used to measure the temperature inside the roasts.

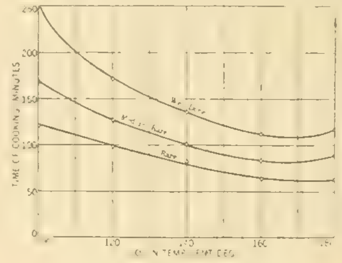


Fig. 11.

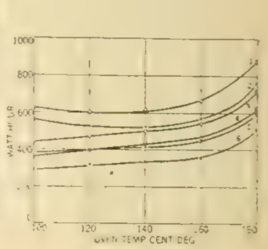


Fig. 12.

Fig. 11.—Effect of Oven Temperature on Time of Cooking of Beef Roasts.

Fig. 12.—Energy required to Roast Beef in Oven No. 2. Starting with Oven Hot and with Oven Cold.

1. Well done roast, oven cold.
2. ,, ,, ,, ,, hot.
3. Med. rare ,, ,, cold.
4. Rare roast, oven cold.
5. Med. rare roast, oven hot.
6. Rare roast, oven hot.

The authorities on meat cooking recommend that a roast be cooked for the first 10 or 15 minutes at an oven temperature of 250 deg. C., so as to sear the outside of the meat. The theory is that the coagulation of the outer surfaces of the meat will act as a seal to keep in the meat juices and volatile flavours. A consideration of the heating curves of the electric ovens discussed in the first part of this paper shows that to heat an oven up to 250 deg. C. and to keep it there for 15 minutes will increase the cost of electricity for roasting the meat about 50 per cent. In order to reduce this extra cost of energy another method was tried which proved very successful. Instead of searing the meat in the oven at a high temperature it was seared on the top of the stove, or, rather, by placing the meat in an aluminium dish over an 880-watt heating coil. The current was turned on for three minutes to get the dish quite hot. The meat was then placed in the hot dish and seared for ten minutes, being turned frequently so as to sear all sides.

After searing, an incision was made in the roast with a sharp narrow-bladed knife, and the thermo-couple was inserted as near as possible in the centre of the roast. The roast was then placed in the oven at the desired temperature. Placing the roast in the oven lowered the temperature by 10 to 20 deg. Full current was turned on until the temperature returned to the desired value; after that the temperature was kept constant within 2 deg. C.

When the temperature inside the roast indicated the meat to be cooked rare, the time and watt-hour readings were recorded. This was also done for medium rare and well done.

Fig. 11 shows the average time of cooking plotted against oven temperature. It will be noticed that at an oven temperature of 160 deg. C. the roasts are cooked in a shorter length of time than at 180 deg. This is probably due to the fact that the slightly charred surface of the meat is a poorer conductor of heat.

The per cent. loss in weight of the roasts increases with the temperature. As far as the losses in cooking a well done roast are concerned, meat is best when cooked between 100 and 120 deg. C., or possibly lower.

The other important factor which determines the best roasting temperature is the cost of the electricity used. The curves of fig. 12 give the energy used in roasting beef in the oven No. 2. The additional energy used in searing the roasts was the same in all cases, 190 watt-hours. It will be noticed that for rare and medium roasts 100 deg. is the most economical temperature. For all the ovens the most economical temperature for well-done roasts lies between 120 and 140 deg. C.

The energy required for roasting meat in oven No. 1 is considerably greater than for oven No. 2. This is due partly to the smaller amount of heat insulation used and partly to the larger size of the oven.

The saving in energy in favour of searing on top of the stove is surprisingly great, making a difference of $.05 (at $.05 per kw.-hr.) in the cost of preparing the roast.

A series of experiments were undertaken on the baking of biscuit, bread, and sponge cake, to determine the range of temperatures within which each article of food could be satisfactorily baked and the particular temperature within this interval which was the most economical for the ovens tested.

The range of temperature for baking biscuits was from 200 to 240 deg. C.

Fig. 13 shows the minimum time of baking and the per cent. loss of weight curves for the bread experiments. The loaves averaged 300 gm. in weight and were baked in a tin the dimensions of which were 3 in. by 5 in. by 3 in. deep.

In the bread experiments the most satisfactory results were obtained above 180 deg. At the lower temperatures the crust was hard and thick, due to excessive evaporation of moisture as indicated by the loss in weight curve. At 240 deg. the outside of the loaf had a tendency to brown over before the inside was thoroughly done.

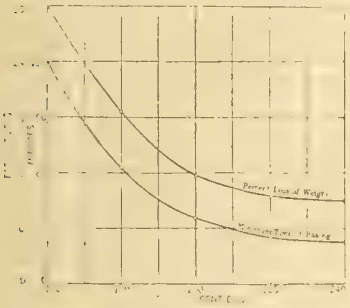


FIG. 13.

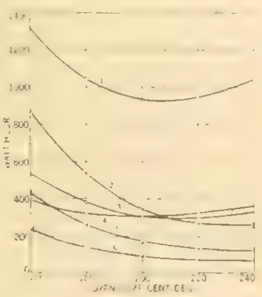


FIG. 14.

FIG. 13.—EFFECT OF OVEN TEMPERATURE ON TIME OF BAKING BREAD AND PER CENT. LOSS OF WEIGHT.

FIG. 14.—ENERGY REQUIRED TO BAKE BREAD STARTING WITH OVEN HOT AND WITH OVEN COLD.

1. Oven No. 1 cold	4. Oven No. 4 cold.
2. ,, ,, 1 hot	5. ,, ,, 2 hot.
3 ,, ,, 2 cold.	6. ,, ,, 4 hot.

The time required for baking a larger loaf would be somewhat longer.

The range of temperature for baking sponge cake lies between 170 and 200 deg. C.

If biscuits are baked immediately after other food is removed from the oven, so that preheating is not necessary, the energy required will be very small compared to the amount required if the oven has to be heated up from room temperature to baking temperature.

Because the conditions of baking biscuits satisfactorily are a high temperature for a short time, ovens used for this purpose should require as little energy as possible for preheating.

The curves of fig. 14 give the energy used in baking bread at the various oven temperatures with and without preheating. It will be noticed that for all the ovens the energy required is a minimum above 220 deg. The most economical temperature for baking bread when the oven is already heated is, therefore, from 220 to 240 deg. C.

The temperature for which the energy required is a minimum lies between 200 and 215 deg. C., depending on the oven used. Although the insulation of oven No. 4 is very much better than that of oven No. 2, it will be noticed that above 205 deg. oven No. 4 requires more energy for baking bread than oven No. 2. This is due to the larger amount of energy required for the preheating.

Consideration of the baking curves as a whole will emphasise the importance of the preheating characteristics in designing an efficient electric oven. For the kind of baking which requires a high temperature for a short time the preheating loss is considerably greater than the radiation and convection loss. Unless some method can be found for decreasing the energy used in heating the oven up from room temperature, it will not be practical greatly to increase the heat insulation of the ovens used for domestic baking. This does not apply, however, to ovens which are used for long intervals at the same temperature.

With the advent of electric ovens a revolution in the methods of cooking has become possible. Automatic electric ovens will probably be developed in which the temperature will be accurately controlled and the necessity of constant vigilance will be removed.

The present-day problem in electric cooking is to determine the methods of cooking that will yield the most in nutrition and flavour, and to formulate definite rules or directions so that a particular article of food can be cooked in the best possible manner by persons of ordinary skill. The engineer's problem is then to design practical cooking devices in which the temperature can be accurately regulated with a minimum of attention on the part of the housewife.

The increased popularity of the fireless cooker indicates that people are learning that food can be cooked at temperatures lower than the boiling point of water. The fact that several hours are required for the cooking is not a disadvantage when the process is automatic and does not require the attention of the housewife. Four hours would probably be the best time to cook the food. The housewife could put in the food for the mid-day meal immediately after breakfast while the oven was still hot. When it is taken out she could put in the evening meal, so that the oven would be used continuously. The preheating loss would thus be reduced to a minimum. During the latter part of the afternoon the housewife need not be tied to her kitchen, as all that would be necessary at this time would be to dish up the food and serve it.

The electric light and power companies should be interested in perfecting this method of cooking and in bringing it to the attention of their customers. A combination of the electric oven and the popular fireless cooker would be a very desirable load for the central station. It would be a nearly steady all-day load and would not interfere with the peak load even in the winter, as sufficient heat can be stored in a well-insulated oven to keep the food hot enough to serve for an hour or more after the current is turned off.

The results of the cooking experiments in electric ovens indicate that it is possible to reduce the art of cooking with electricity to an exact science. If definite rules of time and temperature were formulated for cooking each article of food, the inexperienced housewife could obtain uniformly good results with the expenditure of a minimum amount of attention and fuel.

THE REPORT OF THE ONTARIO HYDRO-ELECTRIC COMMISSION.

THE seventh annual report of the Ontario Hydro-electric Commission, which covers the year's working to October 31st, 1914, fills a bulky volume, which, with its numerous illustrations and detailed statistics, one must suppose [illegible] the most complete annual electric supply report in existence.

The total capital expended to October 31st last on the Niagara, Severn, Wasdell's, St. Lawrence, Eugenia, Port Arthur and Renfrew systems, and on municipal construction, etc., amounted to $10,130,048, of which some $4,390,000 was expended during the year. The Commission is [illegible] adding to [illegible] [illegible] [illegible] municipalities who are [illegible] [illegible] [illegible] in the present report, which [illegible] that [illegible] [illegible] these also have made investments in distributing plant to the extent of $15,2[illegible], [illegible] [illegible]

Large Transformer Station, Ontario Hydro-electric System.

Including operating charges these municipal undertakings cost for the year $2,634,7[illegible] and earned $[illegible], leaving a gross surplus of $[illegible] [illegible] depreciation, a surplus of $[illegible]. The accumulated surplus [illegible] invested in plant extensions, is $[illegible] [illegible], and deducting $850,618 for depreciation reserve, the surplus of $750,51[illegible] is over 10 per cent. on the revenue of the three years.

The report says, "the result is of particular interest and value as it is the final answer of the municipalities to their experiment in the co-operative transmission and municipal distribution of hydro power." The total number of consumers was 96,744, of which 93,179 were lighting and the rest power consumers. The highest cost per KW.-hr. for domestic lighting was 10.9c. and for commercial lighting, 9.4c.; the respective average costs were 4.8c. and 3.9c.

Standard Distributing Station.

The Niagara system is, of course, the principal one controlled by the Commission, having 609 miles out of the total of 800 miles of secondary transmission lines connected; the pressure of these lines varies from 46,000 to 2,200 volts. The yearly average H.P. of the Niagara system is over 50,000, while the connected power load is about 68,000 H.P. The total transformer and distribution station capacity of this system is 183,440 K.V.A. (including Niagara station, 80,500 K.V.A. and Toronto station, 25,000 K.V.A.), while for the whole of the Commission's systems, the capacity is apparently over 193,000 K.V.A.

During the year important extensions were carried out to the transmission system. A duplicate line from Niagara to Dundas, 50 miles, has been completed, using copper cable and tandem steel tower construction, with standard spans of 630 ft.

The first of the Commission's own power plants, at Wasdell's Falls, was brought into operation, this being a 1,200-H.P. hydro-electric plant.

The Eugenia Falls scheme which will develop 8,000 H.P., is now being carried out, the initial installation calling for two 2,250-H.P. turbines.

On account of the widening and deepening of the Welland Canal by the Dominion Government, it was necessary to lengthen the spans across the canal from 407 to 532 ft. To do this, one standard tower was removed from the transmission line, one anchor tower was moved 45 ft. and the two high towers supporting the canal crossing span were moved, one 63 ft. and the other 62 ft. The important part of this work was the moving of the two latter towers; each weighed 25 tons and was supported on a heavy reinforced concrete base; the overall height was 168 ft. These towers were moved standing, being pulled along timber skidways to new concrete foundations. To maintain continuity in supply, two temporary crossing lines were built north and south of the crossing, far enough apart to allow of a vessel in between, and by this means a boat could pass through with very little delay and without having a complete shutdown of the power circuits.

As many distributing stations are required to meet similar demands, the Commission has prepared standard designs and layouts, covering eight capacities, from 3-25 K.V.A. to 3-150 K.V.A. transformers.

Under the section devoted to "operation," the report states that the power furnished to the Commission by the Ontario Power Co. had been practically continuous during the year. The greatly reduced number of H.T. interruptions due to insulator trouble, indicates the efficiency of the arrangements now in use for eliminating defective insulators.

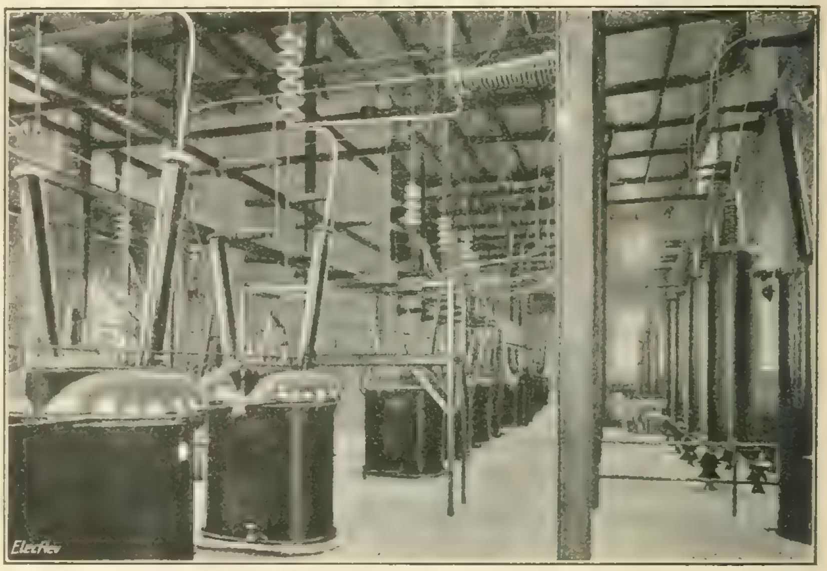
Thirty-three different electrical storms were reported over the system, and of these ten were severe and the rest moderate. They occurred between March 25th and October 10th, and seven of them traversed the whole system.

There were two total interruptions of service, due to lightning and only momentary. The operating characteristics of the steel reinforced aluminium transmission cable used on recent work have proved very satisfactory, and confirmed the advantage over the straight aluminium cable, which was expected.

All the municipalities under the control of the Commission have now adopted a standard schedule of rates; for domestic service this year the "service" charge is 3 cents per month per 100 sq. ft. of floor area, with a minimum charge on 1,000 sq. ft in cities; 1,200 sq. ft. in villages; or 1,500 sq. ft. in suburban districts, and a maximum service charge on 3,000 sq. ft. An additional consumption charge per unit is made, and a 10 per cent. discount is given for prompt payment. What is known as a "follow-up" rate (and has been used in this country with another name) is offered: all energy consumed over a certain amount being charged at half the recognized consumption rate. Commercial and street lighting rates are offered and power rates based on a charge of $1 per month per H.P. of connected load or maximum demand and three consumption charges, varying according to locality, for the first and second 50 hours' and subsequent use of the load.

In addition power consumers are divided into four classes, *i.e.*, 24 hrs. unrestricted and restricted users and 10 hrs. unrestricted and restricted users, and they receive discounts, amounting to 33⅓ per cent. in the latter case.

The Commission has a Purchasing Department whose services are offered to any municipality or institution in Ontario; about $600,000 worth or material was purchased during 1914



H.T. Room, London Transformer Station, Ontario.

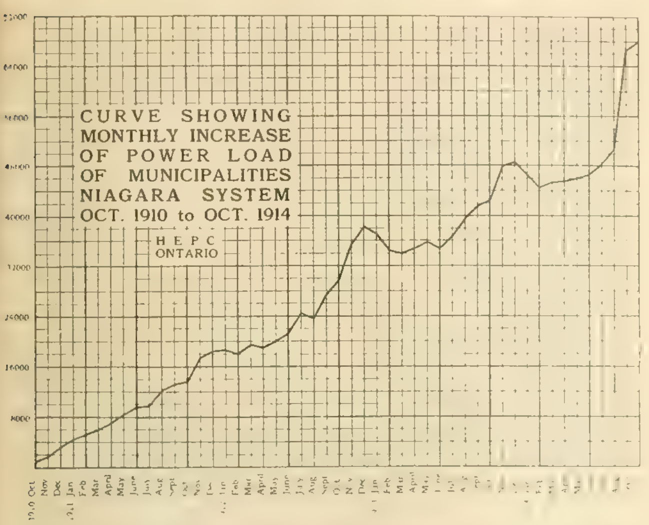
H.T. Room, Brant Transformer Station, Ontario.

in this way, and savings of from 10 to 50 per cent made in transformers, meters, lamps, and wire.

During the year an Electrical Inspection Department has been formed, and seventy municipalities have appointed inspectors.

Farming Supply.—Arrangements were made with a number of manufacturers for the erection of a model Barn and Dairy, which were electrically driven by a 5-H.P. and ½-H.P. motor respectively, and used for demonstration purposes at the Canadian National Exhibition, 1914. Each manufacturer had a demonstrator with his apparatus, and the opportunity was taken to instruct farmers as to supply facilities.

The exhibit was electrically lighted by a system installed in conduit, and a "Syndicate" electric outfit for silo filling and threshing, consisting of a 20-H.P. motor installed in one wagon, the necessary transformers, meters, and connections installed in another wagon, and one of the largest ensilage cutting boxes was also shown. Demonstrations of electric household and farming appliances were made at numerous fairs and exhibitions throughout the area.



NIAGARA LOAD CURVE, ONTARIO HYDRO-ELECTRIC COMMISSION.

The advantages of electric power over steam, gasoline, windmill, and sweep power are quite apparent to the farmer in most districts, but the question with him is how he can apply the power so as to receive full value for the money expended per year for service and power. To make proper comparison the value of the farmer's and his assistants' time has to be taken into account; until recently the farmer would not concede that his time was worth "so much per hour." Electricity in rural sections is supplied for farm lighting, power and cooking, including power for threshing and silo-filling. Also to brick and tile yards, saw mills, cheese and butter factories, pumps, chopping and flour mills, beet sugar factories, quarries, street lighting, etc.

Electric lighting is greatly appreciated by the farmer as relieving the dull appearance of the farm, decreasing the fire risk, etc.; in barns it is found necessary to run the wire in conduit.

The cost of such installations in Canada varies for open wiring from $1.25 to $1.75 per outlet, and for concealed wiring from $1.50 to $2.25 per outlet. Surface conduit installations in farms and farm buildings vary from $3.25 to $4.50 per outlet; the figure does not include fixtures, but includes switches. An interesting series of tables are included relating to farm uses of electricity, of which we give some abstract data in tables I.-III.

The totals are given below table II.; the service charge is $2.40 per month, and the current charge 1½c. per KW.-hour, with a 10 per cent. discount on the latter only.

[The revenue from the six farmers amounted to about £88-89 for domestic uses and one motor; the same revenue would be obtained in England with rates of 6d. per unit for lighting and 2d. per unit for power.]

Table III.—Total KW.-hours, 5,524; av. cost per KW.-hour, exclusive of syndicate motor, 2.54c., and for all uses, 2.65c.

Similar data relating to five farms is given, from which it appears that electrical milking machinery costs between .18c. and .26c. per cow per milking for farms with from 12 to 30 cows, and together with lighting and water heating (where used) gives the biggest individual revenue items. The average yearly consumption per farm for the five cases, for all purposes, was 4,700 KW.-hours, and the average revenue per farm $134 (£27).

Municipal and Railway Work.—During the last two years 22 municipalities have consulted the Commission regarding their underground systems, and the question of street lighting has been considered at the same time. For ornamental street lighting the nitrogen-filled lamp has been used with advantage, and complete installations of these lamps have been made at Hamilton and Stratford. Resolutions have been received from 138 townships, 38 villages, 42 towns, 11 cities, etc., asking for reports and estimates on proposed electric railways; preliminary surveys have been made of some 1,200 miles of line.

Sections of the report deal with the work of the Commission's testing and research laboratories, and with hydraulic investigation and the construction of recent hydro-electric additions to the Commission's plant.

TABLE I.—COMPARISON OF ELECTRIC AND STEAM THRASHING COSTS ON VARIOUS FARMS.

Running time; hrs.	Bushels of grain.	KW. hours used.	Cost At 4½c. per KW.-h.	Cost By steam.
15½	2,017	280	$12.60	$28.87 *
9½	1,380	174	7.83	16.62 *
7	710	130	5.85	7.00 *
34	3,000	297	13.37	34.00 †
30	2,290	665	29.93	30.00 †
14½	1,775	268	12.06	14.50 †
15	1,750	286	12.87	15.00 †
35	2,710	540	24.30	35.00 †
21	2,370	452	20.34	21.00 †

* By custom rig. † By syndicate rig, engine only, at $1 per hour.

TABLE II.—SIX FARMERS: DOMESTIC AND SYNDICATE MOTOR USES ONLY.

Domestic use. Average KW.-hours per day.	Domestic use. Estimated KW.-hours per year.	Syndicate motor, KW.-hours per year estimate.	Total KW. hours per year, domestic and syndicate motor.	Cost per year current plus $30 service charge.
·84	306	836	1,142	$76.25
1·29	471	1,060	1,531	92.00
1·04	368	856	1,224	79.58
·8	294	505	799	62.36
·97	354	435	789	61.95
·82	297	746	1,043	72.24
5·76	2,090	4,438	6,528	$444.38

TABLE III.—DETAILS OF ENERGY USED ON ONE FARM.

Operation.	Times used per year.	Total hours per year.	H.P. of motor.	KW.-hours per year.	Cost of electricity
Milking	660	440	2	748	$19.00
Grinding	12	84	5	315	8.03
Cream separating...		all	milk	sold	
Pumping	330	412	5	412	10.46
Sawing	—	—	5	19	.48
Thrashing... ...	—		25	216	8.64
Silo-filling... ...		—	25	178	7.12
Water heating ...	250	2,000	—	1,200	30.48
Vacuum cleaner ...	44	22	1/6	3	.08
Washing	36	18	1/6	2	.05
Electrical iron ...	44	176	—	88	2.24
Lighting	—	—	—	1,649	41.88

As regards testing, the peculiar characteristics of the demands of rural consumers which now form a rapidly increasing percentage of the Commission's power load, have called for special types of metering apparatus, and experiments have been conducted on various metering principles to meet the requirements.

Prolonged tests under actual conditions have been carried out on six types of electric cooking ranges, twelve makes of electric toaster, and 14 makes of electric irons.

The subject of street illumination was investigated. A large majority of towns use the series system of distribution and 60—100-watt lamps equipped with radial wave reflectors.

In connection with the question of exterior illumination, extensive tests have been made on different glassware, the results showing a consistent superiority of one make over the other.

Some 750 lots of lamps, representing 100,000 lamps, were tested during the year.

Advance in Prices.—THE WALSALL ELECTRICAL CO., LTD., announce that they have withdrawn all outstanding quotations from June 14th, excepting those given in within the last 30 days, which will hold good for a period of 30 days. They are at present rearranging their catalogue prices, and will notify the trade of their new prices in the near future. In the meantime they will be pleased to quote against specification.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

([illegible] expressly for this journal by MESSRS. W. P. THOMPSON & CO., [illegible] Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.)

8,[illegible]2. "Transmitter." H. [illegible] (F[illegible] Telegraph Co., United States). May 31st. (Complete.)

8,01[illegible]. "Construction of [illegible] magnets." STEEL, PEECH & TOZER, LTD., & H. I. BOWES. May 31st.

8,028. "Electrical [illegible] apparatus." H. [illegible] WEST. May 31st. (Complete.)

8,041. "Electrical targets [illegible] which projectiles are not actually fired." W. H. B. SIMMONDS & [illegible] MATTHEWS ([illegible] as F. J. Matthews & Co.). May 31st.

8,047. "Switches for lighting installations." R. BOSCH (firm of). May 31st. (Convention date, June 9th, 1914, Germany.) (Complete.)

8,052. "Magneto [illegible]." F. H. L'ABBE LENT. May 31st. (Complete.)

8,060. "Electro-magnetic locking devices." L. CADENEL. May 31st. (Divided application on 13,715/14. Convention date, June 10th, 1913, France.) (Complete.)

8,074. "[illegible] meters of the [illegible] centre." R. BEATTIE. June 1st.

8,090. "Apparatus [illegible]." W. A. A. [illegible]. June 1st.

8,099. "[illegible] light [illegible]." R. F. [illegible]. June 1st.

8,100. "[illegible]." F. R. QUAIN. June 1st.

8,106. "Alternating electric transformer protective arrangements." F. E. BERRY. June 1st.

8,107. "Oil-cooled transformers." BRITISH ELECTRIC TRANSFORMER CO., LTD., & W. McWILLIAM. June 1st.

8,163. "Connectors for electrical signalling wires and cables." A. W. S[illegible]. June 2nd.

8,169. "Electric hoisting equipment." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States). June 2nd.

8,173. "Vapour rectifiers." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO., LTD. June 2nd. (Convention date, July 11th, 1914, United States.) (Complete.)

8,180. "Three-way switches [illegible]." R. BOSCH (firm of). June 2nd. (Convention date, February 18th, 1915, Germany.) (Complete.)

8,189. "[illegible]." F. A. H. MESSAY. June 2nd. (Complete.)

8,19[illegible]. "[illegible] signals [illegible] railway and [illegible]." W. F. J. H. BOUMAN. June 2nd. (Convention date, June 2nd, 1914, Holland.) (Complete.)

8,203. "Sound-transmitting means." P. J. HACKETT. June 2nd. (Complete.)

8,204. "[illegible]." W. [illegible]. June 2nd. (Complete.)

8,221. "A [illegible] plug top." H. A. DAVIES & [illegible] BASSETT. June 3rd.

8,227. "Electrical generators." F. A. HEYS (Neuland Magnetos, Ltd., [illegible] States). June 3rd. (Complete.)

8,2[illegible]8. "Discontinuous [illegible]." A. W. SHARMAN. June 3rd.

8,245. "Electric welding and apparatus [illegible]." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States). June 3rd.

8,268. "Multiple [illegible] plugs." G. DAVIES. June 3rd. (Complete.)

8,272. "[illegible] metals, tungsten in particular." ALLGEMEINE ELEKTRICITATS-GES. June 3rd. (Convention date, June 3rd, 1914, Germany.) (Complete.)

8,303. "Insulation division piece or partition for a controller arc deflector, [illegible]." W. R. McRAE & R. RUSSELL. June 4th. (Complete.)

8,305. "Method of and means for separating metals by electrolysis." A. WALSH. June 4th.

8,318. "Mechanism for operating [illegible] railway track points." J. MURRAY. June 4th.

8,319. "Electric wiring systems." G. S. BOOTHBOYD & CALLENDER'S CABLE AND CONSTRUCTION CO., LTD. June 4th.

8,321. "Apparatus for use in wireless telegraphy and the like." M. F. S[illegible], R. M. GRAVES, & B. BINYON. June 4th.

8,326. "Electric welding and apparatus therefor." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States). June 4th.

8,327. "Composite metal bodies." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States). June 4th.

8,332. "Holders for electric incandescent lamps." A. H. MIDGLEY & C. A. VANDERVELL. June 4th. (Complete.)

8,333. "Electric heating devices." JOH. KREMENEZKY (firm of). June 4th. (Convention date, June 9th, 1914, Austria.) (Complete.)

8,334. "Dynamo-electric driving mechanisms of the unipolar systems." M. BRESLAUER. June 4th. (Convention date, June 4th, 1914, Germany.) (Complete.)

8,358. "Field telephone and telegraph apparatus." H. NORTH. June 5th.

8,367. "Sparking plugs." M. POUSSON. June 5th. (Addition to 6,593/15. Convention date, June 16th, 1914, France.) (Complete.)

8,374. "Fluid-pressure braking apparatus." W. V. TURNER. June 5th. (Convention date, October 1st, 1914, United States.) (Complete.)

8,375. "Fluid-pressure braking apparatus." P. H. DONOVAN. June 5th. (Convention date, Nov. 25th, 1914, United States.) (Complete.)

8,376. "Safety device for use with electrically-driven vehicles." W. V. TURNER. June 5th. (Convention date, October 24th, 1914, United States.) (Complete.)

8,377. "Fluid-pressure governing mechanism." June 5th. (Convention date, November 25th, 1914, United States.) (Complete.)

8,378. "Fluid-pressure braking apparatus." W. V. TURNER & P. H. DONOVAN. (Convention date, February 10th, 1915, United States.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1914.

11,842. CONTROL APPARATUS FOR ELECTRIC LIGHTING SYSTEMS ON MOTOR CARS. F. E. Wilson. May 13th.

11,889. CONNECTION BOXES, JUNCTION BOXES, AND THE LIKE. St. Helens Cable & Rubber Co., and J. C. White. May 14th.

11,987. ELECTRICAL APPARATUS FOR AUTOMATICALLY LOCKING RAILWAY CARRIAGE DOORS WHILE THE TRAIN IS IN MOTION. E. Genders & H. B. Genders. May 15th.

12,047. SELF-PROPELLED VEHICLES. British Thomson-Houston Co. (General Electric Co.). May 15th.

12,350. MAGNETOS AND THE LIKE. H. Ford. May 19th. (Addition to 15,636/13.)

12,386. ELECTRIC METERS. British Insulated & Helsby Cables, Ltd., and I. B. Wilson. May 20th. (Cognate application, 15,615/14.)

12,551. ELECTRICAL HEATING APPARATUS. A. F. Berry. May 21st.

12,599. FITTINGS FOR METALLIC CONDUIT SYSTEMS FOR HOUSING ELECTRICAL CONDUCTORS. Simplex Conduits, Ltd., & L. M. Waterhouse. May 22nd.

12,885. ELECTRICAL SIGNALS IN MINES AND COLLIERIES. E. C. Theedam, Ltd. May 26th.

12,906. LAMP-LOCKING AND ANTI-VIBRATOR DEVICE TO INCANDESCENT ELECTRIC LAMPHOLDERS OF THE BAYONET SOCKET TYPE. C. Wharram. May 26th.

13,095. GALVANIC BATTERIES. A. Thomas & J. Stott. May 28th.

13,374. HIGH-FREQUENCY CURRENT RECTIFIER FOR RECTIFYING HIGH-FREQUENCY WAVE IMPULSES IN A WIRELESS RECEIVING CIRCUIT. C. S. Lenz. June 2nd.

15,356. ELECTRIC INDUCTANCE COILS FOR THE PROTECTION OF ELECTRICAL MACHINES AND CIRCUITS. J. S. Highfield & W. Duddell. June 26th.

15,681. APPARATUS FOR RECEIVING OR RELAYING ELECTRIC SIGNALS. G. W. Pierce. June 30th. (August 5th, 1913.)

15,868. ELECTRIC METERS OF THE INDUCTION TYPE. British Thomson-Houston Co. (General Electric Co.). July 2nd.

16,612. ELECTRIC HAIR BRUSHES. V. Sence. July 11th.

17,004. MACHINE SWITCHING TELEPHONE SYSTEMS. Western Electric Co. (F. T. Woodward acting for Western Electric Co.). July 17th.

18,092. ELECTRIC ACCUMULATORS OR SECONDARY BATTERIES. F. A. Coles. July 31st.

21,904. TELEPHONE CALL REGISTERING DEVICES. V. Thompson. November 2nd.

1915.

5,848. COMMUTATORS FOR DYNAMO-ELECTRIC MACHINES. F. Zimmerman. April 19th. (April 17th, 1914.)

The Fixation of Atmospheric Nitrogen.—A great electrical undertaking which is intended to furnish energy in connection with the fixation of atmospheric nitrogen for the production of calcium cyanamide, from which nitric acid is to be obtaine for the manufacture of explosives, so as to render the countr totally independent of external sources, in association with othe works extracting nitric acid from synthetic ammonia, is now bein taken in hand in Germany by the Berlin Electricity Works Co The undertaking is primarily based upon the utilisation as fuel o the extensive lignite coalfields at Golpa-Jessnitz, near Bitterfeld which were originally acquired by the Berlin company in expecta tion of a prolongation of its concession in Berlin and the intentio to transmit power from Bitterfeld for distribution in Berlin. Bu before the Berlin Municipal Council recently resolved to take ove the undertaking of the Berlin electricity works next October, i had been decided on national grounds to devote the lignite field in question, which cover a superficial area of over 2,500 acres affording an adequate quantity of fuel for the projected statio for a period of 30 years, to the realisation, indirect as it is of the scheme for the fixation of nitrogen. The fields are owne by the Golpa-Jessnitz Co., which, in turn, is controlled by th Berlin company, which will possess the whole of the former' capital on the receipt from the Berlin municipality of the amoun of the purchase price for the Berlin undertaking next October. A for the scheme itself, it appears that the Golpa-Jessnitz Co. ha concluded a contract with the Bavarian Nitrogen Works Co. whereby the former has agreed to supply the latter wit energy at a pressure of 80,000 volts for a period o fifteen years, the purchaser having the right to exten the contract for a further ten years on the sam conditions, which are not disclosed, but which are reported t represent a price as low as 1 pfennig (·125d.) per KW.-hou owing to the exceptionally favourable conditions for working th lignite deposits. On its part the purchasing company has under taken to accept delivery of 500,000,000 KW.-hours per annum It is intended to erect for this purpose a generating station fo an output of 180,000 KW., divided among eight units each o 22,500 KW., of which four sets are said to be already under con struction and are to be brought into operation by the end of th present year. The second batch of four machines is to serve fo supplying undertakings similar to the Bavarian company, whic are to be established near Bitterfeld, and the total output wil then reach 1,000,000,000 KW.-hours per annum. The electro chemical plant for the Bavarian company is also in course of con struction, so as to be ready when the four sets of generatin machinery at Bitterfeld are brought into use. In this way th Germans hope to be able to meet the entire home demand fo explosives and fertilisers in conjunction with the large extension of plant for the production of synthetic ammonia which are i progress at the Baden Aniline works, and which are also to b completed by the beginning of 1916.

Aluminium Solder.—A new aluminium solder, know as the A B C, has lately been introduced by PROCTOR'S GARAGE LTD., of Parliament Buildings, Orchard Street, Westminster, an Tontine Street, Folkestone. The solder is stated to be the resul of a long series of experiments, its success being due not only t the ingredients used, but also to the special method of mixing which ensures the quality being always reliable and free fro variation. It is claimed that the solder can be used equally we for either the oxy-acetylene or ordinary tinsmith's process, pro vided the simple instructions given in a leaflet sent out by th company are followed.

THE

ELECTRICAL REVIEW.

VOL. LXXVII. JUNE 25, 1915. No. 1,961.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: June 25, 1915. [No. 1,961.

Page
The I.M.E.A. Meeting 877
Rubber 878
Street Explosions 878
The Regent Palace Hotel (*illus.*)... 879
Battery-Bell Signalling Systems in Mines (*concluded*) ... 881
A Locomotive Coach fitted with the Thomas Transmission (*illus.*) 882
Legal... 885

Correspondence—

Automatic-Lift Accidents 886
Pitting of Brushes 886
Battery-Bell Signalling Systems in Mines... 886
New Electrical Devices, Fittings and Plant (*illus.*) 887
War Items 888
Business Notes 889
Notes... 894
Electrical Progress in Shanghai 896
City Notes 897
Stocks and Shares 899
Share List of Electrical Companies 900
Market Quotations 900
Exports and Imports of Electrical Goods during May, 1915 ... 901
Import Trade of Peru 902
Incorporated Municipal Electrical Association 902
The Practical Result of the Point Five Tariff 903
The Use of Electric Vehicles in Municipal Service ... 904
Trade with Italy 906
New Patents Applied for, 1915 908
Abstracts of Published Specifications 908
Contractors' Column ... ... Advertisement page xx

THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos.: Holborn 938; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND, N.Z: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

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MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto I. 307.
SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London, City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).

1915 EDITION
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THE I.M.E.A. MEETING.

ALTHOUGH the meeting of the Incorporated Municipal Electrical Association this year was held under exceptional conditions, and the business was limited to the reading and discussion of reports, the proceedings were by no means devoid of interest. The attendance was fairly good, all things considered, and the discussions were well maintained. One outstanding feature of the proceedings was the catholicity of the Association's activities, which was well exemplified in the range of subjects touched upon in the report of the Council. The meeting of the Association in the theatre of the Institution was not without a certain irony.

The joint report of Messrs. Blackman and Roles was in effect a eulogy of cheap units combined with the rateable-value system. It is clear that the Point Five tariff increases the consumption per house and the amount of consuming apparatus installed in a remarkable degree; the revenue per house is also materially improved, though, as would be expected, the average price obtained per unit is much less. Thus both the consumer and the contractor are "satisfied." The correction applied by Mr. Blackman to his figures, to allow for the effect of the introduction of the metal-filament lamp, is important in interpreting the results; it does not appear in Mr. Roles's tables, though his comparative figures for last year indicate that the 1910 results cannot safely be used without it. It is satisfactory to note, too, that the maximum load on the feeders has increased at a far less rate than the kilowatts installed—giving due weight to the footnote to Mr. Roles's table. To sum up the matter briefly, it appears that the rateable-value method of assessment applied with discretion affords a very practical means of arriving at the fixed charge, and is easily understood by the consumer; the running charge of a halfpenny per unit adequately covers the cost under the conditions obtaining; with few exceptions, no difficulty has been experienced due to the increased load on the mains; the use of one meter and a single wiring system is an immense advantage; and the adoption of electric heating and cooking has received a very marked stimulus wherever the tariff has been introduced. It was distinctly unfortunate that the discussion side-slipped on to the subject of the rateable-value system, which was merely incidental to the report.

Mr. Ayton's report on the use of the electric vehicle in municipal service contained powerful arguments for the adoption of this type, and indicated that many municipal authorities had been so far impressed by its advantages as to place orders for "electrics." Most of the arguments, it is true, are more or less familiar, but they will bear much repetition—it is singular how difficult it is to persuade people to do themselves a good turn. The economy of the electric vehicle as compared with either horse haulage or petrol propulsion was clearly brought out—and this in spite of the heavy (some say excessive) first cost. It is interesting to note that satisfactory results are recorded, no matter what type or make of battery is used. With the battery and tires on maintenance contracts, there is little left to worry about, as the rest of the equipment is not likely to run up high maintenance charges, and the convenience, ease of handling, instant readiness and other advantages of the electric vehicle cannot be questioned. Much interest was shown in the collection of vehicles drawn up on the Embankment, representing a great variety of applications, and we trust that the outcome of the demonstration and report will be greatly increased interest and sympathy on the part of municipal engineers, and a greater readiness to provide charging facilities and a uniform price of 1d. per unit "off the peak." Without the charging facilities "electrics" cannot become popular; without the "electrics" the charging facilities are useless. This is a typical "vicious circle," and it rests with the station engineers to break through it by doing their part first—the public will do the rest. The risk is small, and the prospect of reward abundant.

The report of the Council shows that in many directions progress is being made, but definite conclusions have not been attained. We note with regret that further negotiations with the Electrical Contractors' Association have failed to remove the deadlock between the two bodies, though the Scottish E.C.A. has accepted terms less advantageous than those offered in the I.M.E.A. Bill. There appears to have been a regrettable misunderstanding with regard to the Yorkshire Electric Power Co.'s Bill; had the I.M.E.A. been correctly informed as to the limits of the powers sought by the company, it would probably have refrained from active opposition to the Bill. It is interesting to note that in many respects the Association is in close co-operation with the B.E.A.M.A. At a joint meeting of representatives of the two bodies with the British Engineers' Association to consider the protection of British interests, it was decided to appoint a committee to prepare a scheme for the creation of a new Government Department, to be entitled the "Board of Industry," one of the main objects being to ensure that public money should be expended only on British manufactures—a principle with which we are in cordial agreement.

The Development Committee appointed last year has been hampered by the war, and appears at present to be marking time; progress has, however, been made with the organisation, and several sub-committees have been formed, the members of which are largely drawn from outside the Association. The Committee emphasises the necessity of additional powers, such as those embodied in the I.M.E.A. Bill, to enable municipalities to engage in publicity and development work.

The progress made by the Electric Vehicle Committee has been recorded in our pages from time to time, particularly in connection with the urgent work of standardisation, and merits hearty commendation; we are glad to observe its unremitting activity, and the freedom with which it enters into collaboration with other societies.

Cordial co-operation between all branches of the electrical industry, and indeed between all sections of the nation, is the most pressing need of the hour; it is not a common feature of our national life, unfortunately, but this is no time for petty jealousies, academic scruples, and casual methods. Organised and collective effort is imperatively necessary to the maintenance of our prosperity; we must all pull together, and pull hard! And in this respect an excellent example is exhibited by the I.M.E.A. and its Committees.

Rubber.

A very fair degree of activity has been passing in the crude rubber market within the last month or so, and although there have been moderate fluctuations in prices, the general tendency has been by no means unsatisfactory when all the circumstances are considered, and it is as clear as possible that consumption is proceeding upon a thoroughly satisfactory basis. There is no great supply of material available on the spot and for early delivery, while the demand is distinctly brisk, with No. 1 latex in the neighbourhood of 2s. 5d. per lb. There has also been a pronounced demand for forward deliveries, and a fair volume of business is reported at prices which must be regarded as exceedingly satisfactory to the growers. There is a disposition to take a strong view regarding the forward position owing to disturbances in the Near East, of which only vague and indefinite reports have reached this country. It is stated now that the trouble in Ceylon has been only a trifling affair, and this may possibly be true. It seems perfectly clear from the private news coming to hand that there is a good deal of unrest, not only in Ceylon but in the Federated Malay States. Various considerations, however, tend to stiffen the rubber market, where fortunately people are still alive to the common-sense point of view, recognising that any serious disturbance of the arrangements made for harvesting the rubber crop will have a very important bearing upon the military effectiveness of the Allies. The consumption of motor tires at the front is simply stupendous, and is bound to increase as more and more troops are put in the field, hence the production of tires and other accessories is limited so far as this country is concerned only by the amount of labour available. America is taking quite a considerable interest in the market, and has been doing a very fair amount of buying in the centres of production. It is estimated by leading trade authorities that the United States this year will import not less than 80,000 tons compared with 60,000 tons last year, 50,000 tons in 1913, and 40,000 tons in 1912. The quantities exported from this side to America this year show an enormous expansion, and the growth seems likely to continue. The way in which America is now showing a preference for plantation rubber over fine hard Para is a matter of general comment, and this preference seems likely to be carried still further.

The exports of plantation rubber from the Federated Malay States during May amounted to 2,708 tons as compared with 2,777 tons in April, and 2,069 tons in the corresponding month last year. The following table shows the exports month by month for the past three years:—

	1913.	1914.	1915.	
January... ...	1,231	2,542	3,473	tons.
February ...	1,757	2,364	3,411	,,
March	1,737	2,418	3,418	,,
April	1,626	2,151	2,777	,,
May	1,225	2,069	2,708	,,
Total (5 months)	8,476	11,544	15,787	,,

Street Explosions.

The case of Goodbody *v.* Poplar Borough Council, which is fully reported in the "Justice of the Peace" (June 5th, page 218), establishes a principle which is of considerable interest to electrical undertakers. The defendants constructed under the pavement a brick chamber in which was placed a box containing fuses. Gas from mains in the neighbourhood leaked into the brick chamber and exploded, owing to the emission of a spark from a fuse in the box. The plaintiff, who was injured by the explosion, brought an action against the Council. A jury found that the defendants had not been guilty of negligence, and that the chamber was not a nuisance, and judgment was entered in their favour. On appeal by the plaintiff it was held that the defendants, not being responsible for the presence of the gas in the chamber, which alone made it a dangerous thing, were not liable. It follows from this that where a street box is properly constructed, the mere occurrence of a short circuit is not a matter which gives a person injured by an explosion a right of action against the electric supply company. It would seem, however, that in such a case the plaintiff may successfully sue the gas company. We recall a case which was heard in the King's Bench Division before Mr. Justice Darling and a jury on March 16th, 1905. The action was brought to recover damages against a gas company for personal injuries caused to the plaintiff by the explosion of a telephone-wire box in Regent Street. There was practically no dispute that the explosion was caused by gas which had escaped from the company's mains, and was ignited by a lamp. The question for the jury to decide was whether the accident arose by reason of any negligence on the part of the gas company. Practically the only evidence on this head was that the gas had escaped, and in spite of the fact that witnesses for the company said it was virtually impossible to prevent a certain amount of gas escaping from street mains, owing to the vibration caused by traffic, the jury held the gas company responsible and they were mulcted in damages. It should be mentioned that an attempt was made, in the Poplar case, to put responsibility for the damage on to the Borough Council on the ground that, in accordance with a well-known principle of law, he who brings a dangerous thing such as electricity on to his land must keep it there at his peril. Mr. Justice Sankey, however, pointed out that here the mischief was done by the gas escaping from the gas company's property into the electrical authority's property, namely, the street box, and that there was no authority for the proposition that a man is under duty to keep a mischievous thing from other people's property off his own land.

THE REGENT PALACE HOTEL.

The Regent Palace Hotel, which has been erected by the Strand Hotel, Ltd., at a cost of £600,000, on an island site adjoining Piccadilly Circus, London, W., is said to be the largest hotel in Europe, being capable of accommodating some 1,500 resident visitors; it is truly palatial in character, and has been built and equipped on the most modern and advanced lines. The engineering installation is especially elaborate and well-designed, and embodies features of exceptional interest, being in some respects unique. Hot and cold water supply and electric heating are provided in every room; the ventilation scheme has been laid out with the utmost care, and electricity is freely employed for lighting and power, bells, &c.

The heating, ventilating, and general engineering plant was designed by Mr. A. H. Barker, and was installed under his supervision; the electrical equipment was carried out by the company's own staff, under the direction of their chief electrical engineer, Mr. Cushion. There are in all some 300 miles of pipes in the building, 15 miles of air ducts, 180 miles of electric cable, and upwards of 300,000 ft. of screwed conduit; the lighting installation includes some 6,000 Osram lamps. From these remarkable figures an idea of the magnitude of the undertaking may be gained.

The heating of the building is effected mainly by hot water and steam radiators, three boilers being provided in the sub-basement for this purpose; electrically-driven centrifugal pumps are employed where necessary to assist the water circulation. There are 1,028 bedrooms, each of which can be warmed by a Belling radiator of 1½ kw. Hot water is supplied to all bedrooms and to the hotel generally by three large calorifiers in the sub-basement; the temperature of the water is automatically controlled by electric valves, and the circulation is assisted by electrically-driven pumps. The ventilating system, which is entirely distinct from the heating installation, is exceptionally complete and elaborate. The principal reception rooms are supplied with fresh air, washed and cooled, or warmed if necessary, by two large centrifugal fans, driven by belts from electric motors; each principal room is also provided with an independent air-extracting fan, so that fresh air is forced in while vitiated air is simultaneously withdrawn, thus avoiding the production of draughts. Warmed or cooled air can be admitted to any room by separate ducts, so that adjoining rooms can be maintained at different temperatures if desired. Special care is taken to ventilate the huge kitchen through ducts entirely separate from the rest of the system, in order to render it impossible for the smell of cooking to penetrate any other part of the building. Warm air is supplied to the large linen room by a Sirocco fan driven by a 5-H.P. motor, and each bedroom, bathroom, &c., is separately ventilated by a duct running to the top of the building.

One of the most interesting novelties in connection with the heating and ventilating systems is the "control room," from which point the whole of the installation is controlled by one man. For this purpose, of course, electricity is the ideal agency to employ, and hence the control room is to be equipped with an array of electrical instruments (owing to the war it has not been possible as yet to complete the installation). By means of these instruments—many of which are of Mr. Barker's own invention and design—the engineer-in-charge can ascertain the temperature at any one of about 250 points in the building; any five of these points can be simultaneously connected to a multiplex recording instrument, so that the changes of temperature can be recorded over any desired period. Other instruments measure the volume of air being supplied at any time to each of the reception rooms, and its temperature. Other indicating instruments show the water level in each of the 16 large water tanks, the boiler pressure, the temperature of the hot water supply, and even the proportion of CO_2 in the flue gases. Thus, the engineer has a bird's-eye view of the working of the whole installation; moreover, he is provided with controlling gear by means of which he can regulate all these factors without leaving the room. Most of the controlling devices are electrically operated, though a few are adjusted by levers, and the apparatus is so organised that not only can the normal conditions be maintained in every part of the hotel, but also emergencies can be instantly met; for instance, a sudden influx of several hundred persons into one of the reception or dining rooms, previously unoccupied, demands an immediate readjustment of the heating and ventilating apparatus, and this can be effected at a moment's notice. The nice balance of air pressures in different rooms is an important point which is fully provided for; as an example, the air in the grill room, which immediately adjoins the kitchen, is always maintained at a slightly higher pressure than the air in the kitchen, so that when the communicating doors are opened there is an outward flow of air from the grill room, and under no circumstances can the kitchen atmosphere gain access to the grill room. The engineer-in-charge is in telephonic communication with every part of the building, and acts the part of a beneficent clerk of the weather towards all its occupants.

A pneumatic dispatch system, installed by the Lamson Pneumatic Tube Co., Ltd., provides a rapid service between various departments by means of independent lines, which do not, as usual, radiate from a central point. This installation comprises over 4,000 ft. of tubing, and is operated by a Roots blower driven by a 6-H.P. motor.

The electrical installation is necessarily of exceptional magnitude and completeness. The whole of the current is supplied at 220 volts by the St. James's and Pall Mall Electric Supply Co., Ltd. Two 0·8 sq. in. cables are run directly and independently into the building from the Carnaby Street sub-station for the heating circuits, and the other main cables are proportionately large.

Interior of one of the Switch rooms, showing Main Circuit breaker, Meters, Disconnecting Links, &c.

They are taken into two separate switchrooms through the company's main switch fuse and a circuit breaker. Three systems are provided: for general lighting, "police" or "Council" lighting, and for the general power service. Each has a capacity of 300 amperes, making a total capacity, apart from the special service to the electric heaters, of 1,800 amperes. The "police" service is a separate service required by the regulations in all public buildings of this kind.

The main service is taken into three main distribution boards, and from these are taken cables which serve each floor independently. Every floor is also separately metered and protected by enclosed cartridge fuses of G.E.C. make.

The distribution board controlling the heating circuits is in a separate chamber in the sub-basement; it comprises 60 separate D.P. fuses and switches, and is over 30 ft. long. From this board are taken 56 pairs of 19/16 cables to the various floors, and on each floor there are six sub-distribution boards. The sizes of the cables and feeders are designed to allow the whole of the heaters to be turned on at the same time.

The accompanying illustrations show the interior of the two switchrooms and the distribution board for the heating circuits. The arrangement of the switchgear is such that should the supply from either source break down, the whole of the circuits can be concentrated on the sound supply within a few seconds by withdrawing the links from the isolating switches on the faulty mains.

The whole of the wiring is carried out in screwed steel "Geekoduct" conduit, with brass unions, which are designed to secure lasting mechanical and electrical continuity throughout the system. Throughout the whole scheme a special water-tight junction-box has been used at frequent intervals. This, together with the conduit lay-out, permits of the withdrawal of any length of wire or cable without any disturbance of the permanent structure, the decorations of the building, or the plaster or cement in which the conduit is buried. The conduit work deserves especial praise, as we have never before seen a job so admirably carried out; the symmetry of the bends in heavy conduit, the neat and orderly arrangement of the tubing, even where dozens of pipes have to be accommodated in a confined space, and the finish imparted to every portion of the work, reflect the highest credit on Mr. Cushion and his staff.

[illegible]

Interior of Switch-room, showing Main Meters, Disconnecting Links, Council Switchboard, &c.

[Campbell-Gray.

Motor Driving Buffing Machines for Boot-cleaning.

It is apparent that no expense has been spared to make the installation in every respect of the first class, and worthy of the building in which it is installed.

There are five electric passenger lifts, each constructed to carry a load of 15 cwt. at a speed of 300 ft. per minute, the height of travel varying from 85 ft. to 122 ft.—one lift travels from the basement to the roof. The cages are of handsome design, and are fitted with Waygood-Otis safety apparatus, designed to arrest the descent of the cage in case of failure of the suspension ropes.

The winding machines are of the firm's latest pattern, with powerful motors coupled to machine-cut worm and wheel winding gear of high efficiency, and designed for smooth running.

Each lift is controlled by a pilot switch in the cage operated by a removable handle which actuates the main controller; the latter is specially designed to secure smooth and gradual starting and stopping.

In connection with the passenger lifts, a signalling arrangement is employed, of the newest pattern. In each cage is fitted a flash-light annunciator signal fixture. When a passenger wishes to call a lift he pushes the button on the enclosure, and this illuminates in each cage a miniature lamp representing that particular floor, and also operates a small buzzer to call the attention of the operator to the signal. The first cage arriving at the floor from which the signal is given will stop and pick up the passenger, and upon leaving the floor will automatically extinguish the signal lamp in all the cages.

The signal is entirely automatic in its operation, and gives the operator no opportunity to extinguish it until he has reached or passed the floor from which the signal is given.

The indicator in each cage shows the operator the direction in which the passenger wishes to travel, as well as the floor on which he is standing. One call-push on each floor is arranged for two lifts, and one for the other three lifts, which are grouped together.

On the ground floor in connection with each lift is provided a mechanical indicator with arrows working on a semicircular dial, which will show the position of each lift in the shaft.

Up and down signal lights are fitted on intermediate floors, which indicate the direction in which the lift is travelling.

This arrangement gives a most complete and convenient system for operating the lifts in groups, to make sure that a passenger requiring the use of the lift receives prompt attention, and at the same time it avoids two or three lifts going to the same floor to answer a call.

There is also an electric luggage lift carrying a load of 15 cwt. at a speed of 300 ft. per minute, and two electric goods lifts of the same duty which travel from the basement to the ninth floor. In all there are 32 lifts, including service and restaurant lifts.

Messrs. Waygood-Otis, Ltd., have also installed a complete hydraulic vacuum cleaning equipment. This plant, which feeds four points on each floor, is operated by an 8-h.p. motor.

In the kitchen equipment, there is a 4-h.p. motor driving a Hall refrigerator, an ice-making machine, an almond crusher, and a "whisk." The latter is provided with an ingenious form of friction drive, which enables the speed to be adjusted within very narrow limits. In the French Bakery there is a 2-h.p. motor-driven bacon-cutter and a mincing machine.

Main Switchboard for Heating Circuits.

The refrigerating plant for the cold storage rooms is driven by an 18-h.p. motor, and is provided with a brine circulating pump driven by a $2\frac{3}{4}$-H.P. motor. There are also a large number of buffing machines for boot-cleaning, driven electrically, as shown on the opposite page.

For the lighting of the building some 6,000 Osram lamps have been installed, and the wiring has been laid out in two systems to comply with the L.C.C. regulations. Convenient control for all the bedroom lights is provided; in each room there are two lamps, either of which is controlled from a three-point switch at the bedside. A certain number of cross and corner corridor lights are supplied from the alternate one of the two systems into which the lighting supply is divided, so that the important lights in corridors are rendered independent of the circuit which supplies the bedrooms immediately adjoining those corridors. These special corridor lights are controlled by master switches at central points.

The general scheme of illumination is on the semi-direct system, and for this purpose a variety of designs of fittings by the Bromsgrove Guild have been installed. In the dome of the Rotunda Court the novel plan has been adopted of introducing opal bulls'-eyes into the risers which support the glazing of the dome. Behind each opal is a 30-watt lamp. Around the cornice of the dome is a ring of lamps, which are concealed from view at the floor level, but which throw a considerable volume of light upwards into the dome.

LIFT MOTORS AND CONTROLLERS.

The scheme adopted for the electric bells has greatly simplified the bell signalling. Each floor is complete in itself and is divided into eight sections, each with a large indicator. By means of a four-point relay an indicator is also operated in the service room, showing which section has been rung up. When the chambermaid goes to that particular section she is shown by the section-indicator the number of the room calling. Thus the use of enormous lengths of multiple-wire cables has been avoided, without loss of efficiency.

We are indebted to the Strand Hotel, Ltd., to Mr. Barker, and to Mr. Cushion for the particulars and photographs embodied in this article, and we desire to offer our congratulations to all these parties on the accomplishment of an enormous undertaking on lines which can truly be said to be scientific, and in accordance with the most modern engineering practice.

Glasgow Exhibition.—We have received from Mr. J. M. Freer, of 38, Bath Street, Glasgow, a copy of the prospectus of the Glasgow Smoke Abatement Exhibition, which is being held under the patronage of the Corporation and the local branch of the Smoke Abatement League, at Exhibition Hall, New City Road, from Thursday, September 23rd, to Saturday, October 16th. Gas and electricity will be supplied free of charge to exhibitors. Class 7 will comprise "electric apparatus and electric heating and cooking appliances; Class 9, boiler furnaces, mechanical stokers, fuel economisers, &c.; Class 10, electric appliances and apparatus for the generation and utilisation of motive power; Class 11, suction gas plants, gas and other engines, &c.; Class 13, ventilating fans; and Class 15, shop window lighting." Particulars can be obtained on application to Mr. Freer, as above.

BATTERY-BELL SIGNALLING SYSTEMS IN MINES.

HOME OFFICE REPORT ON THE DANGER OF IGNITION OF FIRE-DAMP-AIR MIXTURES.

(*Concluded from page* 849.)

Dr. Wheeler points out that the single-bobbin bell (*b*) in the foregoing table is the more efficient, as this required a resistance of 230 ohms in circuit to prevent the bell ringing, while only 55 ohms had to be introduced to obtain the minimum igniting current. He further suggests winding the coils of the magnets with silk-covered annealed brass wire, instead of copper, as is usually used, and a bell arranged on these lines with a single bobbin wound with 11 layers of 25-gauge brass wire gave the following results, when operated with a battery of 10 Leclanché cells:—

Resistance of magnet, 13 ohms.
Current, bell only in circuit, 0·62 ampere.
Resistance required to prevent bell ringing, 200 ohms.
Current with bell and resistance in circuit, 0·04 ampere.

The minimum igniting current, obtained from a battery of 10 *dry* cells, was found to be 0·72 ampere.

This bell was tested under practical conditions at a colliery in Durham with a battery of 10 Leclanché cells, and "at 1,620 yards the bell rang very strongly. This was the end of the third section of the signal wires, and a connection had to be made to the third section. The wires in the latter had a great number of connections, *mostly bad ones*, which might have caused any bell to cease ringing. However, the bell rang quite distinctly, though not very loudly, at 1,910 yards, the end of the wires." The italics are ours, and herein lies the crux of the whole question of efficient signalling in mines. Dr. Wheeler's experiments were carried out under perfect conditions, but below ground the conditions are very far from being perfect, or, very frequently, in decent order. Electric signalling is so simple that anyone presumes to know all about it, and any sort of a connection will do, and frequently one will see a perfect network of wire connections without any order or system, whereas, arranged systematically, probably less than half would be required. Hence the demand for a bell that would ring under conditions which ought not to exist, and which required only a small current, necessitating the use of highly inductive magnet coils. Tests were made with eight bells of different makes with the following results:—

Bell.	Resistance of magnet.	Current (bell only in circuit.)	Resistance required to prevent bell ringing.	Current (bell and resistance in circuit)	Minimum igniting current.	Resistance required to reduce current to minimum igniting current.
	ohms	amp.	ohms.	amp.	amp.	ohms.
A	12	0·63	175	0·07	0·19	[illegible]
B	13	0·59	80	0·13	0·13	80
C	30	0·38	75	0·12	0·12	75
D	12	0·63	225	0·05	0·20	65
E	10	0·74	170	0·07	0·21	40
F	14	0·58	65	0·15	0·15	65
G	20	0·45	150	0·07	0·17	40
H	37	0·29	250	0·04	0·12	[illegible]

"Two points stand clearly out from an examination of this table. One is that all the bells tested are capable of giving a dangerous break-flash when used with a battery of 10 wet Leclanché cells (15 volts). The current available at the break-flash, supposing the signal-wires to be short-circuited close to the bell so that only the resistance due to the magnet is included in the circuit, is in every case more than twice as great as the minimum igniting current, while in one instance (bell B) it is four times as great. The other point is that in the majority of cases sufficient non-inductive resistance could be introduced into the circuit to reduce the current available at the break-flash below the minimum igniting current without seriously affecting the ringing power of the bell. Bells D and H in particular allow ample margin for bad connections on the signal wires." For that very reason bells D and H would be looked upon as excellent bells.

Dr. Wheeler next tried "parallel" winding, in which one winding is used for ringing the bell, while the other is short-circuited on itself, with the following results:—"Two bobbins were wound with 28-gauge copper wire in this manner and inserted in the bell frame. Tests were made using a battery of 10 wet Leclanché cells," with

(*i.*) Two bobbins, the additional winding being left open, and the ends of the wire being free.

(*ii.*) Two bobbins, the additional winding being short-circuited.

(*iii.*) One bobbin, additional winding as in (*i.*).

(*iv.*) One bobbin, additional winding as in (*ii.*).

The main data obtained were as follows:—

—	Resistance of magnet.	Current (bell only in circuit).	Resistance required to prevent bell ringing.	Current (bell and resistance in circuit).	Minimum igniting current.	Resistance required to reduce current to minimum igniting current.
	ohms.	amp.	ohms.	amp.	amp.	ohms.
(*i.*)	20	0·47	100	0·10	0·30	17
(*ii.*)	20	0·47	115	0·09	*	*
(*iii.*)	10	0·70	75	0·14	0·48	10
(*iv.*)	10	0·70	95	0·12	†	†

* Ignition at 1·55 amps., 38 volts, from 26 dry cells.

† Ignition at 2·3 amps., 31 volts, from 21 dry cells.

It was found that whether one or two bobbins were used, the bell rang better with the additional winding short-circuited, and further, that more current was required for ignition by the break-flash when the additional winding was present but open than when the winding was absent altogether.

Layers of tinfoil between the iron core and between the layers of copper winding were also tried; one bobbin was wound with 16 layers of 28-gauge copper wire in this manner, with a tinfoil strip between each layer, and tested with a battery of 10 Leclanché cells, with the following results:—

Resistance of magnet, 12 ohms.
Current, bell only in circuit, 0·78 ampere.
Resistance required to prevent bell ringing, 115 ohms.
Current, bell and resistance in circuit, 0·10 ampere.

The minimum igniting current for the break-flash was found to be 2·30 amperes (at 27·5 volts) obtained from 19 dry cells.

Several other methods of preventing sparking were tried with more or less effect, but not so simple of application as those described. The conclusions reached were briefly as follows:—

1. All the bells examined were capable of producing a highly dangerous break-flash at the signal-wires when used with a battery of 10 wet Leclanché cells, the current voltage being 15. The break-flash was still more dangerous when a battery of 10 dry cells was employed, since the current available from them is considerably greater than that obtainable from wet Leclanché cells.

In general the bells examined were "overpowered." A single bobbin with a reduced number of layers of wire was found in several cases, when fitted to the original bell-frame, to actuate the bell as efficiently as is required in practice. The use of only one bobbin (*i.e.*, a bar electro-magnet) with a small number of layers of winding reduces the self-induction of the circuit, and thereby decreases the danger of the break-flash at the signal wires.

2. Inasmuch as the voltage is relatively of little importance compared with the current strength so far as the safety of the break-flash on the signal wires is concerned, it is desirable that attention should be directed towards not exceeding a certain maximum number of cells in the battery, rather than that care should be taken not to exceed a certain voltage. Moreover, it is desirable that a cell of comparatively high internal resistance, such as the wet Leclanché cell, should be employed, so as to avoid the possibility of obtaining large currents on short-circuiting the battery.

3. Taking as a standard battery 10 wet Leclanché cells, quart size . . . . . giving a voltage of 15 and a maximum current on short-circuiting of about 1·5 amperes, it is possible so to modify the usual pattern of bell as to render the break-flash at the signal wires safe in the most sensitive methane-air mixture, without impairing the ringing power of the bell. This can be done in several ways, of which the simplest probably are:—

(i) By the introduction of a non-inductively wound resistance coil in series with the magnet-coils, such that it will reduce the current available at the break-flash below the minimum igniting current.

(ii) By increasing the resistance of the magnet windings of the bell by the use of wire of fairly high resistance, such as brass wire, for the same purpose as (i).

(iii) By the use of "parallel" winding, and

(iv) By the use of tinfoil strips between the layers of winding, in the manner and for the purpose already described.

Of these four methods the third may be open to the objection that should the short-circuited winding be accidentally broken, the bell might become unsafe.

No experiments were made as to the igniting power of the maintained spark at the trembler of the bell, for it was apparent from the bells examined that the provision of an adequate flame-tight casing, affording complete security against ignition of a firedamp-air mixture at the trembler of the bell, was not a difficult matter. Nor were any experiments made with relays such as are often introduced in battery-bell signalling systems, for, in Dr. Wheeler's view, a relay, if introduced into the signalling system, simply takes the place of the bell, and, from the point of view of danger at the break-flash on the signal wires, can be regarded as a bell. This, of course, is an entirely mistaken impression.

The report is interesting and settles once for all a much debated point. It was, of course, never seriously questioned that an electric spark would ignite firedamp, but the extremely weak currents of the signalling systems were considered harmless. As a matter of fact, Dr. Wheeler's report confirms this impression to some extent, but the self-induction of the magnet coils, which is the true source of danger, was never really considered. It ought not to be a difficult matter for colliery managers to arrange their signalling systems now so as to be absolutely safe, and with a little care and attention to maintain them so.

We are glad to note that Dr. Wheeler is to continue his investigations into the relay and alternating-current systems of signalling.

A LOCOMOTIVE COACH FITTED WITH THE THOMAS TRANSMISSION.

On Thursday last week we were enabled, by the courtesy of The Thomas Transmission, Ltd., to witness a demonstration at Birmingham of a 200-H.P. locomotive coach which has been fitted with their system, for use on the New Zealand Government Railways.

Our readers are already familiar with the principle of this extremely ingenious system of transmission, as fitted to heavy lorries, &c., which was first described in our issues of May 5th and June 23rd, 1911, and has been referred to from time to time in our pages. In a paper read before the British Association in Australia last year by Mr. H. J. Thomson, and abstracted in our issue of October 30th, 1914, the application of the system to heavy internal-combustion locomotives was discussed, and the recent demonstration marks a further step in this direction.

In view of the vast stretches of arid desert across which railways are now being constructed in Australia, the importance of the subject to the Commonwealth is obvious, steam locomotives being handicapped for supplies of coal and water: but even where there is no lack of these, it is claimed that the oil-engine driven locomotive equipped with the Thomas transmission has many points in its favour.

It will be remembered that, in the briefest outline, the Thomas system employs two electrical machines (each about one-third of the power of the engine) and a planetary gearing which connects these machines with the engine and the load. During starting and acceleration the power is transmitted partly mechanically and partly electrically to the wheels, but when full speed is reached the whole of the power is transmitted directly from the engine to the wheels. In the case of the locomotive here referred to, certain modifications have been introduced into the design, without affecting its main principles.

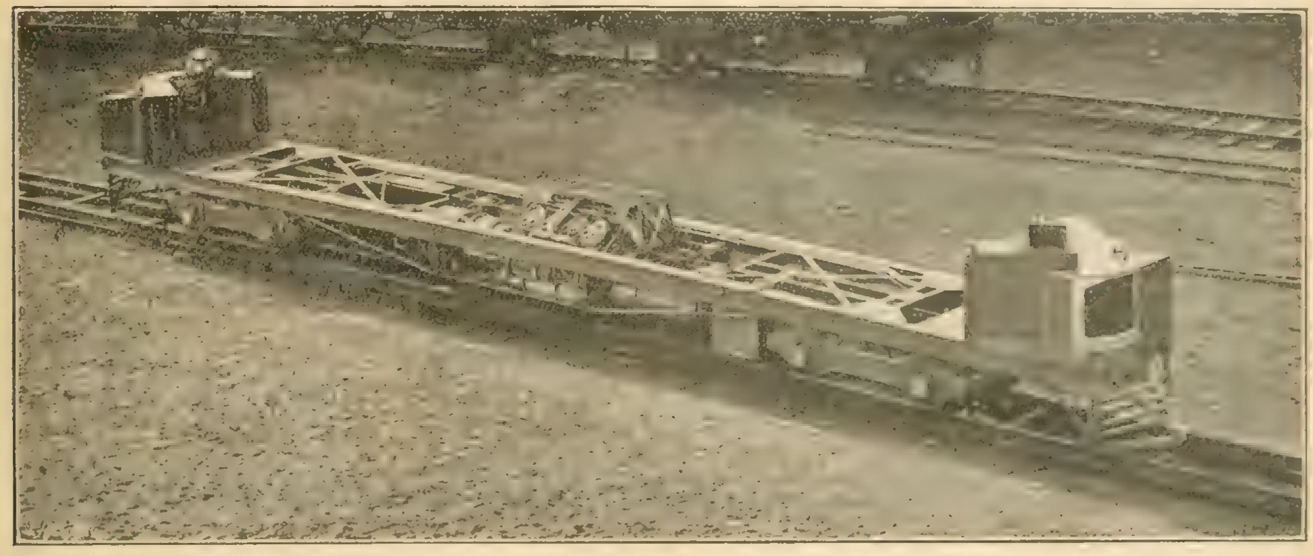


Fig. 1.—Locomotive Chassis fitted with the Thomas Transmission System.

The locomotive chassis has been built by The Thomas Transmission, Ltd., for suburban traffic, where the smoke and noise of a steam locomotive would be objectionable, and has been fitted with a petrol engine by Messrs. J. Tylor and Sons, Ltd. Fig. 1 shows the complete chassis, and fig. 2 the Tylor engine, while a closer view of the controller and one of the bogies is given in fig. 3. The body will be made and fitted in the works of the New Zealand Government Railways at Wellington. The seating capacity of the coach will be about 50 passengers, and it will haul two 25-ton trailers, each having about the same seating capacity. It is expected that the output will be about 200 ton-miles per gallon of petrol. The vehicle will have to be able to haul one 25-ton trailer up a grade of 1 in 40 at 15 m.p.h., the gross load being about 60 tons; the maximum speed on the level will be over 40 m.p.h., and it is estimated that the vehicle will haul a gross load of 85 tons up a grade of 1 in 40 at about 10 m.p.h. By itself the coach will ascend this grade at 28 m.p.h. It is 62 ft. 6 in. in length overall.

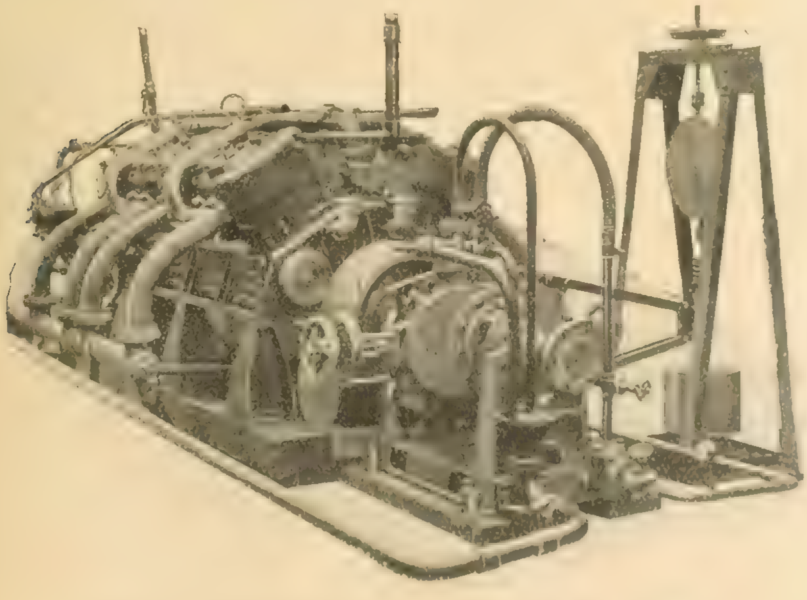


Fig. 2.—Tylor 200-h.p. Petrol Engine on Brake Test.

As shown, the engine is of the V type and has eight cylinders, 7 in. bore × 8 in. stroke; the normal speed is 900 r.p.m., and the maximum 1,500 r.p.m. Opposite cylinders act on the same crank, thus shortening the engine

All the valves are external to the V, so as to be readily accessible. The engine is reversible, and is extremely compact; the circulating water is cooled by radiators at either end of the locomotive, both of which are effective irrespective of the direction of motion, and separate radiators are provided for cooling the lubricating oil for the engine and the planetary gearing respectively, the oil and water being circulated by pumps driven by the engine. Although the engine is reversible, only the crankshaft reverses its direction of rotation, the pumps, magnetos and cam-shafts always running in the same direction.

The planetary gear wheels are double helical, and are provided with forced lubrication, running silently and with high efficiency. The two electrical machines, which are alternately motors and generators, are totally enclosed and weigh only 15 cwt. each; they are arranged on a plan differing from that adopted for motor lorries, one machine forming a complete unit with the planetary gearing and two magnetic clutches, as shown in fig. 4, while the other is mounted independently of the prime mover and transmission unit.

The former unit is rigid in construction, ensuring perfect alignment, and transmits the mechanical drive to the outside axle of one bogie; the latter unit drives the outside axle of the second bogie purely electrically. Tubular cardan shafts are used for both drives, with universal joints which ensure perfectly uniform angular velocity of the driven wheels. The final drive is effected by means of bevel and spur-wheel reductions, as shown in fig. 5, which diagrammatically illustrates the arrangement of the transmission.

It will be noticed that in this form of the system the second machine is not directly coupled to the larger sun-wheel, as in the lorry previously described; it is, however, indirectl coupled to it through the driving wheels and rails. Another difference lies in the use of magnetic clutches, which are exceedingly easy to control and are admirably adapted to deal with large powers. Moreover, reversal is effected by reversing the engine, and not by electrical means, as the locomotive must run with equal facility in either direction. The bogies are of novel construction, designed to eliminate rolling and to give easy riding of the vehicle.

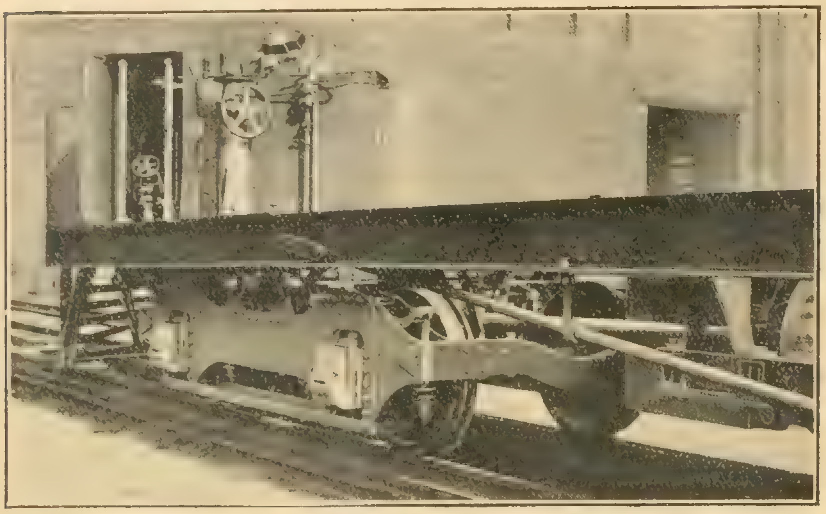


Fig. 3.—Controlling Gear and Bogie.

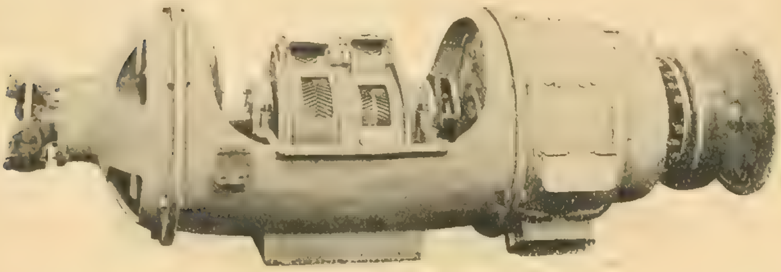
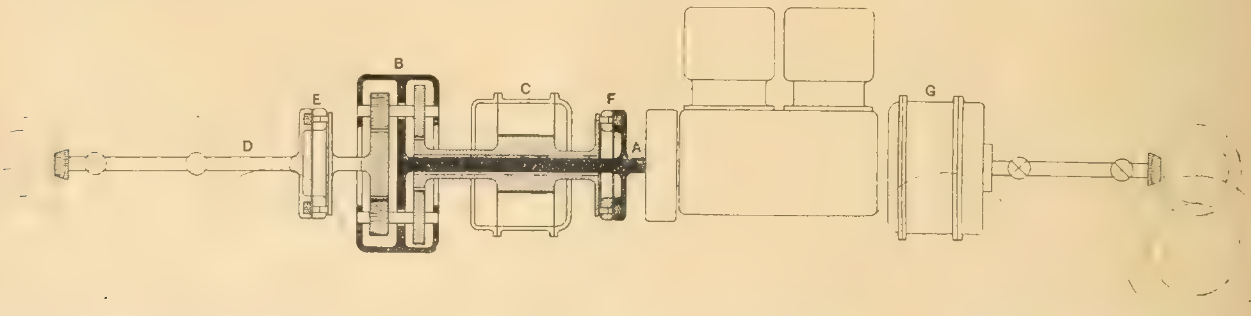


Fig. 4.—Transmission Unit, with Planetary Gear and Magnetic Clutches.

The control of the locomotive can be effected from either end of the vehicle. The main controller provides for 12 forward speeds, including direct drive on top. The reverse for continuous working is obtained by reversing the direction of rotation of the engine. Two reverse notches are provided in the controller for reversing for short distances when shunting, &c., the power being then transmitted purely electrically. This is effected by coupling up No. 1 machine directly to the engine and transmitting the power electrically therefrom to No. 2 machine, which is permanently coupled to one of the driving axles.



A, engine drive to B, planetary gear casing; C, first electrical machine connected to small sun wheel; D, mechanical drive to first bogie; E, magnetic clutch for free-wheeling; F, magnetic clutch for direct drive on top speed; G, second electrical machine, driving second bogie.

Fig. 5.—Diagrammatic Arrangement of the Transmission System.

In addition to the main controller an auxiliary switch is provided, which is used to control the car in much the same way as the clutch pedal on an ordinary touring car. It will be seen from the diagram, fig. 5, that there are two magnetic clutches, first, the free-wheeling clutch, which is engaged for all running speeds, and, secondly, the top-speed clutch, which is engaged only for the direct drive, starting the engine, and emergency reverse. Both of these clutches can be disengaged by putting this auxiliary switch in the "off" position. It will thus be seen that if at any time the driver wishes to bring the vehicle to rest, it is not necessary to move the main controller, the act of freeing the engine being effected by moving only the auxiliary switch lever.

In order to start the locomotive, the control handle is moved into the "start engine" notch, which connects the battery across No. 1 machine; the auxiliary switch is then closed, thus coupling No. 1 machine by means of the top-speed clutch directly to the engine.

As soon as the engine has been started the auxiliary switch is put into the "off" position and the main controller moved into the first speed notch. By slowly bringing the auxiliary switch into the "on" position, the free-wheeling clutch is gradually engaged, causing machine No. 1 to be driven round in the reverse direction to the engine. As the vehicle gains speed the main controller is gradually moved to the top-speed position, when the direct drive is obtained by engagement of the top-speed clutch, which locks the epicyclic gearing together, and at the same time reduces the current generated to zero. The notch beyond top speed provides for charging the battery, which has a capacity of 200 A.H. at 40 volts.

The method of charging the battery with two series-wound machines is novel and ingenious. The connections are so arranged that one machine runs as a motor in series with the field of the generator, and as the speed of the motor armature (machine No. 2) is controlled by that of the locomotive, its counter E.M.F. is proportional to the speed of the coach; hence the current in the field magnet of the generator varies inversely as the speed, and the result is a constant E.M.F. in the generator armature for charging the battery at all speeds.

Westinghouse brake equipment is provided, the compressor being directly coupled to the crankshaft of the engine. In addition hand brakes are provided for emergency use.

The weight of the complete vehicle, exclusive of the body, is approximately 18 tons, of which the engine, transmission, and radiators weigh about 7 tons.

As previously recorded in our pages, The Thomas Transmission, Ltd., entered the railway field some years ago, and the excellent results obtained with their rail-car in South Africa led Mr. W. W. Hoy, general manager of the South

African Railways, to recommend it for use on the New Zealand Railways.

The advantages of the system have been pointed out in our pages, and the fact that it provides the flexible and efficient link between the engine and the wheels that is essential to the success of the internal-combustion engine on railways ought to be fully recognised.

The obvious point to which criticitism would naturally be directed is the gearing; but while in the past this might have constituted a weakness, with modern well-lubricated gear wheels that is no longer the case, and the fact that the R.A.C. awarded the company the Dewar Trophy in its 2,000-mile trials in 1911 testifies to the merits of the system. Where complete electrification would not be justified by the traffic conditions, the next best thing is to employ rail-cars of this type. It is, of course, not essential to use petrol; whether petrol, paraffin, or crude oil be used is a question which has nothing to do with the transmission system. A specially important feature is the high efficiency of the system at all but the lowest speeds; the speed on grades approaches the maximum possible with the engine power available, and during most of the running time the engine drives direct, so that the losses in the variable-speed gear are practically negligible.

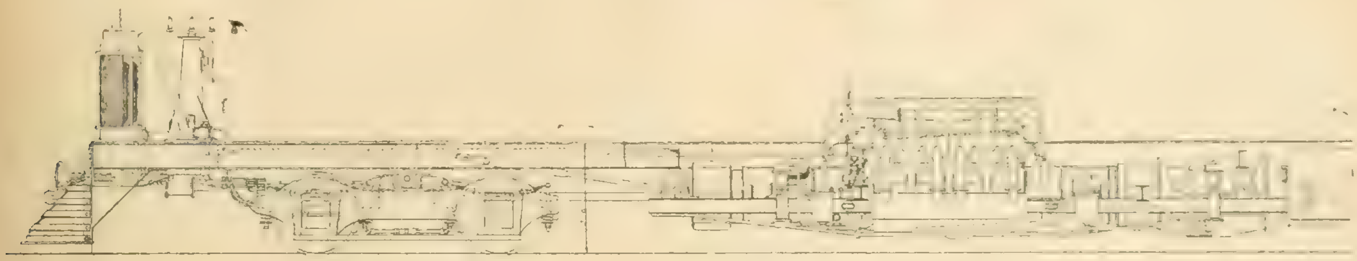


Fig. 6.—Part Side Elevation of Locomotive, with front Sole-Bar partly Removed.

Fig. 7.—Locomotive Hauling a Load of 200 Tons.

The company are to be congratulated on the success their system has already attained; we commend it to the notice of all our readers who are interested in traction, for it is applicable to all kinds of self-contained locomotives, including vehicles propelled by storage batteries.

LEGAL.

Electrical Apparatus Co., Ltd., *v.* Canadian British Engineering Co., Ltd.

In the City of London Court on June 17th, this case was mentioned. Plaintiffs, as already reported, had recovered judgment for £70 18s. 6d. against the defendant company, for electrical goods supplied in the way of trade.

Mr. Young, plaintiffs' solicitor, asked the Court to permit execution to be levied in accordance with the Courts Emergency Act. Defendants' secretary hoped the Court would not do that. A Committee of inspection of the defendant company had been appointed in Canada, and was working with the managing director, who was in Winnipeg.

Judge Rentoul wondered whether the assets of the defendant company would be less if he refused to allow execution to be levied.

Defendants' secretary said they had a business in Winnipeg, but they could not realise their stock at present. They had £10,000 of stock there. If the Court granted the application it might make the defendant company go into liquidation. That would not be to the interests of the creditors.

Judge Rentoul: The other creditors are not here, but the plaintiffs wanted to get up a winding up order I must grant the present application.

Defendants' secretary added that there were no assets in England and that they could do nothing with the plaintiffs, as all the creditors must be treated in the same way. All the creditors would stand together.

Judge Rentoul said the plaintiffs would have leave to issue execution.

The Burgh of Alloa *v.* Alloa Theatre Co., Ltd.

A test case has been brought in Alloa Sheriff Court, before Sheriff-Substitue J. Dean Leslie at the instance of the Provost, Magistrates and Councillors of the Burgh of Alloa against the Alloa Theatre Co., Ltd., trading at The Pavilion, Alloa, for the payment of an account for the supply of electricity during the month of March.

The defence stated that the defenders had been charged at the rate of 4d. per unit, this being the rate charged for lighting purposes, whereas they contended that they were entitled to be charged for the current used in connection with the motor for the bioscope at the rates for motive power purposes, which, according to scale, were from 2d. to 1d. per unit.

Mr. Charles Thomson, Town Clerk, for the Corporation, said that Parliament had not laid down a rule that energy for lighting and power were to be charged at different rates. There was nothing in their Electric Order or in the Acts of Parliament that power and lighting were to be charged at different rates, nor had Parliament laid it down that these were to be charged at the same rates. The question was left quite open to the undertakers so long as they gave no undue preference. In this case the defendants had been supplied with current from November, 1913. They had been charged at the prevailing lighting rate until now, when they disputed the account for which they were being sued. The motor in the Pavilion was used for driving a dynamo. The pressure of current supplied to the Pavilion was 440 volts. They could not pass 440-volt current through the lantern for the purpose of lighting a bioscope. The object of this motor was to drive the dynamo, and the dynamo converted the pressure of 440 volts into something like 60 volts. Therefore they had a motor-converter. It was not a motor for driving power at all.

The Sheriff: If a man takes energy from you and is ingenious enough to get a motor in order to change it, are you to charge lighting rate? Are you not to supply him with power to do with it what he pleases?

Mr. Thomson: No.

The Sheriff: You say that it is used for lighting, and, therefore, must be at lighting rate?

Mr. Thomson said that that was so. If their contention was sound that they were entitled to be charged power rate because of the existence of the motor-generator or converter, what was to stop them from, in the same way, lighting up the premises? All this current was supplied by the undertakers for lighting purposes. The theatre company might do what they liked with it, but they must pay the lighting rate. The motor used by the defenders was used for lighting. Let them put aside how that light was brought about, but it was lighting. In the case of an ordinary motor it was used for mechanical power—a different thing altogether. The determining factor in a case of this kind was the ultimate use to which the current was to be put. He submitted that the ultimate use here was lighting. The Council made no distinction in price between the two theatre houses.

Mr. John Reed, solicitor for the defence, said that there were in the defenders' premises three meters, two of them for current at 220 volts, and the current passing through these two meters was for lighting the stage and the main building. There was a third meter, the current passing through which was supplied at 440 volts, and the whole of the current which went through that meter was used for defenders' purposes in driving this dynamo. So far as regarded the current supplied through the third meter, he claimed that it was current for motive purposes, and that he was entitled to get that at the rate at which the Town Council intimated they were prepared to supply customers for motive power purposes. He claimed to be supplied at the power rate intimated. They fixed a special rate for the Pavilion at 3d. per unit after 4,000 units, but he was not satisfied with it, and that was why he was there. There was no agreement between the Town Council and the theatre company.

The Sheriff said it was a question of take it or leave it.

Mr. Reed replied: Exactly. His position was that this current supplied at 440 volts was supplied for motive purposes. It would entail a proof as to whether this was used for motive purposes or not. He could not see how his friend was going to say it was not for motive power purposes, whether the ultimate effect of this dynamo was to produce a certain kind of light or not. That did not affect the question of driving the dynamo.

The Sheriff said it was not light in the ordinary sense.

Mr. Reed replied : It is not light in any sense.

The Sheriff : But there is light.

Mr. Reed said, supposing they had a gas engine driving the dynamo, they could produce the same light.

The Sheriff : But what is the light thrown upon the screen ?

Mr. Reed : It is produced solely by the dynamo, which is the property of the defenders. That is light generated by the defenders.

The Sheriff : It is the pursuers' electricity altered in a certain way ?

Mr. Reed : Not at all. The pursuers' current is supplied to this motor which drives the dynamo, and from this dynamo we produce current of our own, which gives us a particular light.

The Sheriff : Could you use the energy that is supplied for lighting the hall for the bioscope ?

Mr. Reed : It could be used, but it is not steady enough, and would simply give a flicker. The reason we have to make our own current is because the current supplied by the Corporation is not suitable.

The Sheriff : So that you say the motor is for manufacturing purposes ?

Mr. Reed : Yes.

Mr. Thomson : What does it manufacture ?

Mr. Reed : The light for throwing the pictures on the screen.

Mr. Thomson : That is our contention, that you manufacture light.

The Sheriff : There are two questions. Whether the motor is being used for motive power. That is a question of fact. Then there is the question as to whether there is undue preference. Unless you can adjust it, the question of the motor can be left to a referee. It is for a skilled man to decide.

The Sheriff, after a few further observations, took the case to avizandum.

Brown v. Lambeth Borough Council.

At the Lambeth County Court, on Friday, Judge Parry gave a considered judgment in an action heard before him, in which a taxi-cab proprietor, of King's Cross, sought to recover damages from the Lambeth Borough Council for injuries to his cab. The action was reported in our issue of May 21st, page 720.

Judge Parry said on January 6th, about 11 o'clock at night, the plaintiff was driving a taxi-cab when he came into collision with the refuge in the middle of the road, knocking down one of its cast-iron guards and damaging the pole of the arc lamp.

The Plaintiff said this occurred owing to the defendants' negligence in not lighting the refuge. The refuge was generally lighted by an arc lamp, which on this date, under police regulations, had been considerably darkened. At the moment of the accident the plaintiff said that the arc lamp was not alight. He was the only witness of this, but he (the Judge) saw no reason to disbelieve him. The arc lamp was lighted and controlled by an electric lighting company acting for the defendants. The company's servants found the arc lamp alight at 5.30 on the afternoon of January 6th, and again at 11 o'clock on the morning of January 7th. Some evidence was given as to the type of lamp and the mechanism by which it was lighted and extinguished, but no effort was made to show that it was of inferior construction or in any way faulty. After the accident a police officer came up and noticed that the light was out, but his evidence was consistent with the defendants' contention that the collision itself extinguished the lamp. He believed the plaintiff's statement that the light was out at the time of the accident, but there was no evidence at all to show how it came to be extinguished or how long it had been extinguished, nor was there evidence of negligence on behalf of the servants of the defendants or the electric lighting company in superintendence, management or control of the lamp. The general lighting of the place was adequate and reasonable, having regard to the police requirements under the Order in Council for the Defence of the Realm. The fact that the arc lamp was not alight undoubtedly contributed to the accident, as did the speed at which the plaintiff was driving. So, too, did the general darkening of the surrounding lamps under the Order in Council. He found that the lamp was out at the time of the accident, that the lamp being out was not due to any negligence of the defendants or their servants, and there was no evidence to show how it came about that the lamp was temporarily extinguished. The action here was founded on negligence. There was no evidence of any negligence, and the defendants must succeed. He gave judgment for the defendants, with costs.

Mr. Lever, for plaintiff, gave notice of appeal.

Osram Lamp Works, Ltd., v. Pope's Electric Lamp Co., Ltd.

On Tuesday, in the Chancery Division, Mr. Justice Joyce commenced the hearing of this action for an injunction to restrain defendants from infringing plaintiffs' letters patent, No. 23,899* of 1904, for damages and for the delivery up of articles or things made in infringement of the patent. The defendants denied infringement, and alleged that there was no subject matter for the plaintiffs' patent, and a want of novelty. Mr. Walter, having opened the case for the plaintiffs, evidence was heard and the case was adjourned. We shall report the matter in our next issue.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Automatic-Lift Accidents.

I am gratified to find that the article I wrote you on the above subject has led to such an interesting correspondence. Mr. Butler gives instances of accidents which have come under his notice, and suggests the desirability of having a gate in the car. I quite agree with this, but the gate is useless unless provided with electrical contacts which prevent the lift being operated when anyone is standing in the car with the gate open. It should, however, be possible to call the empty car to any landing, assuming the landing gates to be closed, even although the last passenger omitted to close the car gate, as a person will rarely take the trouble on alighting from a lift to close two gates.

Referring to the question of arcing over in electric locks, I have myself experienced considerable trouble due to this. It is generally caused by one of the misuses I referred to, namely, stopping the lift by opening the gate whilst the car is passing. This breaks the pilot circuit in the lock, and as Messrs. Smith, Major and Stevens point out, a switch or contact which is constructed for making a circuit only is not well adapted for breaking it, the arcing distance being too short. The troubles which I have experienced from this cause have occurred principally on lifts on 400-volt circuits, and where the current carried by the pilot circuit was higher than should be necessary with properly designed solenoids. It is largely a question of distance between contacts ; distance between contacts and earthed metal ; and wattage.

Mr. Rosenbusch and Messrs. Smith, Major & Stevens both complain that I have not done full justice to the most recent types of electromagnetic locks, and that the sketch I gave only illustrates the simplest form of such devices.

I made it quite clear in my article that the illustration was intended to illustrate only the general principle on which electro magnetic locks operate, and was not intended to show the detail of any actual lock. I am well aware that there are many excellent locks now on the market, as is mentioned by all the lift makers who have so kindly contributed to the discussion, and Mr. Scott showed details of the lock made by his firm (Messrs. The Medway Safety Lift Co.). It was very clear, however, from his excellent letter, that the best type of lock is not always fitted, as a purchaser who does not understand the technicalities of electric lifts cannot discriminate between safe and unsafe types of apparatus and, as a rule, accepts the cheapest quotation.

It was suggested by some of the correspondents that the Home Office or the County Council ought to frame regulations covering electric lifts, and no doubt they will in due course do so. The H.O., of course, exercise a general supervision over lifts in factories, for although they have no special rules bearing on the point, it is to some extent covered by the general rules relating to moving machinery and to electric installations. There are, however, a large number of lifts in buildings which do not come under the Factory Acts, and, therefore, do not come under the supervision of the H.O. Inspectors ; and, moreover, there are thousands of lifts outside the jurisdiction of the London County Council, so that it is obvious that if these two bodies drew up special regulations they would only cover a fraction of the lifts in actual use.

Frank Broadbent.

London, E.C., *June* 16*th*, 1915.

Pitting of Brushes.

I should be obliged if any of your readers could indicate the cause of, and suggest a remedy for, the strange behaviour of the positive brushes of a 500-KW. motor-converter, compound-wound, and used for lighting and traction supply.

All the brushes are of hard carbon, 2½ commutator bars in thickness, and there are six brush arms on the machine. All the positive brush surfaces are badly pitted in the middle, but at both leading and trailing sides of the pitted portion the surfaces are perfect. The brushes are well bedded, the arms properly spaced round the commutator, and the machine runs sparklessly at all loads. The negative brushes and the commutator are in excellent condition.

Thanking you and your readers in anticipation.

A. B. Johnstone.

Gateshead-on-Tyne, *July* 18*th*, 1915.

Battery-Bell Signalling Systems in Mines.

It is somewhat surprising that Dr. Wheeler, in his experiments, has not tried the spark-extinguishing device (known to every telegraphist, and fitted to nearly all local telegraph instruments) of a non-inductive shunt of about five times the resistance of the magnet whose inductive effect it is required to get rid of. The shunt must be joined directly across the electromagnet (not across the bell terminals). A few feet—in some cases a few inches only—of 3-mil platinoid wire wound double on a bobbin is all that is required. The cost is negligible, and the result completely effective.

The lower the resistance of the shunt the more effective it is in extinguishing the spark, but if made of a resistance approaching

that of the magnet it shunts, it would slow the action of the bell: if the shunt is made about five to ten times the resistance it bridges, then the slowing action is but slight, whilst its spark-extinguishing effect is most marked.

H. R. Kempe.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electric Lighting Sets.

Whilst there are now few towns of any size in this country that are not provided with a supply of electricity, there are innumerable small villages, hamlets, and isolated houses which have not yet enjoyed the convenience and economy of the electric light, and these afford a very wide field for enterprise. Many firms have taken steps to meet the needs of the larger country-house owners, who can afford to install comparatively expensive plant, but until recently the case of the well-to-do farmer had received little, if any, attention. While this gentleman may not feel himself justified in expending a considerable sum on an electric lighting installation, he is quick to appreciate the advantages of electricity as compared with the oil lamps which he is usually compelled to put up with, and he is a handy man with tools; moreover, he often possesses one or more oil engines to drive his machines, and is accustomed to their management. These facts have been fully realised by the Associated Manufacturers' Co., of 72-80, Mansell Street, E., who for many years past have supplied enormous numbers of their handy oil engines to British farmers, and are thoroughly acquainted with the capabilities and mental attitude of their customers. The problem, however, was a difficult one to tackle, as it necessarily involved the use of a dynamo and a storage battery, the latter especially being a class of apparatus that one would hesitate to place in the hands of a wholly unskilled user. The cost of the whole installation also had to be kept down to the absolute minimum, and this called for the rigid standardisation of the whole outfit.

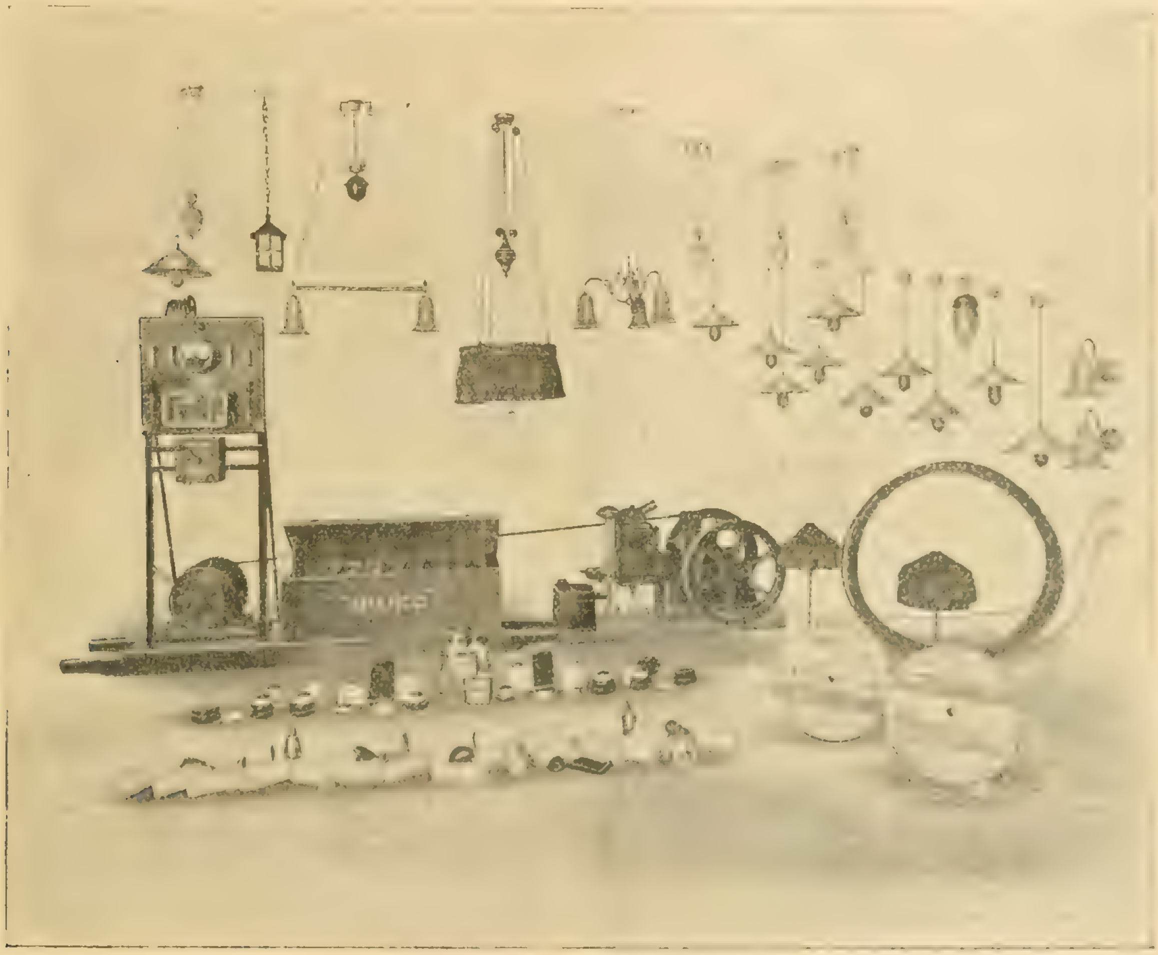


Fig. 1.—"Amanco" 25-Light Farm-house Lighting Set.

But the idea of a farmer's installation was too good to be discarded without an effort to carry it out, and the company designed a sample set, which was shown at an Exhibition in September last year; the inquiries which resulted indicated that the attempt was on the right lines, and, after further experiments, a complete "Amanco" electric lighting plant was placed on the market with gratifying success. We recently had the pleasure of inspecting one of these interesting sets, which are admirably designed for the purpose outlined above. With the exception of the petrol engine, the whole of the apparatus is of British manufacture, and the greatest pains have been taken to make it in every respect as simple, robust, and reliable as possible. We illustrate herewith the outfit (No. 1 "D"), which contains "everything for a complete installation of 25 16-c.p. lamps down to the last screw," the intention being that the purchaser shall be in a position to erect the whole of it without having to buy anything in addition to the contents of the packing-cases, and without any outside assistance whatever—except, perhaps, the advice of the company's local agent.

For this reason the arrangement of the parts is carefully devised, so that the minimum of thought and work is required to place them in correct position and connect them up; the fittings and the switchboard are completely wired in advance, and all the terminals not already wired are labelled, so that the user has no difficulty in identifying those that are to be connected together. Full and lucid instructions are provided for erecting the plant and for running it. The switchboard carries only two single-pole switches and d.p. fuses, for the charge and discharge circuits respectively, a Record automatic switch, centre-zero ammeter, pilot lamp and shunt regulator. The battery consists of 26 cells of the Naylor Battery Co.'s make, these having been selected on account of their ability to withstand rough treament and unskilled attention, and no attempt is made to regulate the battery voltage; the use of end-cell switches would inevitably lead to trouble, and would destroy the essential element of simplicity, while the voltage variation is of little consequence in comparison with the fluctuations experienced with oil lamps. The battery is not charged whilst the lamps are in use. It is of sufficient capacity to run two-thirds of the lamps for eight hours, and full instructions are given for its charging and maintenance; the plates are contained in celluloid boxes.

The Amanco set is made in sizes for 25, 50 and 100 lamps of 16 c.p. each, and is arranged in four standard ways—for driving by an existing engine, which is possible in many cases, or by its own engine, and with or without the wiring and fittings, as in some cases the purchaser may prefer to have the installation carried out by a contractor. The illustration shows the complete 25-light set. The only variation from the standard set is in the design of the fittings, of which different patterns are available. Not the least interesting feature of the system is the series of attractively designed folders, with the aid of which its advantages are effectively brought to the notice of prospective purchasers, and the drawbacks and dangers of oil lamps and lanterns are emphasised. We congratulate the company not only on developing a good idea, but also on the efficient and capable manner in which it has been carried into effect.

"Switch-off" Labels.

Messrs. Herbert Terry & Sons, Ltd., of Redditch, have sent us a sample of a patented metal label for attaching to ordinary tumbler switches, to remind the user to switch off the light. It consists of a metal ring with a projecting piece bearing the legend: "Please switch off when not required"; the ring fits on the porcelain base, being held in position by the switch cover.

These labels are printed in colours and quite reasonable in price.

Indicator Movements.

In their new catalogue of electric bells, accessories, &c., the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., show a great variety of patterns of signalling devices. We illustrate in figs. 2 and 3 two new indicator movements; the first is for mechanical replacement, and is provided with double bobbins mounted on a brass base, to which all carrying pillars are bolted, no part being riveted except the flag. Fig. 3 shows a lift indicator movement which is self-locking, and is not affected by vibration.

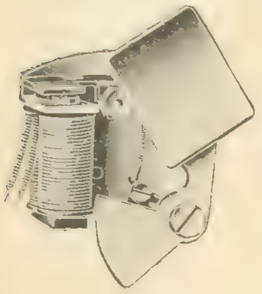


Fig. 2.

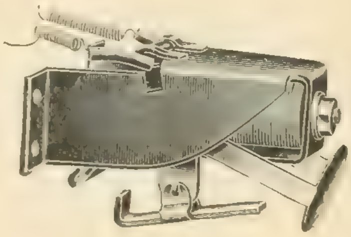


Fig. 3.

G.E. Co. Indicator Movements.

WAR ITEMS.

Employment of Disabled Sailors and Soldiers.—The Council of the Institution of Electrical Engineers desire to call attention to the demand for employment from disabled sailors and soldiers. The number at present requiring employment is not very large, but it may increase considerably during the next few months.

Enemy Trading in China.—Reuter's correspondent at Shanghai states that there has been a renewed agitation for the prohibition of enemy trading in China, in consequence of the discovery that the Germans are selling English-made goods.

Wage Disputes in Australia.—Reuter's agent at Melbourne states that engineers there are demanding an increase of wages and have intimated their refusal to work with non-unionists. The dispute threatens to interfere with the output of munitions.

Australia and British Manufactures.—The council of the New South Wales Chamber of Manufactures has unanimously endorsed the following resolutions, which were agreed to at the meeting of the executive of the Associated Chambers of Australia, held recently at Melbourne:—

"That the British Trade Commissioner be approached and requested to communicate with the British Board of Trade, urging upon it the necessity of encouraging the formation of a central body of manufacturers incorporating associations truly representative of industrial production as distinguished from commerce, with the view of enabling oversea buyers to discriminate between *bona-fide* British manufacturers and merchants and factors distributing foreign as well as British goods.

"The executive of the Associated Chambers of Manufactures of Australia further suggests that such an association, when formed, should link up with manufacturing associations and chambers of manufactures throughout the Empire."—*Sydney Morning Herald.*

Petrograd Electricity Works.—With reference to the discussion which has been proceeding in Russia for some months past, Reuter reports from Petrograd that the Council of Ministers has decided that the Petrograd Electric Light Co., founded in 1886, is worked with German capital, and that the management of the company shall be taken over by the Russian Government. A similar decision has been taken with regard to the Electro-Peredatcha Company, of Moscow.

Air Raids and Street Lighting.—A communication has been addressed to local authorities in London by the Commissioner of Police of the Metropolis with reference to the question of the extinction of street lights in the event of a raid by enemy aircraft. Manifestations of popular opinion have occurred in favour of the total extinction of the street lighting when warning is received of an impending attack by hostile aircraft. In the early stages of the war the matter was very carefully considered by the Admiralty who are the Authority responsible for the protection of London against aerial attack, and their decision, which has been confirmed after further consideration, was that such a course was most undesirable. The Commissioner points out that the extinguishing of street lights would be fraught with the most serious consequences, and would possibly bring about many more casualties than would be caused by the enemy aircraft; that in the event of fires breaking out, the Fire Brigade would not be able to reach their destinations; that the traffic actually in the streets would be dangerously impeded; that ambulance and Police movements would be hindered; and that all the elements of panic would be introduced. The Commissioner also states that, as perhaps is not generally known, numerous observations from the air have been made from time to time by the Admiralty, who are satisfied that the present system of reduced lighting is the more satisfactory condition, since an observer from the sky is quite unable to determine the quarter of London he is passing over. According to expert opinion, the extinction of street lighting would rather aggravate than reduce the degree of danger to which the public are exposed.

Mechanics Called Back.—Questions were asked in the House of Commons last week regarding the application that had been received by the War Office and the Minister of Munitions' Department for the discharge from the Army of skilled mechanics who had enlisted but whose services were required by employers engaged upon War Office work. Mr. Lloyd George said that a scheme for dealing systematically with the matter was being arranged under which the Secretary for War would utilize the services of such men who were available in this country, by getting them back from the ranks to the workshops. The delay and inconvenience referred to by members of the House was largely due to the difficulty in finding the men. Continuing (according to the "Times" report), Mr. Lloyd George said:—"Steps have been taken through the Adjutant-General to find out skilled men who have joined the ranks. It was almost impossible to get at them. A good many men gave their names and were found not to be engineers at all. Now we have proceeded the other way. We have circularized all the engineering firms to get the names of the men they want back. These names are now coming in every day. We have already thousands coming in; we are going to classify these names and take steps on that basis to get the actual men whose assistance the firms want."

From the Front.—One of our correspondents with the Forces in a letter from Suez dated June 2nd, thanks us for some copies of the "Electrical Review" which "came as an oasis in the desert." He adds: "Never was the 'E.R.' more welcome than here. It makes a distinct break from the routine of army life and outpost duty to be able to absorb 'ozone' from an electrical source." After giving a graphic account on the landing at the Dardanelles, as witnessed by the writer from a vessel anchored off the peninsular of Gallipoli, and the shelling of the trenches by the "Queen Lizzie," he expresses a longing, as some adequate means of retaliation against the enemy, for "an electric chair with a good plant behind it. It would be such a fine thing to be able to cure nervous disorders in our enemies by electrical treatment, all free of charge." In some observations on electrical work in the neighbourhood of Suez, the writer says that in wandering round "you find things which would give an English fire office inspector fits. For shop lighting flex on insulators wanders round indiscriminately; where a showcase is in the way, well, the flex goes through it—any old way as long as the light gets there. The native mind says cheapness at any cost and damn the consequences." "Overhead systems seem to be the order of the day, and a hole punched through the wall is sufficient for lead in wires. In a great many cases the houses seem to be held together by the electrical attachments." "Again thanking you for the connecting link between the electrical world and desert existence, I will cease fire."

Steel Production in Germany. In reply to a question in Parliament, Mr. Runciman (according to the "Times") said that the quantities of steel produced in the German Empire (including Luxemburg) in the first four months of this year had been reported as follows:

1915	Metric tons.
January	962,736
February	946,015
March	1,098,273
April	1,012,334

Harrogate Electricity Staff and War Munitions.—The Electricity Committee of the Harrogate Corporation have delegated to the chairman and the borough electrical engineer (Mr. G. Wilkinson) the matter of dealing with the application of the engineer for the use of the workshop and the machinery therein for the purposes of making munitions of war. The employés have offered to work overtime on the production of war munitions if the application is sanctioned.

Personal.—Mr. James Hall, in charge of the electricity works at Polquhairn Colliery, Ayr, has joined the Royal Navy.

Mr. Williams, traffic superintendent of the Bury (Lancs.) Corporation Tramways, has offered his services to the Military Motor Transport Department.

Mr. John Ward, of Brierley Hill, manager for the Dudley and Stourbridge District tramways, has enlisted as a private in the Royal Army Medical Corps.

The Bury Tramways Committee has authorised Mr. W. Clough (manager) to act on the local munitions committee. Mr. S. J. Watson, the borough electrical engineer, has also joined the committee.

The American "Electrical Review" states that Dr. G. Klingenberg, director of the Allgemeine Elektricitäts Gesellschaft, Berlin, has been decorated with the Order of the Iron Cross for services in the field.

The "London Gazette" contains the following announcements:—

Regular Forces.—Attached to Headquarter Units. Chief engineer—Lieutenant-Colonel Alain C. de L. Joly de Lotbinière, C.S.I., C.I.E., Royal Engineers, and to be temporary Brigadier-General whilst so employed. Dated 12th December, 1914.

Tyne Electrical Engineers.—Corporals C. A. C. Aitkins and R. H. Rooksby have been promoted to be Second-Lieutenants. Dated June 23rd.

The City of Dundee Fortress Engineers (1st Company), under the command of Captain H. Richardson, city electrical engineer, Dundee, had an enthusiastic send-off on Tuesday afternoon, when they left for France. Headed by the Royal Scots Band, they marched from headquarters to the station, the route all the way being densely packed by spectators. At the station the departure was witnessed by a large crowd, including the Headquarters Staff, Captain Richardson's brother officials of the city, the Lord Provost and Town Councillors, and the chief members of the staff of the Electricity Works. Amid general expressions of good luck and a happy return, the train steamed out of the station to the accompaniment of rousing cheers. We presume, from the fact that at the I.M.E.A. Convention Captain Richardson was referred to as Major, that he holds that temporary rank.

Roll of Honour.—Private Harold Burrows, 8th Battalion Manchester Regiment, who was with Messrs. Mirrlees, Bickerton & Day, Bramhall Moor, Stockport, has been killed in action in the Dardanelles.

Private A. G. Bell, of the 1st Northamptonshire Regiment, who has been killed in action at Aubers Ridge, was engaged in the Kettering electricity department prior to enlisting.

Private Fred Ellison, 8th Lancashire Fusiliers, who, prior to the war, was a clerk at the Westinghouse Works, Trafford Park, has been killed in action at the Dardanelles. He was 18 years of age.

We also learn that Mr. Ralph P. Hulton, A.M.I.E.E., who was formerly north country representative of Holophane, Ltd., has succumbed to wounds received in the operations at the Dardanelles. Immediately upon the outbreak of war, Mr. Hulton enlisted in the Engineer Section of the Royal Naval Division.

Private Edward Gilbert, formerly an engineer at the Eccles Corporation electricity works, and son of the foreman engineer at the works, has been wounded while fighting in Flanders.

George Guscott, employed at the Exeter Electricity Works, and who was called up as a Naval Reservist at the outbreak of war, is reported missing through the sinking of H.M.S. "Triumph" on May 25th.

BUSINESS NOTES.

Metal Exports from the United States.—Statistics have been prepared in relation to the exports of various metals from the United States from the beginning of August, 1914, down to the end of December, and in regard to the exports of copper to different countries in recent years. The figures are reported as follows in English tons :—

UNITED STATES EXPORTS IN AUGUST-DECEMBER, 1914.

Destination.	Copper. Tons.	Zinc. Tons.	Lead. Tons.	Aluminium. Tons.	Nickel. Tons.
England... ...	48,374	33,680	14,770	1,333	2,535
France	19,224	6,177	—	—	236
Russia	300	3,450	10,101	—	1,562
Italy	13,669	1,770	225	15	295
Scandinavia ...	11,579	554	270	270	10
Holland ...	9,560	—	75	—	160
Total ...	102,706	45,631	25,441	1,618	4,798

UNITED STATES EXPORTS OF COPPER.

Destination.	1912. Tons.	1913. Tons.	1914. Tons.
England	42,531	55,682	87,133
France	56 337	65,826	66,326
Italy	20,882	18,877	25,968
Russia	185	40	425
Germany	116 095	145,529	88,452
Austria	18,456	15,539	13,809
Holland	66,889	77,129	58,940
Belgium	3,273	2,782	2,876
China and Japan ...	502	80	1,890
Various countries ...	2,815	1,326	12,039
Total	327,965	382,810	357,858

For the first seven months of 1914 the business exports of copper to England are returned at 38,759 tons ; to France, 47,102 tons ; Italy, 12,299 tons ; Germany, 86,298 tons ; Austria, 13,611 tons ; Holland, 49,380 tons ; and Belgium, 2,338 tons.

Catalogues and Lists.—Messrs. Greenwood and Batley, Ltd., Albion Works, Armley Road, Leeds.—Eight-page illustrated pamphlet, describing their De Laval steam turbines for electric lighting and various industrial purposes, and giving a list of works and factories where they are in service ; also an eight-page illustrated pamphlet giving full particulars of a 300-kw. De Laval mixed-pressure turbine and dynamo of their make installed at the Griff Colliery, near Nuneaton.

Mr. A. H. Avery, Fulmen Works, Tunbridge Wells.—Price leaflet of Fulmen automatic cut-in and cut-outs.

Messrs. Johnson & Phillips, Ltd., Charlton, S.E.—Three new catalogues. One of 52 pages contains brief descriptive notes, with prices and illustrations, of a wide range of watertight electric light fittings—single light vertical fittings, mill fittings, English china, acid and damp-proof fittings for chemical works, laundries, &c., shop window fittings, iron cluster fittings for metal-filament lighting, street lighting lanterns and globeless cluster fittings, hand lamps, ship fittings, &c. A 12-page price list of steel conduits and fittings, enamelled and galvanised. A 28-page catalogue of electric light installation accessories, including bayonet lampholders, switch-holders, weatherproof holders, ceiling roses, wall plugs, tumbler switches, switchplates, cut-outs, wood blocks, wood casing, porcelain cleats, &c.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—New edition (the eighteenth) of their catalogue of electric bells and accessories. It consists of 80 pages of illustrated descriptive notes and prices of a wide range of manufactures, including many qualities and types of bells, indicators, relays, pushes and pulls, burglar alarms, cells, many accessories, and lightning conductors. Several pages are devoted to diagrams of connections and a numerical index.

Messrs. Haylock & Haslett, 63, Queen Victoria Street, London, E.C.—Price leaflet of the "Penlite" electric pocket torchlight, which is provided with a clip so that it can be carried in the pocket beside the fountain pen.

Private Arrangements.—C. S. Mayfield, electrical engineer, trading as J. T. Mayfield & Co., 63, Cannon Street, London, E.C.—A further meeting of the creditors of the above was held a few days ago, at the offices of Messrs. Corfield and Cripwell, Balfour House, Finsbury Pavement, E.C., when the representative of Messrs. Siemens Bros. was elected to the chair. The approximate statement of affairs presented showed liabilities of £677, of which £517 was due to the trade, and £100 to the debtor's wife, while the mother was a creditor for £60 in respect of the arrears under an annuity. After allowing £14 for preferential claims the assets were estimated to realise £185, or a deficiency of £492. The household furniture was claimed by the debtor's wife. Mr. P. Houston said that at a previous meeting a resolution was passed that a deed of assignment should be executed with Mr. G. E. Corfield as trustee, for the benefit of creditors, provided the debtor's mother agreed to give up the charge she held on the book debts, and that she ranked as an ordinary creditor. In pursuance of that resolution a deed of assignment was duly executed to Mr. Corfield, and the solicitors acting for the mother had agreed on her behalf to withdraw the claim to the book debts and to rank with the ordinary creditors, provided all the creditors agreed to the deed of assignment. Under the circumstances the creditors unanimously decided to confirm the deed already executed.

Durrell, Walker & Co., Ltd., 10, Bush Lane, Cannon Street, London, E.C., electrical contractors.—The creditors interested herein were called together recently, when it was reported that a conference of the larger creditors was held in March last as several firms were suing. Since then some of the creditors had continued their actions, with the result that it had been necessary for the debenture-holder to appoint a receiver. The company was registered on November 10th, 1911, with a nominal capital of £3,000, of which £2,002 was subscribed in cash and 998 shares were issued as fully paid. A debenture was issued for cash for £1,000, and on June 6th Mr. H. Dennis was appointed Receiver. The company had certain contracts for the supply of palm oil machinery, but it was stated that the contracts had not been proceeded with. The company had incurred a substantial loss in connection with the transaction to the extent of at least £500. They had also been concerned in litigation with regard to a patent, in which they were unsuccessful, and all the machinery in connection with the patents had had to be destroyed. Some little time ago the company obtained a concession for the supply of electricity to the town of St. Heliers, Jersey, and negotiations had been pending for the option to be transferred to another company. The result was that arrangements had been made for the transfer to take place, and the company were to be paid £1,500 in cash and £3,000 in shares, but the cash to be received was already charged to the extent of £800. The debenture-holder had hoped to make a proposal to the creditors, but nothing definite had been arranged, although it was hoped at a later date it would be possible for some offer to be submitted. It was suggested that a Committee should be appointed to negotiate with the Receiver and to report to the creditors, and that another meeting of creditors should be held about July 15th. The other assets of the company, apart from the concessions, amounted to £1,128. The liabilities, in addition to the debentures, were £4,680, of which £1,920 was due to trade creditors, £1,600 was money lent, including an overdraft at the bank, £300 was for rent, rates, &c., and £860 for other debts. The creditors decided to appoint a Committee consisting of the representatives of Messrs. W. T. Henley's Telegraph Works £653, the Sun Electrical Co. £398, the General Electric Co. £121, Tudor Accessories Co. £123, and Mr. E. H. Hawkins (Messrs. Poppleton, Appleby & Hawkins).

Liquidations.—Pintsch's Electric Manufacturing Co., Ltd — A meeting of creditors is called for June 29th at Friars House, New Broad Street, E.C., by the liquidator, Mr. H. Woodburn Kirby.

East Coast Development Corporation, Ltd.—Mr. Justice Neville, in the Chancery Division last week, appointed a receiver and manager on the application of the Union of London and Smith's Bank.

Buenos Ayres Port and City Tramways Co., Ltd.—In the Chancery Division, last week, three motions with regard to this company's affairs were before the Court. A receiver was appointed to act at once.

Australian Imports.—We have received from the Australian Association of British Manufacturers and their representatives a copy of the tabulated statement compiled by H.M. Trade Commissioner in Australia, showing the trade of the United Kingdom, Germany and the U.S A. in competition. It is stated that the U.K. share of the Commonwealth imports of competitive manufactured merchandise (January to June, 1914) was 61·9 per cent. We extract the following figures. The percentages in the right-hand section of the table show the proportion of competitive merchandise of United Kingdom origin—taking into account imports from all countries of competitive manufactured merchandise directly imported into each of the six States of the Commonwealth —

Table of Australian Imports.

Class.	All countries.	U.K. origin. Value.		Germany. Value.		U.S.A. Value.		U.K. origin. Imports into separate States. N.S.W.	Vic.	Q.	S.A.	W.A.	Tas.
	£	£	%	£	%	£	%	%	%	%	%	%	%
Metals—Manufactured ...	6,556,761	4,609.907	70·3	894 601	13·6	811,959	12·4	71·2	67·9	70·7	69·7	75 1	62 2
„ Machinery ...	2,554,039	1,378,733	54·0	190,370	7·4	851,252	33·3	58·1	50·3	52 8	50·6	47·9	21·8
„ Miscellaneous manufactured	2,271,246	1,327,153	58·4	173,800	7·6	451,140	19·9	58·1	63·7	45·1	56·1	57·2	55·6
„ Bars, rods, blooms ...	668.424	372.670	55·8	164,366	24·6	34,877	5·2	56 7	44·0	72 6	67 2	83·8	67·5
„ Pig and ingot	190,351	120,476	63·3	4,608	2·4	26,004	13·7	53·9	61·8	95·3	79 0	70·2	100 0
Earthenware, cement, china, glass, &c.	759,444	347,953	45·8	198,870	26·2	34,879	4·6	46·1	48·1	38·3	48·2	43·5	57·3
India-rubber—and manufactures of ...	390,489	129,306	33·1	115,762	29·6	51,742	13·3	40·4	24·7	37·4	36 3	48 9	46·4
Instruments—Scientific, surgical, &c	355.840	143 567	40·4	48 640	13·7	125.250	35·2	35 7	45·6	57·2	58·7	64·5	60·5

Canada.—An agent in Dartmouth (Nova Scotia) wishes to take up agencies of United Kingdom manufacturers of electrical apparatus, fittings and accessories. Application should be made in the first instance to the Board of Trade Commercial Intelligence Branch in London. Reference, C.I.B. 31,659.

Russia.—An agent wishes to represent United Kingdom manufacturers of locomobiles, steam turbines, Diesel and semi-Diesel engines, generators and electrical fittings. Application should be made in the first instance to the Board of Trade Commercial Intelligence Branch in London. Reference, C.I B. 30,132.

Ironsafe Power Switchboards.—Twenty years ago the ironclad medium pressure type of switchboard was unknown. To-day it is to be found controlling the electric power and lighting of many a modern factory and workshop. The construction of solid steel, iron, copper and mica is the embodiment of "strength," and the exposure of "live parts" in open boards has given way to the totally enclosed ironsafe fool-proof type of switchboard. The original inventors and developers, Messrs. Berry, Skinner & Co., fool-proof ironclad switchgear specialists, 78, Upper Thames Street, London, England, inform us that they possess over 600 original designs and patterns dealing with every class of work, every type of cable connection, and every conceivable electrical hazard.

Book Notices.—"Dielectric Phenomena in High-Voltage Engineering." By F. W. Peek, jun. London: Hill Publishing Co. Price 12s. 6d. net.

"Arithmetic of Alternating Currents." By E. H. Crapper. London: Whittaker & Co. Price 2s. 6d. net.

"*Bulletin* of the Bureau of Standards." Vol. 11, No. 3. May 10th, 1915. Washington: Government Printing Office.

"Annual Report of the National Physical Laboratory for the Year 1914-15." Teddington: W. F. Parrott.

Fire.—Damage estimated at £1,000 was done by fire on 16th inst. on the premises of Messrs. David Bone & Co., electrical engineers, Bishop Street, Anderston, Glasgow.

Australia: Catalogues Wanted.—A firm of merchants and agents invites British manufacturers of arc lamp carbons, metal conduits, porcelain insulators, and electrical accessories, to send catalogues and prices. He desires to take up agencies. Applications should first be made to the B. of T. Commercial Intelligence Branch, London, and later to H.M. Trade Commissioner at Sydney.

Correction.—The name of the amalgamated battery company referred to on page 855 of our last issue should have been given as "Pritchett & Gold and Electrical Power Storage Co., Ltd.," not *Pritchetts* & Gold, &c.

For Sale.—Farnworth U.D.C. has for disposal one Lancashire boiler, 30 ft. × 7 ft. 6 in., with accessories. Tenders by July 14th. Particulars are given in our advertisement pages.

LIGHTING and POWER NOTES.

Aberdare.—Cottage Lighting.—Subject to the cable being extended, the U.D.C. has decided to have the electric light installed at the Council's tenements at Abernant at a cost of £3 per house, the tenants to pay an increased rental of 6d. per week to cover the cost of current supplied.

Arbroath.—Street Lighting.—The Arbroath Electric Light and Power Co. has informed the T.C. that it will be prepared to renew the contract for street lighting for a period of seven years, when the present restrictions on public lighting are withdrawn, at £280 per annum as before. Owing to the unsettled conditions the company did not see its way to differentiate for shorter periods of three and five years, and as the cost of supplies had greatly increased it was unable to offer any reduction in price. The Council has decided to allow the present contract with the company to run out, and not to enter into any contract for lighting with either gas or electricity until the present lighting restrictions are withdrawn.—*Dundee Advertiser.*

Aberdeen.—Restricted Lighting. — Owing to the restricted public lighting, the Corporation Lighting Committee reports that there has been a saving of £6,000 for the year on this matter.

Australia. — Electric Cooking. — The Australasian Temperance and General Mutual Life Assurance Society, Ltd., has given an order to Messrs. W. G. Watson & Co. for the supply of 180 electric ranges and stoves for the new T and G residential flats building at Hyde Park, Sydney. The order is valued at £750, and the apparatus will be of the Hotpoint type, manufactured by the Hotpoint Electric Heating Co., of Ontario. The complete plant is capable of cooking for 1.170 people.—*Com. Engineer.*

The Mount Gambier Council (South Australia) has, at the request of a local company, decided to apply for an Order in Council to install electricity in the town.

The Kyneton (Victoria) Council has decided to obtain a report from a consulting electrical engineer on the lighting of the municipality, and also of the town of Trentham.

The Williamstown Council (Victoria), which had earmarked £18,000 out of the £35,000 proposed loan from the Government, for the installation of a municipal electric lighting scheme, has decided to make other arrangements for the floating of a loan. It was stated that the object of the Government in offering to lend money to municipalities was to provide employment, and as a large portion of the lighting loan would be sent abroad for the purchase of machinery, that object would be defeated if the full amount of the loan was granted.

The Lillydale Shire Council (Victoria) has established an electric lighting system in the township of Ringwood, with extensions to Croydon, at a cost of £1,600.

The municipality of East Fremantle (W.A.) proposes borrowing £1,428, to which will be added £8,571 by the municipality of Fremantle for additions to power house plant, &c., tramway extensions, cars, and mains and transformers for lighting purposes.

The W.A. Railway Commissioner has notified the Fremantle Council that it was the intention of the department in the near future to supply current to the local railway station, harbour works and other Government departments direct from the new power station in East Perth, also to the naval base at Cockburn Sound.—*Tenders.*

The *Sydney Daily Telegraph* states that the North Sydney Council has decided to enter into a contract for five years for street lighting by gas, at £4 per lamp per annum. It was pointed out that the Sydney City Council's offer was £3 2s. 6d. for electric light, and if the latter gave light equal to the gas there would be a saving to the Council of about £1,000 a year. It was finally considered that it would be to the interests of the Council to enter into the agreement with the gas company.

A Sydney company has taken up a large area of coal-bearing land on the western boundaries of the Corrimal-Balgownie, Bellambi and Bulli Collieries, N.S.W. It is intended to proceed at once with the development of the property, and for this purpose a modern electrical power plant is to be installed. By boring, a seam of coal 8 ft. 3 in. in thickness was proved at 1,614 ft. deep.—*Tenders.*

Buxton.—PROPOSED LOAN.—The U.D.C. has written to the L.G.B. urging the granting of a loan of £1,000 to cover excess expenditure up to March 31st and to meet present urgent requirements of the electricity department. The price of current is to be increased from the date of the taking of the meter index in June.

Barnstaple.—YEAR'S WORKING.—The annual accounts of the Council's electricity undertaking show total loans authorised amounting to £32,442, and amount at present outstanding £21,128. Working expenses for the year were £3,198, and the amount carried to net revenue account was £2,032.

Bradford.—The Corporation is to supply current for lighting and power purposes to Dumb Mill, Frizinghall. When the installation is complete it will comprise the largest drive of spinning plant in Bradford. In this connection it is pointed out that at the present time—with coal at such abnormal figures—it would easily be a paying proposition for a mill owner to shut down his old plant and replace it with an electric installation, especially so where room is a consideration.

Burton-on-Trent. — YEAR'S WORKING. — The annual report of the Corporation electricity department shows that during the past year 3,000,000 units were sold, and that the units used for heating and cooking had increased by over 300,000. The installation of new plant resulted in a reduction during the last two years in the annual cost of fuel of £1,200, although one-third more electricity was generated. During the year the profit-sharing system came into operation, and with regard to the electricity department, each man would receive about 6 per cent. on his total wages for the year. The year's profits were £3,056, as compared with £3,747 for the previous 12 months.—[*Burton Evening Gazette.*

Bury (Lancs.).—The T.C. has applied to the B. of T. for consent to the erection of a 6,600-volt overhead line in the town.

Canterbury.—YEAR'S WORKING.—The accounts of the Corporation's electricity undertaking for the past year show that the working expenditure was £6,135, an increase of £400; and the revenue amounted to £12,053, an increase of £901 over the previous year; the gross profit was £5,917, as against £4,415, and the net profit £1,891, as against £1,436.

Castletownbere.—L.G.B. INQUIRY.—An inquiry has been held into the application of the District Council to be vested with urban powers for the purpose of carrying out a scheme for lighting the town by electricity.

China.—The town of Kongmoon, situated near Canton, is making rapid progress with its electrical development. It is now four years since the present electricity station was equipped with a 40-KW. generator, belt-driven from a suction gas engine. Having at last overcome the superstition of the natives, electric light has become so popular that further extensions have now become imperative, and three 75-KW. twin-cylinder gas engine sets with producer plant, the engines driving single-phase generators, are to be installed, the contract having been secured by Messrs. Shewan, Tomes & Co., of Hong-Kong. It is expected to be ready to start up in about four months' time.

Continental.—RUSSIA.—Engineer Nevodnichansk according to the *Vilna Viestnik*, is preparing plans for the installation of a fifth set of machines in the Vilna town electric station regarding which negotiations have been taking place with English, Swedish and Swiss firms.

The Town Council of Ryazan is engaged on a project for providing the town of Ryazan with electricity. The acquisition of a fourth set of plant and the extension of the electric lighting of the town, besides tramways, &c., is in contemplation.

A group of capitalists and engineers in Pinsk is asking for a concession for the electric lighting of Pinsk. The group will proceed to the work of construction immediately on receiving the concession.

On April 4/17th a start was made in firing two boilers at the Petrograd central electric station with petroleum. The fitting of the remaining boilers to burn petroleum is being actively proceeded with.

The Siemenoff (Nizhi-Gorod Government) T.C. has appointed a select committee to examine a project to install electric lighting in the town.

At Saratoff it is proposed to construct a special electric station for the Post Office buildings. It is calculated that it would cost 20,000 roubles per annum to purchase energy, whilst it would only cost about 10,000 roubles to generate it at the institution. The cost of the station is estimated at 50,000 roubles. It is contemplated also to sell current to other concerns, and thus to improve the financial position of the enterprise.

A town electric station in Vladikavkaz in the Caucasus is under consideration.

The Minister of the Interior has confirmed a contract between the town of Slutsk and the engineer, V. V. Dmitrieff, for the installation of electric lighting in the town.

Dublin.—The Corporation, by 34 votes to 11, agreed to the Electricity Supply Committee's recommendation for an increase in lighting charges of one halfpenny, and in power rates of a farthing per unit.

Edinburgh.—NEW POWER STATION.—The Corporation has finally decided to accept the estimate of the Stirling Boiler Co. for water-tube boilers for a new power station at Portobello, amounting to £32,286, although an effort was made by a minority of the Council to delay the work on the ground that the time was inopportune. Under the provisional order of last year the Corporation is bound to lay new mains by August, 1916, and to supply four parishes in Midlothian.

Exeter.—YEAR'S WORKING.—The electrical engineer's report on the past year's working of the electricity department shows a gross surplus of £8,243, and net surplus of £1,554. The total number of units sold was 1,716,350, an increase of 47,236 over the previous year. The output for tramways increased by over 8 per cent., and for power and heating by a similar amount, but reductions occurred in private lighting.

Federated Malay States.—As it is believed that the Taiping field will pay for dredging, a scheme is proposed which involves a central station for generating current for electrical dredges, capable of treating half a million yards monthly —*Tenders.*

Halifax.—RESTRICTED LIGHTING.—The local authorities, as a result of representations by the Chamber of Trade, have modified the lighting restrictions, so that tradesmen need no longer draw blinds over their shop windows and may use ordinary window lighting, but naked lights must be shaded so as not to throw a direct glare on the footpath, and no outside lights are yet permitted.

Haworth.—The Council has petitioned to be heard against the confirmation of the provisional order granted to the Keighley Corporation, in respect of the electric lighting of the urban districts of Oakworth and Oxenhope and the rural district of Keighley.

Heckmondwike.—Owing to the increased cost of coal, the U.D.C. has advanced the present prices for current by 10 per cent., with a discount for prompt payment of accounts, and withdrawn the present scale of discounts.

Heywood.—YEAR'S WORKING.—The annual report of the Corporation electricity department shows a total income of £7,121, an increase of £695. The income from traction shows an increase of £1,234, and the income from power a decrease of £525. The expenditure amounted to £8,049, a net decrease of £2,987; and the debit balance is £927, compared with a debit balance in the previous year of £4,610. The total number of units sold was 1,287,006, an increase of 124,195. It is anticipated that by October, 1915, the Bury bulk supply scheme will be in operation.

Hucknall Torkard.—PROPOSED E.L.—A scheme of E.L. has been submitted to the U.D.C. by the Sherwood Colliery Co., which contemplates the extension of its electrical plant at the Hucknall pits. The company has offered to supply current in bulk to the Council when the extension of plant is complete, but the scheme will not be carried out until the termination of the war. The proposal is viewed favourably by the Council.

India.—*Indian Engineering* says there have been many complaints regarding the electric lighting throughout Bangalore city and station, but matters, it is understood, will be rectified by July 16th, when a lot of the plant which has been in use for 12 years at Sivasamudram is to be replaced by modern machinery. Mr. H. P. Gibbs, a former chief electrical engineer to the Mysore Government, is now in Bangalore in the capacity of consulting engineer.

Ipswich.—PRICE INCREASE.—On account of the greatly increased cost of coal, &c., the T.C. has advanced the price of current for lighting from 4d. to 4½d. per unit, and for heating, power, cooking, &c., including charges under the rateable value tariff by 10 per cent., from the meter readings for the June quarter.

Kettering.—PRICE INCREASE.—On account of the rise in the price of coal, the U.D.C. has decided to increase the charge for current for power purposes by 10 per cent. for the ensuing year. The price of current for lighting remains unaltered.

Liverpool.—The Mersey Docks and Harbour Board proposes to provide at the west block of the Waterloo grain warehouses, two modern belt electric discharging elevators, at an estimated cost of £8,750.

London.—POPLAR.—The Finance Committee of the B.C. has adopted the proposals of the Electricity Committee for the allocation of the surplus profits of the undertaking for the past 12 months. By the adoption of this proposal, the balance in hand will be as follows:—Net surplus for the year, £14,749, less allocation in respect of first charges, £4,823; superannuation and pension funds, £1,352; general fund, £3,500; and grant to staff, £1,000; leaving a balance of £4,073. From this has to be deducted the value of the machinery displaced during the year, less repayments on account of same and residual value of plant

£1,565; and the amount to be written off after disposal of the batteries of the north and south sub-stations, £1,605. This leaves £902 unappropriated, which it is proposed should be carried forward and ear-marked against the disposal of No. 4 generating set, which will have to be dealt with during the current year, when it is impossible to forsee any large sum available for this purpose.

Kensington.—Half-Watt Lighting.—The borough engineer reports that the substitution of half-watt lamps and fittings for the arc lamps in the streets of the borough has been completed. There are 112 of the latter lamps for which the Council has no further use, and instructions have been given for the invitation of offers to purchase.

Stepney.—Loan Sanction.—The Treasury has sanctioned the borrowing of £15,000 by the B.C. for mains for the electricity supply undertaking.

L.C.C.—The Finance Committee recommends the Council's sanction to the borrowing of £15,038 and £1,240 by the Stepney B.C. for the acquisition of property in connection with the electricity undertaking; part of the land is required for coal storage, and another portion to allow sufficient frontage on the river to enable a steamer to be brought alongside. The Treasury has agreed that sanction may be given in this case.

The Committee also recommends the Council to sanction the borrowing of £3,031 by the Hackney B.C. in respect of money spent up to March 31st, 1915, for house services. The Treasury raised no objection to the sanction.

Merthyr Tydfil.—Price Increase.—The Electric Traction and Lighting Co., Ltd., has decided to advance the price of current for lighting at Merthyr, Penydarren and Dowlais to 4½d. per unit., less ½d. per unit for prompt payment of accounts, as from July 1st.

North Ormesby.—Owing to the refusal of loans for the laying of additional mains, the Middlesbrough T.C. has had to refuse the request for the mains to be extended to North Ormesby.

Portstewart.—E.L. Scheme.—The Town Commissioners have decided to request Messrs. McLenahan to proceed with the scheme for lighting the town with electricity.—*Irish News.*

Northampton.—B. of T. Inquiry.—Mr. A. P. Trotter held an inquiry on Tuesday last into the application of the Northampton Electric Light and Power Co., Ltd., for the consent of the B. of T. to the construction of a new generating station on the River Nene, near the Midsummer Meadow. In support of the application it was stated that the output was increasing so rapidly that it was imperative to make extensions; at the present time it was 30 per cent. more than for the same period of last year, and 80 per cent. of the current sold was for motors. Referring to some of the objections, the inspector stated that no one would be more sorry to spoil the view of the country than he, but the Act of Parliament did not protect that. The town clerk stated the main objection of the T.C. was that the station would be outside the borough, and the inspector said the question of rateable value was rather outside the scope of the inquiry. As regarded the objection to smoke from the new works, he did not anticipate any nuisance in view of the modern appliances to be installed.

Preston.—Price Increase.—The T.C. has been informed that the National Electric Supply Co. had notified an increase of ½d. per unit in the price of electricity for lighting.

Radcliffe.—Price Increase.—From October next the price of electricity is to be increased—for lighting by 10 per cent. and for heating and power by 15 per cent.

Rochdale.—Price Increase.—The Electricity Committee has decided to recommend that the charges for electricity for lighting be increased by 10 per cent., and for power purposes (including tramways) by 15 per cent. The new charges are to come into force in the September quarter.

Salford.—New Plant.—The Electricity Committee has asked for permission to apply for sanction to borrow £19,225 for the supply and erection of a 5,000-kw. turbo-alternator, together with the requisite foundations, piping, &c., at the Frederick Road station, and £5,250 to cover the cost of plant, &c., required in connection with the additional supply of power.

Shrewsbury.—Year's Working.—There was a surplus on the electric light undertaking for the past year of £785, as compared with £131 in the previous year.

Stockport.—New Electricity Charges.—The following charges for electricity have been fixed by the T.C., and come into operation next week:—Lighting: First 25 units consumed per quarter, 5d. per unit, all in excess at existing rates, plus 10 per cent. increase. Power: Existing rates to be charged, and coal clause to apply to all consumers. Heating: First 25 units per quarter at 1½d. per unit, all in excess at existing rates, plus 10 per cent. Accounts under £1 are to be net, and other accounts are to be subject to 1¼ per cent. discount for payment on the due dates. A minimum charge of 7s. 6d. per quarter is to be made to all consumers.

Tempo (Co. Fermanagh).—L.G.B. Inquiry.—An inquiry was held at Enniskillen last week into an application by Enniskillen Rural Council for urban powers for the lighting of the village of Tempo.

Willesden.—The Electricity Committee of the U.D.C. proposes to extend the mains in order to supply the Picture Palace at Stonebridge, provided the company interested agrees to advance £250 toward the cost, such sum to be repaid by means of deductions from the accounts for the current at the rate of ½d. per unit consumed.

TRAMWAY and RAILWAY NOTES.

Bolton.—In connection with the application of the Amalgamated Association of Tramway Workers for an advance of a farthing per hour on July 1st next, and a further farthing on January 1st, the Association is to be asked to send a deputation to the next meeting of the Tramways Committee.

Burton-on-Trent.—Year's Working.—There was a gross profit on the Corporation tramways, for the year ended March last, of £3,531, and a net profit of £838; £1,500 has been placed to renewals fund, making a net loss of £662.

Edinburgh.—Electric Vehicle.—A new 30-cwt. Edison truck has been purchased by the Electric Lighting Department. The truck is capable of travelling 40 miles on one charge.

Glasgow.—Year's Working.—The abstract statement of the revenue and expenditure of the tramway department for the year ending May 31st shows that there was a total revenue of £1,076,868, against a total of £1,083,847 for the previous year. The total expenditure was £735,987, and included £51,816 spent in connection with the European war in the provision of allowances to employés who have joined the Colours, the raising and equipment of the Glasgow Tramways Battalion, and other relative outlays. The expenditure for 1913-14 was £676,277. The net revenue account amounted to £406,717, compared with £472,558, out of which the following appropriations were made this year:—Rent of Paisley lines £5,559, against £5,830 last year; interest on capital, £79,797, against £82,921; sinking fund, £105,491, against £102,607; income-tax, £22,790, against £14,056; Parliamentary expenses, £8,818, against £609; and renewal and depreciation, £172,310, against £212,642—total £393,866, against £418,566. The surplus to be handed over to the Common Good Fund this year was £12,951, against £53,892.

Greenock.—Trailer Cars.—The Corporation is to allow the local tramway company to use trailer cars early in the morning, at meal hours, and in the evening when men are coming from work.

Heywood.—Year's Working.—The report on the year's working of the Council's tramways shows a total income of £11,626, compared with £11,838 in 1914, and total expenditure amounting to £7,944, as compared with £7,068. The gross profit was £3,681 last year, and £4,770 in 1914; and the net loss was £1,042, compared with a profit of £85 in 1914. The car-miles run numbered 269,087, against 269,426; the passengers carried, 2,268,331, against 2,322,007; the units used, 376,726, against 426,792; the units per car-mile 1·40, against 1·58; and revenue per car-mile 10·37d., against 10·54d.

Hull.—Female Labour.—The tramwaymen have entered a strong protest against the proposal of the Tramways Committee to employ women as conductors, and many of the men have declared that they will refuse to run the cars if the proposal is carried into effect. The tramway manager has opened a register for women, which has met with an excellent response.

Oldham.—Parcels Delivery.—A proposal is on foot for purchasing a motor delivery van for the parcels delivery department of the tramways, and the general manager is to prepare a report on the probable cost and revenue.

Rochdale.—The Tramways Committee has agreed to receive a deputation from the tramway workers respecting their application for a permanent advance of a penny per hour in lieu of the war bonus, which is stated to be calculated to operate unfairly.

Southend-on-Sea.—As a number of employés on the tramcars and motor-'buses are joining the Army, the T.C. has decided to fill the vacancies with men not eligible for the Forces.

TELEGRAPH and TELEPHONE NOTES.

Russia.—The inauguration of a new wireless station, the largest in Russia, which has been erected during the war, took place last week, messages being exchanged between the Chairman of the Duma and the Speaker of the House of Commons.

Spain.—The American Consul at Seville states that for some time there has been an agitation on foot for the extension of telephone lines to the various towns and villages surrounding Seville. The town at present has an urban system which is more or less satisfactory, but which so far has declined to extend its lines outside the city limits. An interurban company serves the different capital cities of Spain, and connection by its lines can be had from Seville with Madrid, Granada, Malaga, Cadiz, Huelva, Cordova and the other larger cities, but this system is not directly connected with the urban system. The present agitation looks towards the combination of the interurban with the urban system, and the extension of the interurban system to the surrounding towns and villages. The six provinces known as Sevillian Andalusia contain a population of over 5,170,000, with an area of 54,059 sq. miles. There are 48 cities in the district and 319 towns, and there are said to be, according to the latest statistics, 533,047 buildings in this territory. The interurban company which contemplates the proposed extensions is known as the Compania Peninsular de Telefonos Interurbanos, 25, Celle Tetuan, Seville. All correspondence with the company and all literature should be in Spanish.

Telegraph Operators.—A number of men between the ages of 17½ and 19, who have attended technical schools, are required by the Royal Engineers for the purpose of training as telegraph and wireless operators. They will be required to enlist in the Royal Engineers at the usual rates of pay. They will then be sent to the General Post Office or one of its branches for the course of training, after which they will be attached, according to the exigencies of the service, to the Royal Engineers or to the Royal Aircraft Corps.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—MELBOURNE.—Aug. 11th. One 1,000-KW. D.C. generator complete, liquid starter, &c., for City Council. See "Official Notices" June 4th.

July 27th. A.C. and D.C. meters and maximum demand indicators, for the City Council. See "Official Notices" to-day.

ADELAIDE.—August 18th. Deputy P.M.G. Switchboard cable (Schedule 387), 325 magneto bells and 215 trembling bells (Schedule 386), switchboard cable and cord (Schedule 388).

PERTH.—August 11th. Deputy P.M.G. Insulators and spindles (Schedule 400), copper wire (Schedule 401).—*Australian Mining Standard.*

Basingstoke.—Installation of electrical plant, including engines, dynamo, battery, cables, &c., at Park Prewett Asylum. See "Official Notices" June 18th.

Batley.—July 1st. Electric light installation, Batley Carr Church. Dr. Ward, Highbury, Batley Carr, Yorks.

Doncaster.—June 26th. Coal (small steam, washed or unwashed), 2,750 tons for six months, 5,500 tons for 12 months, for the Corporation Electricity Department. General Manager, Grey Friars Road.

Eastbourne.—June 26th. 160 ft. of 14-in. cast-iron circulating water piping and valves. See "Official Notices" June 11th.

Edinburgh.—July 12th. Corporation. One 1,000-KW. motor converter and transformer. See "Official Notices" to-day.

Erith.—July 5th and 19th. U.D.C. One water-tube boiler with superheater, economiser, automatic stoker, steel chimney, induced-draught plant, steam valves, steam pipes, and all auxiliaries. One 2,000-KW., H.P. turbo-alternator, with condensing plant, switchgear, and all accessories. See "Official Notices" June 18th.

Exminster.—June 29th. Electrical appliances for a year, for Devon County Lunatic Asylum. Mr. H. E. Morgan, Clerk.

France.—July 23rd. The Administration des Chemins de Fer de l'Etat wants 99 sets of heating apparatus for electric railway vehicles. Apply at the Bureaux du Service Electrique (3rd div.), 72, Rue de Rome, Paris, on Tuesdays or Fridays, from 3 to 5 p.m.

Halifax.—July 1st. Corporation. One 5,000-KW. turbo-alternator complete with condenser; two natural-draught chimney-type cooling towers; one water-tube boiler, superheater and mechanical stokers. See "Official Notices" June 18th.

India.—Our special correspondent writes:—"The Commissioners for the Port of Calcutta have issued conditions and specifications and invite tenders for four 250-KW., 6,600-500-volt, 50-cycle, three-phase main transformers; four 60-KW., 6,600-500 volt, 50-cycle, three-phase auxiliary lighting transformers, together with high and low tension switchgear for the same, for the riverside jetties and sheds at Garden Reach. Most of the gear must be fixed and in working order by January 1st, 1916, under a penalty of 100 rupees per day for each day late beyond this date. Tenders must reach Calcutta by July 27th. Under ordinary conditions two months is ample time in which to get out prices from home, but under present war conditions it will be a scramble to get out by post particulars so as to quote in time. This contract will be a useful one for any firm to get, as a good deal more three-phase gear is certain to be required later by the Port Trust."

Limerick.—July 2nd. Corporation. 180 tons of coal (anthracite peas) for delivery in August. Particulars from Mr. E. Badham-Thornhill, Borough Electrical Engineer.

Liverpool.—June 26th. Electrical supplies for three months, for Toxteth Park Board of Guardians. Mr. R. A. James, Clerk, 15, High Park Street.

London.—METROPOLITAN ASYLUMS BOARD.—June 30th. Lighting installation at the Grove Fever Hospital, Tooting Graveney, S.W. See "Official Notices" June 11th.

FULHAM.—June 30th. 11,000 tons of coal, for the Borough electricity works. See "Official Notices" June 11th.

Manchester.—June 28th. Sanitary Committee. Additional electric lighting plant, &c., at the Baguley Sanatorium. Specifications (two guineas, returnable) from the City Architect.

Rangoon.—August 11th. Installation of a system of fire-alarms, for the municipality. Specification (10s.) from Messrs. Ogilvy, Gillanders & Co., 67, Cornhill, E.C.

Salford.—June 28th. Supply of stores, including cable, &c., for the Electricity Department. See "Official Notices" June 18th.

Spain.—August 3rd. Spanish Ministry of Public Works, Madrid. Concession for the construction and working of an electric tramway between Deusto and Ibarrecolando (Province of Vizcaya). Application has already been made for the concession for the projected line, but, in accordance with the usual plan in Spain, the scheme is being put up to public tender.

Tasmania.—LAUNCESTON.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Walsall and West Bromwich.—July 5th. Lighting; heating apparatus; drainage and septic tanks, for Unions Joint Committee. See "Official Notices" June 18th.

CLOSED.

Australia.—The Hawthorn Tramway Trust has accepted the following tenders in connection with the construction of the line from Melbourne to Burwood via Swan Street, Richmond:—

Buffer battery.—Sutherland & Ashman, on behalf of the Chloride Accumulator Co., £2,732.
Booster.—Sutherland & Ashman, on behalf of Mather & Platt, £[illegible].
Motor generator.—British Westinghouse Co., England, £[illegible].
Switchboard.—British Westinghouse Co., £[illegible].

Aylesbury.—The U.D.C. has accepted the tender of Messrs. Drake & Gorham for Osram metallic-filament lamps for street lighting, at £33.

Glasgow.—A T.C. sub-committee recommends acceptance of an offer by Messrs. Ferguson, Pailin & Co. for a switchboard at Govan electricity station, at £1,923.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

WAR OFFICE.

Battery boxes.—Accumulator Industries, Ltd.; [illegible] Mfg. Co., Ltd.
Insulator brackets.—Bayliss, Jones & Bayliss, Ltd.; Bullers, Ltd.; [illegible] and Beal, Ltd.; Johnson & Phillips, Ltd.; S. Lewis & Co., Ltd.; Francis, Morton & Co., Ltd.; Stevens Bros. & Co., Ltd.
Electric cable and wire.—B.I. & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connolly Bros., Ltd.; Craigpark Electric Cable Co., Ltd.; J. Frankenstein & Sons, Ltd.; General Electric Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph & I.R. Works, Ltd.; India Rubber, Gutta Percha and Telegraph Works Co., Ltd.; Liverpool Electric Cable Co., Ltd.; C. Macintosh & Co., Ltd.; Ransom, Sims & [illegible] Iron Co.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Ward and Goldstone, Ltd.; Western Electric Co., Ltd.; Yorkshire Cable Co., Ltd.
Electric cells (parts of).—Siemens Bros. & Co., Ltd.
Pole clips.—Bullers, Ltd.; Siemens Bros. & Co., Ltd.
Condensers.—Automatic Telephone Mfg. Co., Ltd.; India Rubber, G.P. and Telegraph Works Co., Ltd.; Telegraph Condenser Co., Ltd.
Stoneware conduits.—Albion Clay Co., Ltd.
Telephone cords.—B.I. & Helsby Cables, Ltd.; London Electric Wire Co. and Smiths, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Distribution boards, switches, &c.—[illegible] Eng. Works.

Ebonite rod and sheet.—Britannia Rubber & Kamptulicon Co., Ltd.; New Eccles Rubber Co., Ltd.; Peel-Conner Telephone Works, Ltd.
Oil engine and dynamo.—[illegible] & Co., Ltd.
Electric light fittings.—Armorduct Mfg. Co., Ltd.; Barton & Sons, Ltd.; Credenda Conduits Co., Ltd.; Eureka Conduit & Fittings Co., Ltd.; General Electric Co., Ltd.; Perfecta Seamless Tube & Conduit Co., Ltd.; Simplex Conduits, Ltd.
Galvanometers.—Edison & Swan U.E.L. Co., Ltd.; A. Kershaw & Sons, Ltd.; Record Electrical Co., Ltd.; Walters Electrical Mfg. Co., Ltd.
Gutta-percha (sheet).—Craigpark Electric Cable Co., Ltd.
Insulators and cups.—Thos. De la Rue & Co., Ltd.
Electric lamps.—Edison & Swan U.E.L. Co., Ltd.; Pope's Electric Lamp Co., Ltd.
Rubber tape.—Ancoats Vale Rubber Co., Ltd.; Irwell & Eastern Rubber Co., Ltd.; New Liverpool Rubber Co., Ltd.; Siemens Bros. & Co., Ltd.
Terminals, electric instruments.—C.L.A.M. Mfg. Co., Ltd.
Electric cables: Rhyl, Oswestry, Cannock and Mansfield.—Callender's Cable & Construction Co.
Electric wiring: Salisbury, Rhyl, Oswestry, Cannock and Mansfield—V. G. Middleton.
Electric light and power installation: South Farnborough.—V. G. Middleton.
Electrical work: Swanage Camp.—Electrical Contracts & Maintenance Co., Ltd.

India Office Store Department.

Cable.—C. Macintosh & Co.; Siemens Bros. & Co.
Cells.—Siemens Bros. & Co.
Telephones.—General Electric Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.
Wire.—F. Johnson & Nephew; Shropshire Iron Co.
Wireless telegraph parts.—Marconi's Wireless Telegraph Co.

Post Office.

Telegraphic apparatus.—Creed, Bille & Co., Ltd.
Telephonic apparatus.—Automatic Telephone Mfg. Co., Ltd.; I.R., G.P. and T. Works Co., Ltd.; Western Electric Co., Ltd.
Telephonic cable.—Callender's Cable & Construction Co., Ltd.; W. T. Glover & Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephone lamps.—General Electric Co., Ltd.
Wood poles.—A. H. Clough; J. Ellis.
Pulley weights.—Siemens Bros. & Co., Ltd.
Insulator spindles.—Bullers, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Insulated bronze wire.—B.I. & Helsby Cables, Ltd.
Telephone exchanges: additional operators' positions at Newport (Mon.).—Automatic Telephone Mfg. Co., Ltd.
Extension of equipment at Edgbaston.—Western Electric Co., Ltd.
Do. do. at Finchley.— Do. do.
Modification of A and B positions at Belfast.—Western Electric Co., Ltd.

H.M. Office of Works.

Electric wiring, Public Trustee's office.—T. Clarke & Co., Ltd.

London.—Stepney.—The Electricity Committee has considered the tenders received for the supply of coal and coke for the ensuing year, and, as the prices quoted are so high, it is unable to recommend the acceptance of any of the tenders. The Committee recommends that the Standing Committees of the Council be authorised to accept, during the pleasure of the Council, offers or tenders for the supply of coal brought to their notice by the responsible officers concerned, particulars of such offers being subsequently reported to the Council for formal approval.

The Electricity Committee has accepted offers of 3,000 tons of coal for the electricity undertaking, at prices ranging from 18s. 9d. to 22s. a ton; and recommends the acceptance of the tender of Mr. W. Badger, at £61, for the supply of piping, valves, &c., in connection with the air-heaters at the Limehouse generating station.

Salford.—The Electricity Committee recommends (1) the acceptance of the tender of the British Westinghouse Co. for one 1,000-KW. rotary converter and transformer (including midwire booster), for £2,820; and (2) the purchase from Messrs. W. T. Glover & Co., Ltd., of high-tension cable, amounting approximately to £1,457, required to connect the electricity station, Frederick Road, Pendleton, to the works of the Broughton Copper Co., Ltd.

Watford.—The Guardians have accepted the tender of Messrs. E. Brook, Ltd., at £28 14s., for an electric motor.

The E L. Committee is purchasing 2,000 tons of Newdigate peas, during the next 12 months, from Messrs. E. Foster & Co., at 21s. per ton, subject to 2d. per ton increase per 2½ per cent. rise in the miners' wages, during the period of the continuance of such rise in wages.

West Ham.—The Education Committee of the T.C. has accepted the tender of Mr. J. T. Halsey, at £163, to carry out the electric lighting work at the Knox Road Special School.

FORTHCOMING EVENTS.

Physical Society.—Friday, June 25th. At 5 p.m. At Imperial College of Science, South Kensington, S.W. Papers on "A Theory of the Electrical Resistance of Metals," by Sir J. J. Thomson, and on "An Unbroken a.c. for Cable Telegraphy," by Lieut. Col. Squier.

NOTES.

Lamp Litigation.—We find that the notice of the Sceando Lamp Co., which appeared on page 20 of our advertisements last week, was wrongly described as a "Patent" notice. The action was one in which the Osram Lamp Works applied for an injunction restraining the defendants from using the word "Axial." No question of patents arose in this action. The patent action pending has not yet come on for hearing.

Electricity in Farming.—For the benefit of those who may be interested, we may mention that the motors illustrated in the views of Hereford flour and cider mills, on page 869, last week's issue, were supplied by the British Thomson-Houston Co., Rugby.

The Electric Vehicle Committee.—A meeting of this Committee was held on June 11th. Mr. A. R. Fearnley, the general manager of the Sheffield Corporation Tramways, has been co-opted a member of the Committee as the representative of the Municipal Tramways Association.

It was reported that the sales of No. 3 (June) issue of "The Electric Vehicle" had been very satisfactory, although the number had only been out a few days, and it was decided to send in a request that evidence be heard by the Special Committee of the L.G.B. on Motor Traffic with regard to the effect of the use of electric vehicles, the Secretary being instructed to give evidence if the application was acceded to.

The Secretary was instructed to write to the representative Electrical Institutions in the Colonies suggesting the advisability of adopting the Committee's Standards with regard to electric vehicles.

The next meeting will be held in September.

Smoke Nuisance.—At the Manchester City Police Court, last week, Messrs. Chas. Macintosh & Co., Ltd., of Chorlton-on-Medlock, were summoned by the Manchester Corporation for certain recent emissions of dense black smoke from their works chimneys. Mr. Clay, who appeared as the firm's representative, said he did not question the facts as stated by the Corporation solicitor, but he objected to the Magistrates issuing an order calling upon them to abate the nuisance, as they were voluntarily having the whole of their plant electrified. The steam drive would be absolutely superseded, he hoped, before the end of September. This would show that the directors were doing all they could to keep down black smoke. He also asked the Court to remember that firemen were extremely hard to keep, as so many were enlisting. There was also the coal question to take into consideration; they were entirely in the hands of colliery owners, and had to put up with any kind of coal that could be supplied.

The Bench made the abatement order asked for by the Corporation.

Scottish Engineers' Wages.—The *Financier* states that a conference was held in Glasgow on Tuesday between representatives of the North-West Engineering Trades Employers' Association and the Clyde District members of the Amalgamated Society of Engineers, to consider a claim by the men for an increase of 1d. per hour time rates and 5 per cent. piece rates. The conference proved abortive, the employers being unable to see their way to grant the advance. It is expected that the men will decide to refer the matter to the Central conference, and, failing a settlement there, to Government arbitration.

Electrolytic Disinfectant.—A report of the Public Health and Housing Committee of the Poplar Borough Council just issued covers the whole history of the manufacture and use of electrolytic disinfectant in the borough. During the working of the apparatus—a period of nine years—many improvements have been introduced; cheap metal drums have been substituted for the glass vessels originally used to receive the fluid, and a double cell of slate has been constructed which prevents "creeping" of the current from one cell to another. The present cells are of earthenware, instead of slate, but the Committee prefers the new slate pattern. Since the plant was installed 381,794 gallons of fluid have been manufactured at a cost for electricity of £402, and for materials of £345 (under ½d. per gallon). Interesting details are given, at considerable length, of the cost of the various items involved in the manufacture. The fluid produced in Poplar is stable for long periods, and is suitable for both municipal and commercial purposes. It is stated that plants have been supplied to Guernsey, Gateshead, Finland, Buenos Ayres, and Rangoon; a similar plant has been installed at Portsmouth, for the manufacture of disinfectant from sea water, using the method for rendering it stable that has been adopted in Poplar, and Finchley Council has ordered an installation.

Fatalities.—At Manchester, on Monday, an inquest was held on a fitter named Marshall (30), who was killed on Saturday. Deceased was attending to an auto-switch on an electric starter when the current was switched on. Robert Lilley, wood machinist at the timber works of Messrs. J. & W. Bellhouse, Miles Platting, said that when he had done his work on Saturday he went with deceased to the sub-station at the works to switch off the current. He switched the current off, and two minutes later he switched it on again at the request of the head horsekeeper. Afterwards he found Marshall lying beside the switch in an unconscious condition. Death took place before the arrival of the doctor. The cover of the switch had not been replaced, but witness had no idea that Marshall was going back. Mr. H. Seal, H.M. Inspector of Factories, said the requirements of the Factory Acts were carried out. A verdict of "Accidental death" was returned.

A Southport boy, aged 8 years, was killed on Sunday on the Lancashire and Yorkshire Railway. He was playing on a bridge and, climbing on to the parapet, fell on to a live rail below. By the time a doctor arrived the lad was dead.

At the inquest on Monday the Coroner pointed out that the bridge was a public one and the railway company should make it as perfect as possible. The jury added a rider to their verdict that the bridge and approach should be bounded to a height of 6 ft.

Two employés of the Victoria Falls Power Co. were recently killed. It appears that they were travelling in a large motor trolley conveying an immense cog-wheel to Brakpan. In descending a hill the steering gear went wrong, and the whole outfit went over an embankment, turning a somersault. The two men killed were named Willy and Blaney, and four others escaped with slight injuries.

Coal Supply.—At the adjourned meeting, on the 22nd inst., of Members of Parliament interested in the question of coal supplies, the Committee of 12 which had been considering the matter formulated two recommendations, which were adopted. They were as follows :—

1. That during the continuance of the war the maximum price for home consumption and for our Allies of coal at the pit-head be fixed on the basis of prices charged at the pit-head for substantial quantities of each class of coal sold during the 12 months preceding the war, with an addition of 4s. 3d. per ton, or other such sum as may be prescribed, to cover the increased costs owing to the existence of the war.

2. That the rate of freight for coasting steamers employed in the coal trade be fixed on the basis of the rate charged for freight during the 12 months preceding the war, with an addition of such sum as will reasonably cover the increased cost owing to the existence of the war, and that the Government be urged to assign a further number of the interned steamers for the use of the coal trade.

Later, it was resolved by a majority of seven or eight that the Government should be requested to regulate the price of coal charged by the merchant to the consumer.

All the resolutions will in due course be submitted to the Government.

Charge Against a Contractor.—Before the Tunbridge Wells Magistrates, on Monday, Henry Arthur Stonham, an electrician and wiring contractor, was summoned for fraudulently consuming certain electricity, of the value of 1d., the property of the Corporation, at Mount Ephraim, between May 29th and June 12th. The Town Clerk conducted the prosecution, and said that although the sum involved was only 1d., the case was an important one. The proceedings were taken under Sec. 23 of the Lighting Acts of 1882, and the charge was briefly one of stealing electricity. Defendant, being an electric lighting contractor, was thoroughly cognisant of what he was doing. To ordinary consumers the charge was 4½d. per unit for lighting, and 1d. per unit for power and heating, but wiring contractors paid only 3d. for lighting, as their premises, when lighted, formed an advertisement for electricity. They could not tell the amount of current that passed through the meter at the cheaper rate, but defendant had been using current for one purpose and paying for it for another purpose. A good deal of evidence was given. Mr. J. E. Pownall, assistant borough electrical engineer, said that he visited the premises on May 29th, and when he switched off the lighting meter the lamp in the office remained on. There were only six lamps on the lighting circuit. Mr. R. N. Torpy, the borough electrical engineer, said that when he visited the premises the lighting lamps were connected with the power and heating circuit. After hearing the case for the defence, the Chairman of the Bench said he considered the case proved, and fined defendant £3.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—Telephone No. : City 682. Headquarters (temporary), Marconi House, Strand, London, W.C. Drill Centre.—Headquarters of London Electrical Engineers, 46, Regency Street, London, S.W.

Company Orders, by Lieut.-Col. C. B. Clay, V.D., Commandant, for week ending July 3rd, 1915 :—

On Mondays, Wednesdays and Fridays, drills at 6.30 and 7.30 p.m. Technical instruction will be given by Instructors of the London Electrical Engineers for one hour, and squad and platoon instruction for one hour.

Orderly Sergeant, L. A. Levy ; Recruit Orderlies (Squad 3), H. de P. Birkett ; (Squad 4), A. T. Scorey.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD. BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, June 24th, 1915 :—

WEEK-END PARADES.

Saturday.—The Battalion will parade as strong as possible at Baker Street Station at 2.30 p m. Proceed by train to Dollis Hill, where they will detrain. The right-half Battalion, under the command of Mr. H. O. King, will proceed by march route and take up a defensive position between Kingsbury Green and Chalk Hill House with the object of defending the Camp. The left-half battalion under the command of Mr. W. Ridd, will proceed by march route *viâ* the Grove, Dollis Hill, and thence in a north-westerly direction towards the Brent Reservoir, and endeavour to make their way into Camp, using any of the roads south of the Edgware main road and north of the Neasden-Dollis Hill road. All roads north of the Edgware main road and south of the Neasden-Dollis Hill road, are out of bounds. Reference Map.—Ordnance Survey, London (North). Scale.—1 in. to the mile.

Sunday.—6 a.m.—Reveille. 7 a.m.—Parade under Sergeant-Major. All men remaining in Camp—handling of arms. Mr. F. H. Stevens will superintend this Parade. 10 a.m.—Church Parade. 10.20 a.m.—Company and Platoon Drill. 2.30 p.m.—Battalion Parade.

The Acton Range will be open from 2.30 p.m. on Saturday next, the 26th inst., for men who have already given in their names to the Musketry Staff.

A. G. JOINER, *Captain and Adjutant.*

Electric Cooking.—We are informed by the Hotpoint Electric Heating Co., of 38, Poland Street, Oxford Street, W., that the electric cooker illustrated in fig. 8, on page 871 of our last issue, is their " El Cooko " oven.

Miners' Lamps Approved.—The *London Gazette* contains a Home Office announcement to the effect that the following safety lamps for use in mines have been approved :—

Messrs. Patterson & Co.'s safety lamp, type B 8.
The " Rutter " miners' electric safety lamp.
The Oldham " Emergency " electric lamp, type No. 2 (Bull's-eye).

Institution and Lecture Notes.—Electrical Association of Australia.—At the first meeting of the VICTORIAN SECTION, on November 30th, 1914, Mr. W. H. Alabaster was elected President for the ensuing year ; Messrs. F. A. McCarly and A. W. Kendall were elected Vice-Presidents, and Mr. E. H. W. Westwood Hon. Secretary. On March 31st the new President delivered his inaugural address, in which he compared the output of electric supply undertakings in Melbourne during the years 1904 and 1914. He stated that the first Federal Council of the Association consisted of the following members :—Messrs. O. W. Brain (president), W. H. Myers, H. B. Forbes Mackay, A. C. F. Webb, H. Payne, W. J. Newbigin, and W. H. Alabaster.

At the March meeting of the NEW SOUTH WALES SECTION, Mr. W. H. Myers delivered his presidential address dealing with the electrical progress in Australia during the past 12 months.

Illuminating Engineering Society.—At the annual general meeting on May 18th the report of the Council was presented and adopted. It showed that the international work of the Society had been interrupted by the war, and many of the members were engaged in war work ; the membership, however, was slightly higher than before the war broke out, and much useful work had been done. Additional funds were required to carry on the work of the Society in a satisfactory manner, and for this purpose new members were needed.

Accident.—Alfred Nicholson, electrician, Manchester, was working on a ladder at the Radcliffe Paper Co.'s works, James Street, Radcliffe, on Friday last, when he fell and fractured his skull. He was removed to the Bury Infirmary in a serious condition.

The National Physical Laboratory.—The annual meeting of the General Board was held on Tuesday, June 15th, when the annual report and accounts for the year 1914-15 were adopted for presentation to the President and Council of the Royal Society, and the programme of work for the coming year was approved. This year the usual gathering of visitors at Teddington, to meet the members of the General Board and to inspect the Laboratory, will not take place ; 25 per cent. of the staff are on active service. The report will be dealt with in a later issue.

Appointments Vacant.—Junior shift engineer (£2) for Accrington Electricity Works ; charge engineer (30s.), for St. Albans Electricity Works ; switchboard attendant (25s.) for Borough of Heywood. Particulars are given in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials. — MR. GILL, electrical engineer at Peterborough, has been ordered by his medical man to take a change of air, and the Town Council have authorised MR. T. ROWLAND to take charge of the works until Mr. Gill's return.

LIEUT. G. C. MILNES, of the 5th King's Own Royal Lancaster Regiment, has been mentioned for gallantry in the field by Field-Marshal French. Lieut. Milnes is the electrical engineer at Lancaster. He has had charge of the machine gun section which has done splendid work, and a gun was once repaired during heavy fire when the Germans were attacking near Ypres.

Tramway Officials.—MR. FERGUSSON, manager of the Dartford tramways, who has recovered from a serious operation, has resumed his duties.

General.—MR. RAYMOND J. MITCHELL has resigned his position as commercial engineer to Edison Accumulators, Ltd., which he has held for the last three years, and has taken a position as engineer to Mr. E. Sanger-Shepherd, of 5, 6 and 7, Gray's Inn Passage, Holborn, scientific instrument maker, who has specialised in various fields, including natural colour photography and the telegraphic transmission of photographs.

At the General Post Office, Aberdeen, MR. W. C. THOMPSON was presented with a writing bureau on his retirement from the position of assistant superintendent of telegraphs in Aberdeen. Mr. Thompson entered the service of the P.O. as a telegraphist at Keith. Mr. A. D. Leiper, superintendent, presided.

MR. ELI MARSDEN is to be recommended for appointment as borough engineer of Darwen, in succession to the late Mr. R. W. Smith-Saville, at a salary of £300 per annum. Mr. Marsden has been with the Corporation 12 years, and served his articles with Mr. Smith-Saville.

DR. W. H. BRAGG, F.R.S., has been appointed to the Quain Chair of Physics tenable at University College, in succession to Prof. F. T. Trouton.

The Highways Committee of the L.C.C. recommends that MR. D. DAVIES and MR. H. MARKS be appointed representatives of the

Council on the Electrical Conciliation Board and the Rolling Stock Conciliation Board respectively, to fill the vacancies caused by the resignations of Lord Alexander Thynne, who is with H.M. Forces, and Mr. Isidore Salmon, also that the deputy chief officer of tramways be appointed on the Electrical Conciliation Board, in the place of Mr. J. Shepherd, the electrical assistant, who has resigned.

MR. WALTER J. CRIDGE, who joined the Queen's Westminster Rifles in November last, has been gazetted as Second Lieutenant to the Sherwood Foresters (15th Notts. and Derby), his appointment dating from May 31st.

MR. RALPH H. CRIDGE has joined the staff of the British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester, in the control gear section.

PRIVATE FRED BOND, of Ashton-on-Ribble, near Preston, an employé of Messrs. Dick, Kerr & Co., has been wounded in the left thigh by shrapnel while serving in France.

We regret to learn that LIEUT. H. L. DOWNES, 8th King's Liverpool Regiment, is reported by the War Office to be missing during the fighting 16th-18th inst. Mr. Downes is a partner in the firm of Downes & Davies, wholesale electrical merchants, of Liverpool and Manchester. He has been connected with the wholesale branch of electrical business for the last nine years, and he has an extensive circle of electrical friends in London and the provinces. According to the Liverpool papers, Lieut. Downes is 32 years of age and unmarried. About three weeks ago he was appointed machine gun officer on the staff of the Brigade to which he was attached. A letter from an officer states that Lieut. Downes's job "was the hottest of all, as he had charge of the bombers and machine guns. He was one of the best soldiers we had. All the men were heroes, and not one of them turned, but on they went, and it was a job to make them come back when we had orders to retire."

Obituary.—HERR EMIL RATHENAU.—The death is reported, from Berlin, of Herr Rathenau, founder and head inspiring genius of the Allgemeine Electricitäts Gesellschaft, at the age of 76 years. The deceased gentleman was born in Germany, and served his apprenticeship in a Silesian foundry. Later he was employed as a draughtsman in the ship engine works of John Penn, at Greenwich. Upon his return to his native soil he started a small foundry in Berlin, but want of capital brought the enterprise to grief. Press reports say that on this account he cherished throughout life a grudge against the bankers who failed to come to his support. Perhaps that experience had much to do with his subsequent efforts to ensure that complete co-operation of finance and industry in the development of the vast electrical and other undertakings in Germany and elsewhere in which the A.E.G. was interested. It is stated that his success dated from the year 1881, when he formed the German Edison Co., which in 1887 became the A.E.G. Herr Rathenau is described as one of the most successful business men in Germany, which he did much to bring into the front rank as an industrial country. As would naturally be expected, and as our pages during the last few months have actually shown, the works of the A.E.G. are engaged at high pressure in the manufacture of war requirements for our enemies.

The death occurred on June 16th of MR. T. CHARLTON, manager and chief engineer of the Bishop's Castle (Salop) E.L. Co. Deceased, who had resided in the town for only a year, died in Salop Infirmary from an internal complaint.

MR. JAMES WALMSLEY, chief engineer of the Blackpool Tower, who had complete oversight of the engineering department, including the electricity plant, was found drowned in one of the filter beds connected with the aquarium tanks of the tower on Thursday last week.

The members of the South African Institute of Electrical Engineers have passed a vote of condolence with the widow and parents of MR. JOSEPH WALTER ANSON, who was connected with the engineering staff of the Corner House, and who recently died in Leeds at the age of 30. Mr. Anson went to the Rand five years ago as electrical assistant to Mr. J. H. Rider, late consulting mechanical and electrical engineer to the Central Mining and Investment Corporation. He left the Rand last January for a six months' health trip.

Will.—It is stated in the Press that the late LIEUT. BRIAN CROSSLEY left £60,213 gross and £17,557 net personalty.

ELECTRICAL PROGRESS IN SHANGHAI.

THE annual report for the year 1914 of Mr. T. H. U. ALDRIDGE, municipal electrical engineer, to the Shanghai Municipal Council, recently came to hand, and shows that the electricity departments is rapidly growing in importance. Apparently the war has had no appreciable effect upon the growth of the demand, and the plant at Riverside station could not be shut down for overhauling; nevertheless, a further large reduction in the generating costs was effected, although a much higher price had to be paid for coal. The consumption of fuel at Fearon Road station averaged 4.57 lb. per unit for the 12 months, whereas at Riverside it was only 2.29 lb., owing to the greater economy of the generating plant. The units sold and accounted for amounted to 32,885,822; the works costs per unit were: coal .206d.; oil, waste, water and stores .024d.; wages .054d.; repairs and maintenance .153d.; rents, rates and taxes .021d.; management .126d.—total .684d.

Unfortunately the war caused delay in the delivery of the new plant, which should have been in operation by the end of the year. Four new B. & W. boilers were put into service, and one of the 5,000-KW. turbo-generators; part of the other generator, and the new switchgear from the British Westinghouse Co. and Messrs. Reyrolle, have not yet arrived in Shanghai, but by temporary expedients the new machine and two of the three new feeders were brought into use. The plant capacity of the two stations is 14,900 KW., not including the second 5,000-KW. set. The maximum load recorded was 11,190 KW., and the load factor attained the high figure of 33.6 per cent., which is much better than in any of the British municipal undertakings—only four in number—which have a larger output than Shanghai. The length of mains was extended by 187 miles, of which 44 were underground. Four large sub-stations, each designed to accommodate 2,000 KW. of plant, were put into service, and the areas of the central district which they serve were converted from single to three-phase supply with satisfactory results. Various other sub-stations were erected on consumers' premises, and the total increase in transformer capacity was 3,579 KW. The street lighting was increased to 108 arc and 1,231 metal lamps; some half-watt lamps have been installed, and these may later on be substituted for the flame arc lamps, as it is very difficult to get natives to trim the latter properly. The number of meters issued during the year was 2,833 (net), and there was a net increase of 3,968 service connections, making a total of 14,955; the equivalent number of 30-watt lamps connected (excluding public lighting and motors) was increased by 99,626 to 528,747. The radiators connected totalled 871, equivalent to 1,700 KW., and 52 electric cookers were in use. The net increase in the motors connected was 6,917 H.P., making a total of 12,181 H.P.; three mills accounted for 4,200 H.P. of the increase. Over 3,000 H.P. additional is expected in 1915.

"Shanghai is now known throughout China and the East generally as a cheap power centre, a fact which, if indications are read aright, points to enormous industrial possibilities for the place."

The units sold were 32,885,822, and 4,206,222 were used at works. Excluding the latter, the net increase over the previous year was 63.75 per cent. Private lighting took 12.3 million units, power 15.2 millions, traction 3.6 millions, public lighting 1 million, and heating and cooking .4 million. The staff numbered 79 foreigners and 801 Chinese; 11 members went home to join the Army—others wished to go but could not be spared.

The net profit for the year was £11,090, and was less than was expected, owing to delay in taking a supply on the part of two large power consumers.

Although the Riverside power station was opened in April, 1913, to accommodate plant of 14,000 KW., further large extensions are necessary, the increase in the demand for 1915 being estimated at 4,600 KW., and the total increase up to the end of 1917 at 13,600 KW. Mr. Aldridge therefore proposes to install two 10,000-KW. turbo-generators and eight boilers, with the necessary switchgear, etc. Allowing for the removal of some old plant, the total capacity at the end of 1917 will be 37,200 KW., and the capacity less reserve plant, 27,200 KW., to meet an estimated load (excluding traction) of 24,000 KW. Orders for the new plant must be placed at once, as the matter is urgent. While not definitely committing himself to the adoption of a pressure of 33,000 volts for the underground cable transmission from Riverside to Shanghai, a distance of five miles, Mr. Aldridge discusses the advisability of doing so, and cites the example of Manchester under similar conditions. The cost of the extensions contemplated is estimated at £256,000.

In a further report the electrical engineer points out that the price of electrical energy in Shanghai compares favourably with the tariffs in force in the four largest municipal undertakings in Great Britain, being 3d. per unit for lighting and 1d. to .75d. for power. The heavy outlay on extensions in the past has never caused the price to be raised, and the amount contributed by the department to aid the rates has increased from year to year. Moreover, the supply of cheap power is aiding the industrial growth of Shanghai, and the use of electricity for heating and cooking is extending. The department for at least 15 years has been entirely self-supporting, paying 6 per cent. interest on debentures and allowing liberally for depreciation. Owing to the abnormal conditions prevailing in Great Britain, delays in supplying plant are probable, and therefore contracts should be placed as soon as possible.

The accounts of the department show that the receipts for the year were £169,625, and the expenditure, including depreciation, £122,915, leaving a surplus of £46,710. After deducting interest, special depreciation on the Fearon Road plant, etc., and contributing £3,782 to general funds, there remained a net balance of £11,091. The total capital expenditure amounted to £607,198.

Mr. Aldridge was to leave for Home *via* the United States on May 29th, and expects to be in England towards the middle of July. We understand that his visit is in connection with the new 20,000-KW. extension scheme, which is to be carried out, and he will issue specifications and call for tenders on the lines set out in his report.

NEW COMPANIES REGISTERED.

North British Electrical Co., Ltd. (9,414).—This company was registered in Edinburgh on June 12th, with a capital of £3,000 in £1 shares, to carry on the business indicated by the title, and to adopt an agreement with George Robertson and James Robertson, engineers, both of Paisley, and Joseph B. Tannahill, electrical engineer, of Belfast. The subscribers (with one share each) are: G. Robertson, Snawdoun Works, Paisley, engineer; J. B. Robertson, Snawdoun Works, Paisley, engineer; J. B. Tannahill, 31, Queen Street, Belfast, electrical engineer. Private company. The first directors are G. Robertson, J. Robertson, and J. B. Tannahill. Registered office: 15, New Sneddon Street, Paisley.

London Telephone (New System) Co., Ltd. (9,415).—This company was registered in Edinburgh on June 14th, with a capital of £10,000 in £1 shares, to carry on the business of making, selling, putting up, maintaining and working, so far as is lawful, private telephones or telegraphs, whether electrical or otherwise. The subscribers (with one share each) are: J. MacMahon, Sherill Park House, Rutherglen, provision importer; R. Logan, Knocknair, Kilbirnie, school teacher. Private company. The number of directors is not to be less than three or more than seven; the first are C. Cochran, F. T. Jackson, J. Levy, R. Logan, and J. MacMahon. Qualification, 250 shares. Remuneration for first year, £30; for second, £40, third, £50 per annum. Registered office: 55, West Regent Street, Glasgow.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Battery Co., Ltd.—Second mortgage, dated June 7th, 1915, to secure £300, charged on all the company's assets, present and future. Holders, A. H. Rose and T. A. Rose, 38 and 39, Bond Street, Barbican, E.C.

Ozonair, Ltd.—Debenture, dated June 5th, 1915, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holders, British Electric Traction Co., Ltd., 1, Kingsway, W.C.

South Metropolitan Electric Light & Power Co., Ltd.—Issue on June 9th, 1915, of £25,000 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Imperial Tramways Co., Ltd.

The directors report as follows for the year ended December, 1914:—

Middlesbrough, Stockton and Thornaby Electric Tramways.—Gross receipts £63,562, an increase of £3,276. The total number of passengers carried was 12,261,621, an increase of 255,608. The net profit for the year was £17,604, as compared with £17,824.

A further length of permanent way has been reconstructed during the year and the cost charged against revenue. The traffic receipts would have shown a much greater increase but for the falling off since war broke out at the beginning of August. The company's services of cars and 'buses have been maintained with little or no inconvenience to the public, but naturally not without difficulty, owing to the war conditions prevailing on the north-east coast and to the fact that one-third of the staff have joined H.M. Forces. Special allowances have been granted to the dependents of the men on active service.

London and Suburban Traction Co., Ltd. This company holds 122,230 five per cent. cumulative preference shares of £1 each and 112,451 ordinary shares of £1 each in the London and Suburban Co., and has received the full dividend for the past year on the preference shares of that company and a dividend on the ordinary shares at the rate of one per cent. per annum for the half-year to June, 1914. The revenue account of the London and Suburban Co. for 1914, however, showed a balance insufficient to pay a dividend on the ordinary capital in respect of the December half-year.

The company's net revenue account for the year shows an available balance of £31,232, and after payment of interest on the debenture stock for the whole year and dividend on the preference shares, it is proposed to pay a dividend for the year at four per cent. on the ordinary capital (less income tax), carrying forward £311.

The directors report the death of Mr. Hugh C. Doggett, J.P., a director. Mr. James H. Howell, J.P., of Bristol, has been elected to the board.

J. G. White & Co., Ltd.

The report for the year ended February 28th, 1915, states that the effect of the war on the business of the company has been very serious. Work in progress has had to be reduced or entirely suspended, and no new contracts are likely to be obtainable under the present adverse conditions. Collections of accounts have in some cases been delayed, as clients have been unable to make financial arrangements. Financial business—from which source the company has made considerable profits in the past—has also stopped. The directors have made drastic reductions in expenses. Under the circumstances, the profit earned of £19,773 is not unsatisfactory. Investments have not been re-valued, their valuation having been on so conservative a basis that even with the heavy depreciation in all securities during the last year, their book value is believed to be below their intrinsic value. They are, however, not readily marketable at the present time, and the company's assets are thus less liquid than is desirable. The cash balance is not far above the amount required for working capital. The directors, therefore, in spite of the large reserves accumulated, did not feel justified in paying an interim dividend in January last, and are now unable to recommend a dividend above the rate of 6 per cent. on both classes of shares. The balance to the credit of profit and loss, after bringing in £21,786 from the previous account, is £41,559. The dividend of 6 per cent., less tax, on the cum. pref. shares absorbs £9,000, and that of 6 per cent., less income tax, on the ordinary shares £3,000, leaving £29,559 to be carried forward.

Annual meeting: June 29th.

Globe Telegraph and Trust Co., Ltd.

Sir J. Wolfe Barry, K.C.B., presided on Tuesday over the annual meeting held at Electra House, E.C. Referring to the changes in some of the investments, he said that some of their large holdings had been somewhat reduced and some of the smaller ones had been correspondingly increased. The total receipts for the 12 months, after deducting the usual working expenses, had amounted to £209,164, a decrease of £609. With regard to the decrease of £609 in the receipts, that was partly due to the increased income tax deducted from some of their dividends and partly to the fact that some of the proceeds resulting from the paying off of the Submarine Trust certificates had not yet been re-invested. Certain changes had taken place in their investments. The Cuba Submarine and Telegraph Company, which for some years past had paid a dividend of 6 per cent., had reduced its dividend to 5 per cent., showing a loss of £12. On the other hand, the Great Northern Telegraph Company had increased its dividend from 20 to 22 per cent., resulting in a gain of £182. There were also increases in the dividends received from the Indo-European Telegraph Company of £167; the Telegraph Construction and Maintenance Company, of £696, and the Western Union Telegraph Company, of £256. The increase in the dividends of the first two of these companies was the result of shares purchased more than 12 months ago, from which they had not received the full dividends when the accounts were closed last year, whilst the addition from the Western Union Telegraph Company was due to the increase of the rate of dividend which they were paying from 3 to 4 per cent. The net result was that they were continuing to pay 6 per cent. to their ordinary shareholders and to carry forward a balance of £27,655, as compared with £25,723 at this time last year. The present market value of the securities held by the company, taking the lowest present market price, showed a surplus over the original capital of £220,575.

Sir James Pender, Bart., seconded the motion, which was carried.

Rand Mines Power Supply Co.

Mr. Bernard Price presided at the annual meeting recently held in Johannesburg. After referring to the resignation of the office of chairman by Mr. F. D. P. Chaplin on his appointment as Administrator of Southern Rhodesia, and to the absence of Major Bagot on military service in Europe, he said that the results for the year under review were thoroughly satisfactory, especially considering the dislocation which might have been caused by the succession of exceptional circumstances commencing with the strike in January, 1914, followed by the outbreak of the European War, the rebellion in that country, and hostilities in German South-West Africa. As a result of the prompt and effective measures taken by the Union Government, the January strike did not influence the business of the company to any appreciable extent. The military operations in the country resulted in an acute shortage of railway trucks for coal traffic and withdrawal, for military duty, of a considerable number of employees from the staff of the company, [illegible] During the year 1914, [illegible] to settle down to steady and [illegible] In earlier years every effort had to be [illegible] supplying the urgent and extensive initial requirements of consumers, and it was not until these requirements had been satisfied that the full complement of spare plant could be installed. [illegible] the full guaranteed [illegible] vided and [illegible] the rapid development [illegible] satisfactorily [illegible] to the [illegible] of routine work. The capacity of [illegible] and air compressing plant now installed and being installed was sufficient to provide somewhat more than the guaranteed margin in reserve for each type of supply, and consequently it should be possible, with relatively small additional expenditure, to meet such further increases in requirements of consumers as were likely to be required for some time to come.

Aluminium Corporation, Ltd.

Mr. Kenneth M. Clark, presiding at the annual meeting held on June 17th, at the Great Eastern Hotel, E.C., said that the first mortgage debenture stock had been increased from £50,000 to £150,000. This was one of the benefits obtained by the exact defining of the value of the participating shares. The chief difficulty at Dolgarrog since the inception of the company had been the limited amount of water-power available. Had they been able to bring all the water obtainable on their watersheds into use, their profits both last year and the year before would have been very considerably increased. It was absolutely essential, if they were to bring the company to a really successful position, that the output of metal should be increased, and this could only be done by additions to their water-power. They had remedied the difficulties in connection with the carbon works by removing these from Wallsend to Dolgarrog, and had now got the works organised in such a manner that they produced a very much larger output. Last year he told them that work had been commenced upon the tunnel to bring the Dulyn water into the Eigiau Lake, and the directors very much regretted that the failure of the contractor to carry out the terms of his contract had deprived the company of the possibility of obtaining some benefit from this water during the present financial year. Money was needed for carrying on this work, and he had, therefore, added to his interest in the company by taking a further £15,000 of the first debentures. Although this water would considerably add to their output they would, on completion of the tunnel, be faced with the fact that a large amount of water was going to waste because the lake was not large enough. It was, therefore, with a view to providing another dam and a second pipe line that these debentures had been created, and they proposed, before placing these in other quarters, to give the present debenture holders and shareholders the opportunity of taking them up. Trading profits showed an increase of over £2,000 above 1913, and this figure had only been prevented from being a much larger one by the fact that it was impossible to manufacture any more metal for want of water power. The special expenditure on the Bauxite Refining Co. had been unavoidable, and to a considerable extent caused by the war. The item for special litigation was in consequence of a claim by Mr. Robertson Lawson, which the directors felt it their duty to contest, and in regard to which the legal authorities gave their decision against the company. The preference dividend continued to accumulate, but, in regard to the dividend on the participating shares, the effect of the conversion which was made during the past year had been to make this rank *pari passu* with the preference dividend. Had this not been done they would have been obliged, on the present occasion, to pay out to the participating shareholders a fifth of the net profits shown. The net result for the year was a profit of £7,812. The present year so far was one of great difficulty, and, as they had been prevented from obtaining the benefit of the Dulyn Tunnel, it was not possible to make promises of any great improvement. A very large proportion of the company's output was prior to the war sold to Germany, and a position of very considerable difficulty was created in August last, but by careful handling the crisis was tided over and satisfactorily adjusted. The demand for aluminium continued to increase, and, although it was quite impossible to foresee the position at the termination of the war, there was ample scope for the uses of the metal to be developed sufficiently to consume the output. Over 25 per cent. of their employés were either called up or volunteered for service with the Forces. They had had serious difficulty in maintaining their supplies of raw materials. In fact, had they not held excellent stocks at Dolgarrog they would have been in an extremely critical position. At Hebburn the bauxite works were not only faced with the fact that the French Government made bauxite contraband; they had also had grave difficulty in obtaining sufficient coal, and the bauxite warehouse at St. Raphael had been commandeered by the French military authorities. Even after they had obtained a permit for shipment of bauxite from the French Government they found it almost impossible to charter ships for its conveyance. Naturally, all these things reacted on the profit and loss account, and it had not been possible to obtain an increased price for the metal commensurate with them. In view of all the circumstances they had considered it wise and in the best interests of the company to transfer £4,646 to depreciation account and to carry forward the balance of £3,286.

Mr. Arthur F. Bott seconded the resolution, which was carried unanimously.

Birmingham District Power & Traction Co., Ltd.

The annual meeting was held on Monday at Electrical Federation Offices, Kingsway, Mr. C. S. B. Hilton presiding. The Chairman said that there had been no addition to the capital account during the year, but the account had been credited with £12,193, the proceeds of the sale of certain omnibuses to the Birmingham & Midland Motor Omnibus Co. During the year £7,268 debenture stock was purchased and cancelled at a cost of £6,185. The item of sundry debtors showed a reduction of £11,700. Loans stood at a high figure, but it had been necessary to make advances to the Shropshire, Worcestershire & Staffordshire Electric Power Co., and the Birmingham & Midland Motor Omnibus Co. to enable those companies to meet commitments contracted before the war broke out for absolutely necessary extensions of their business. All expenditure was carefully scrutinised. The same amount had been credited to renewals account as in previous years. The heavy expenditure on that account last year was due to renewals falling due. £2,000 had been added to the reserve, bringing that fund up to £16,493, so that the total reserves amounted to the respectable figure of £67,000. The traffic receipts showed a decrease for the year of £790. Expenses showed a decrease of £470. As a result, the amount available for appropriation, after placing £4,000 to renewals, was £51,845, compared with £58,367 in the previous year; but the interest payable on loans was £8,750 less, owing to the loan from the Shropshire Co. having been repaid by the sale of the Smethwick Electric Supply undertaking to that company. The available balance, therefore, was £1,500 more, but the debenture sinking fund required £760 more, and after paying the same dividend on the preference shares and on the preferred ordinary shares, and placing the same amount to reserve as in 1913, there was an addition to the carry forward of £700. Having regard to the effect of the war on the tramways during the latter half of the year, the net results of the company's trading for the year might be considered satisfactory. The total revenue from their investments was £38,185, compared with £30,849; an improvement of £7,336. That represented a return of 3.71 per cent. on the cost of the company's investments, compared with 3.05 per cent. in 1913. The increase of £7,400 in dividends was accounted for partly by the dividend on the deferred ordinary shares in the Electrical & Industrial Investment Co. and partly by the dividend received for the first time for some years on the company's holding in the preference shares of the South Staffordshire Tramways (Lessee) Co.; and the first dividend on the preference shares held in the Birmingham & Midland Motor Omnibus Co. In the case of the latter company, the shareholders had cancelled the arrears of dividend on the preference shares, and a dividend of 5 per cent. was declared and paid for 1914. The rate had been increased from 5 per cent. to 6 per cent., and it was believed that that would be regularly paid in future. The South Staffordshire Tramways (Lessee) Co. had also cancelled all arrears of preference dividend and increased the rate of dividend to 7 per cent., and he hoped that in future the company would pay dividends on the preference shares regularly. The Dudley, Stourbridge & District Electric Traction Co. was compelled to reduce its dividend from 4 per cent. to 1 per cent., a direct result of the war. The Shropshire Power Co. had made good progress and paid the same dividend as in 1913, after placing £4,000 to reserve, against which no such provision was made in 1913; and it had increased the carry forward by a small sum. The company had obtained the sanction of the Treasury to raise further capital to the extent of £150,000, either by way of debentures or preference shares, and negotiations, in which they, as the largest shareholders, were taking part, were now taking place with a view to obtaining that capital, which had every promise of materialising. On the outbreak of the war a mutual aid fund was promoted by the different companies for giving financial assistance to the dependents of employés who had enlisted. That fund had already done much useful work and was much appreciated by the men. 39 men had joined the Colours, and it was becoming more and more difficult to carry on the work. It was a matter for satisfaction that during the year no serious labour troubles had occurred. In addition to their subscription to the mutual aid fund, they were paying a war bonus to all their employés to meet the increased cost of living. Owing to the shortage of men, an experiment was tried of training women as conductors, but it did not meet with the success it deserved owing to some opposition from the men, and it had to be abandoned. He was convinced, however, that it would shortly be revived, as week by week the drain of men became more and more acute.

Mr. J. A. Lycett seconded the motion, which was carried unanimously.

A Swiss Issue.—The Columbus Electrical Undertaking Co., which was formed a few years ago as an investment company at Glarus, and is associated with the Brown-Boveri group, has decided to make a loan issue of £400,000 in 6 per cent. bonds, to provide further working capital, and one-half of the amount is now being offered for subscription in Switzerland. At present the company, which has a paid-up ordinary share capital of £650,000, owns 75 per cent. of the share capital of the Compagnia Italo-Argentina de Electricidad, of Buenos Ayres, which holds a concession similar to that of the German Transmarine Electricity Co. in Buenos Ayres, and already has private, municipal and State contracts, which ensure an annual income of £240,000. The Italo-Argentina company also holds the whole of the shares in electrical undertakings in the provincial towns of Dolores, Corrientes and Pergamino.

Manila Electric Railroad and Lighting Corporation.—The report for 1914 states that the gross earnings were $1,602,001, a decrease of $96,592; operating expenses and taxes increased $27,628, while the net earnings from operation were $783,586, a decrease of $124,220. Four dividends of 1¾ per cent., making 7 per cent. for the year, were paid. Of the decrease of $96,592 in the total gross earnings, $82,000 occurred in the railway department. The electricity department earnings fell $9,000, the balance being caused by the closing-down of the trucking department.

Greenwood & Batley, Ltd.—The report for the year ended March 31st states that, after providing for interest on the debentures, expenses of management and doubtful debts, the accounts show a profit of £68,395, and the balance at credit of profit and loss at March 31st, 1914, £4,825, makes £73,220. The directors have appropriated £28,000 for depreciation and £10,000 to reserve account, and they recommend a dividend of 12½ per cent. per annum on the paid up ordinary share capital, leaving £6,418 to be carried forward.—*Financial Times.*

Puebla Tramway, Light and Power Co.—The payment on July 1st of coupon No. 8, due that date, on its prior lien gold bond issue, which issue ranks in all respects prior to the first mortgage bonds, is announced, but owing to the conditions existing in Mexico the coupon, No. 17, due the same date, on the first mortgage bonds, cannot be paid. It is stated in the Press that a meeting of the first mortgage bond-holders will be held as early as possible in July to consider a funding scheme in connection with their bonds.

Credenda Conduits, Ltd.—The report for the year ended April 30th shows that the profit, after providing for repairs, depreciation, directors' fees, and reserve for income-tax, amounts to £5,147, which, with £714 brought forward, gives an available balance of £5,862. The directors have written £1,000 off the goodwill account, and they recommend a dividend at the rate of 8 per cent. per annum, free of income-tax, on the ordinary shares, carrying forward £862. *Financial Times.*

Stock Exchange Notice.—Application has been made to the Committee to allow the following securities to be quoted in the Official List :—

Electro Bleach and By-Products, Ltd.—112,044 7 per cent. participating preference shares of £1 each, fully paid, Nos. 1 to 112,044.

Winnipeg Electric Railway Co.—Dividend 2½ per cent. for the quarter to June 30th, being at the rate of 10 per cent. per annum on the fully paid up capital stock.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—Interim dividend for the quarter to March 31st of 2s. 6d. per share, free of income-tax.

Eastern Telegraph Co., Ltd.—First quarterly interim dividend of 1¼ per cent. on ordinary stock, free of income-tax.

STOCKS AND SHARES.

TUESDAY EVENING.

Publication of the prospectus of the new War Loan has had the useful effect of putting an end to the suspense which its advent had caused to act as a damper upon every market in the Stock Exchange. The new loan was bound to come into competition with existing issues, to the natural detriment of the latter, but we are all of us getting so accustomed by this time to be told that we must not mind enduring such little hardships, for the sake of winning the war, that nobody grumbles. Possibly there may be selling of some of the older securities, in order that the money may be freed for the taking up of the new loan; and this for a time will have a heavy effect upon prices. There is much relief felt, however, at the knowledge that no fresh public borrowing is likely to be required for some time to come; and, in spite of all official warnings, there are those in the Stock Exchange who declare their confidence in the end of the war being reached before the money raised by the present loan shall have become exhausted.

With so much attention fixed upon the newcomer, it is scarcely likely that other securities can command an increase of public interest. The general tendency is still disposed towards dullness due, of course, to the War Loan, as noticed before, and also to the idea that, were Lemberg to fall, the consequences to our Russian allies would prove unpleasant for the time being, although the advantage could scarcely be anything but temporary to the Germans.

The Electric Lighting market holds its own with a good deal of firmness. For some shares there is insistent demand. On the other hand, the remaining sections with which we deal mostly lean to the lower side, and the quietude of business is in itself a cause for the sagging away of prices here and there.

Home Railway stocks are decidedly on the down grade. The Steam issues have dropped abruptly, and, in sympathy, those of the Tube companies are also lower, although not to any great extent. Underground Electric Incomes shed 1½, because there is still something of a speculative account left in them. The shilling shares were called nominally 5s. the other day, though the price was a trifle optimistic;—actually, at the present time, it is 1s 6d middle. The staffing of the various stations on the Tube lines with women is rapidly growing, and admiration of the way in which the young ladies perform their duties is in no wise diminished by the pardonable curiosity occasionally displayed by an "official" more interested in some happening in the street than in the clipping of tickets.

Brazil Tractions continue to move in volatile fashion—actuated chiefly by the vagaries of the fluctuations in the Rio rate of exchange. Within the past week the price has been up to 53 and down to 51, with a good deal of business (in small lots) taking place day by day. The Mexican division marks time, holding its recovery of a fortnight ago, but not sufficiently supported by fresh buying orders to make a further forward movement. Mexico Tramways common shares were done the other day at 33; and the 5 per cent. first mortgage bonds of the Mexican Light & Power Co. are changing hands occasionally on the basis of 25—a fall of 55 points in the less than twelve months. Mexican Electric Light 5 per cent. first mortgage bonds are quoted at about the same price as those of the Light & Power Co., and can be dealt in on a similar basis. From which it is manifest that quotations are slightly less nominal than they have been until just lately.

The Anglo-Argentine Tramways group is steady, with inquiries for the 4 per cent. debenture stock, and a little business is doing, too, in the first preference shares, the yield on which comes to 6⅜ per cent. Bombay Electric debenture stock has again risen a point, and other descriptions in the foreign market are very firm.

The Madras Electric Supply Corporation turned its deficiency of £5,300 in 1913 into a profit of £300, but as the sinking fund came into operation for the first time last year, and the company also received less interest, the net result for the year was a loss of £11,700. The present debit balance is £43,000. The company, however, is now equipped with new plant, so that it ought to be able to develop on more progressive lines than has hitherto been possible. The £5 ordinary shares, which stood at 30s. when war broke out, have not changed hands since the Stock Exchange re-opened last January.

The Imperial Tramways Co. shows that, to maintain the ordinary dividend at 4 per cent., £2,000 had to be taken from the dividend equalisation fund. Expenses advanced faster than takings, but the net profit of £17,600 is only £200 less than that of the previous year. The company, of course, received no dividend on its holding of ordinary shares in the London & Suburban Traction Co. in respect of 1914. British Electric Tractions hold the advances which they recently made on the dividend announcement and report.

Lively dealings have sprung up within the last few days in the shares of the Colombia Gas & Electric Co., which have hitherto been stagnating at about 10 for the $100 shares. The price jumped to 14½ on the announcement that a deal has been practically closed whereby the Colombia Co. secures control of the United Fuel Gas Co.; but the advance brought in sellers, and the price reacted to 12½.

Electric Constructions have been good at 13s. 6d., and there was a rush of small orders early this week. The shares seem to have become suddenly popular with a comparatively wide circle of small investors. British Aluminiums hardened to 22s., though the preference are a shade easier at 18s. 3d. London has been a seller of the latter, while support was forthcoming for them from the North. India Rubber shares eased off to 8¾ and British Insulated to 11. Other Manufacturing shares are quietly steady.

The Telegraph group is generally easier. Some idea can be gathered of the limited character of investment markets by the fact that the sale of a few hundred pounds sufficed to put down Eastern Extension 4 per cent. debenture stock some [illegible] points. The price hitherto had been 91—fairly high, of course, considering the yield obtainable from Trustee securities. Industrial debenture stocks are now likely to move on to a lower plane of price all round, in consequence of the competition of the War Loan. Investors who were content to buy unimpeachable stocks in the industrial companies to yield 4½ to 5 per cent. will probably elect to pass by such issues in favour of the national loan. Patriotism and 4½ per cent. form a tempting pair, and although the price of the loan may go to a premium, the effect upon issues all round cannot fail to make itself felt for a long time.

Anglo-Americans are easier, after their recent rises; and falls have occurred in Globe preference, Western ordinary and Eastern Extension shares. Marconis slipped back a little, and the prices of the subsidiaries are scarcely so firm as they were. It may be recalled that, in their circular of three months ago, the Marconi directors stated that the works and all the company's staff have been working under the highest pressure throughout the period of the war, although the company's business had been necessarily disturbed. In consequence of a number of matters being in abeyance at that time, the board were unable to estimate with sufficient accuracy the results of the business of last year to warrant them at that moment in declaring an interim dividend upon the ordinary shares. Therefore, the next dividend [illegible] will be in respect of the full twelve months.

The rubber market is one of the firmest in the Stock Exchange. Business continues unaffected by [illegible] the quietude prevailing in other sections. Prices are well maintained, in consonance with the quotation for the raw product. Buyers still predominate, and in many of the higher-priced shares there is not sufficient supply to go round. The Armament group is inclined to be easier, and such shares as Birmingham Small Arms and Vickers [illegible] somewhat sharply. For the time being, the section is a little out of favour. Not so, however, that for Copper shares, which continue to rise steadily, the improvement being more marked in the case of the lower-priced descriptions than in that for the heavier shares.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend, 1914.	Price June 22, 1915.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	8¼	—	£6 1 [illegible]
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4	— ¼	6 5 0
do. do. do. 4½ Pref. ..	4½	4⅛	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅜	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	13¾	—	6 11 0
do. do. 6 per cent. Pref. ..	[illegible]	12	— ¼	5 0 0
do. do. 5 Deb.	5	110	—2	4 11 0
do. do. 4½ Deb.	4½	96	—	4 13 10
County of London	7	11⅜	—	6 3 1
do. do. 6 per cent. Pref. ..	6	11½	—	5 4 4
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	95 xd	—	4 14 9
Kensington Ordinary	9	[illegible]	—	6 8 7
London Electric	4	1½	—	8 0 0
do. do. 6 per cent. Pref. ..	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	3½	8	— ⅛	5 16 8
do. 4½ per cent. Pref. ..	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	74	—	4 12 [illegible]
St. James' and Pall Mall	10	7½	—	6 13 4
do. do. do. 7 per cent. Pref.	7	6⅜	—	5 9 10
do. do. do. 3½ Deb.	3½	75	—	4 13 4
South London	5	3	—	6 13 4
South Metropolitan Pref.	[illegible]	1⅛	—	6 4 5
Westminster Ordinary	9	7¼	—	6 4 2
do. 4½ Pref.	4½	4¾	—	4 14 9

Telegraphs and Telephones.

	Dividend, 1914.	Price June 22, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	105½	— ½	5 18 9
do. Def.	1½	22½	— ⅛	6 13 4
Chile Telephone	[illegible]	6¾	—	5 18 5
Cuba Sub. Ord.	5	8½	—	5 17 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12¼	— ¼	*6 5 7
do. 4 Deb.	4	87½	—3½	4 11 5
Eastern Tel. Ord...	7	131	— ½	*6 1 9
do. 3½ Pref.	3½	75½	— ½	4 12 9
do. 4 Deb.	4	91	—	4 8 0
Globe Tel. and T. Ord.	6	11	—	*6 4 9
do. Pref.	[illegible]	11½	— ¼	5 4 4
Gt. Northern Tel.	22	33	—	6 13 4
Indo-European	65	64	—	6 0 4
Marconi	20	1[illegible]	— [illegible]	11 0 8
New York Tel. 4½..	4½	97	—	4 13 0
Oriental Telephone Ord.	10	2⅛	—	4 14 1
do. Pref.	6	1³⁄₁₆	—	5 1 1
Tel. Egypt Deb.	4½	[illegible]	—	5 2 8
United R. Plate Tel.	[illegible]	6	—	*7 10 0
do. Pref.	5	5	—	5 0 0
West India and Pan.	1	1¼	—	8 0 0
Western Telegraph	7	13¼	— ¼	*6 0 9
do. 4 Deb.	4	90	—1	4 9 0

Home Rails

	Dividend, 1914.	Price June 22, 1915.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented ..	4	75	— 2	5 6 8
Metropolitan	1¼	28½	— ¼	4 7 0
do. District	Nil	14⅝	—	Nil
Underground Electric Ordinary ..	Nil	1¼	—	Nil
do. do. "A"	Nil	4/6	—	Nil
do. do. Income ..	6	73½	—1½	*9 6 8

Foreign Trams, &c.

	Dividend, 1914.	Price June 22, 1915.	Rise or fall this week.	Yield p.c.
Anglo-Arg. Trams, First Pref. ..	5½	4½	—	6 2 3
do. 2nd Pref.	5½	8¾	—	7 6 8
do. 4 Deb.	4	85½	+1	4 13 6
do. 4½ Deb.	4½	87	—	5 3 6
do. 5 Deb.	5	86½		5 15 7
Brazil Tractions	6	51½	—	11 13 [illegible]
Bombay Electric Pref.	6	10⅜	—	5 16 10
do. 4½ Deb.	4½	93	+1	4 17 4
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds ..	—	63	—	Nil
do. 6 per cent. Bonds ..	—	80	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	39	—	Nil
do. 1st Bonds	—	48	—	—
Adelaide Sup. 6 per cent. Pref. ..	6	5⁵⁄₁₆	—	5 13 0
do. 5 Deb.	5	103	—	4 17 1

Manufacturing Companies.

	Dividend, 1914.	Price June 22, 1915.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	14	2½	—	5 12 0
British Aluminium Ord.	5	22/-	+3d.	4 12 0
do. Pref.	6	18/3	—2d.	6 9 9
British Insulated Ord.	15	11	— ½	6 13 4
do. Pref.	6	6⅛	—	5 0 0
British Westinghouse Pref.	7½	1⅞	—	8 0 0
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11⅛	—	6 6 4
do. 5 Pref...	5	5	—	5 [illegible] 0
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	8½	—	4 12 6
Edison & Swan, £3 pd.	Nil	12/6	—	Nil
do. do. fully paid	Nil	1⅞	—	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/6 xd	+ 6d.	8 17 10
do. do. Pref.	7	1 xd	—	7 0 0
Gen. Elec. Pref.	6	10	—	6 0 0
Henley	20	14½	—	*7 13 8
do. 4½ Pref.	4½	4⅞	—	4 12 4
do. 4½ Deb.	4½	97	—	4 12 9
India-Rubber	5	[illegible]¾	— ¼	5 14 3
Telegraph Con.	20	87	—	6 9 10

* Allowance made for dividends being paid free of income-tax.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the five weeks ended April 30th, 1915, amounted to 2,176,193, compared with 1,713,968 units in the corresponding five weeks of 1914.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, June 23rd.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	4/6	..
a	„ Nitric	„	19/-	..
a	„ Oxalic	per lb.	..	..
a	„ Sulphuric	per cwt.	..	..
a	Ammoniac Sal	„	£49	..
a	Ammonia, Muriate (large crystal)	per ton	£40	..
a	Bleaching powder	„	£9	..
a	Bisulphide of Carbon	„	£21	..
a	Borax	„	£22	..
a	Copper Sulphate	„	£29	..
a	Lead, Nitrate	„	£35	..
a	„ White Sugar	„	..	..
a	„ Peroxide	„	..	..
c	Methylated Spirit	per gal.	..	..
a	Potassium, Bichromate, in casks	per lb.	7d.	..
a	Potash, Caustic (88/90 %) ..	per ton	..	..
a	„ Chlorate	per lb.	1/6	..
a	„ Perchlorate	„	1/6	..
a	Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	Nom.	..
a	Shellac	per cwt.	65/-	..
a	Sulphate of Magnesia	per ton	..	..
a	Sulphur, Sublimed Flowers ..	„	£11 10	..
a	„ Recovered	„	£8	..
a	„ Lump	„	£8 10	..
a	Soda, Caustic (white 70/72 %) ..	„	£10 2 6	..
a	„ Chlorate	per lb.	10½d.	..
a	„ Crystals	per ton	45/-	..
a	Sodium Bichromate, casks ..	per lb.	3½d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots ..	per ton	£105	£5 inc.
b	„ Wire, in ton lots (1 to 14 S.W.G.)	„	£135	£5 inc.
b	„ Sheet, in ton lots ..	„	£135	£5 inc.
p	Babbitt's metal ingots	„	£50 to £221	..
c	Brass (rolled metal 2" to 12" basis)	per lb.	1/2¼ to 1/2½	..
c	„ „ (solid drawn) ..	„	1/2¾ to 1/3	..
c	„ Wire, basis	„	1/2½ to 1/2¾	..
c	Copper Tubes (solid drawn) ..	„	1/2¼ to 1/2½	..
g	„ Bars (best selected) ..	per ton	£110	£6 inc.
g	„ Sheet	„	£110	£6 inc.
g	„ Rod	„	£110	£6 inc.
d	„ (Electrolytic) Bars ..	„	£96	£4 inc.
d	„ „ Sheets ..	„	£114	£4 inc.
d	„ „ Rods ..	„	£102	£4 inc.
d	„ „ H.C. Wire	per lb.	1 ⁵⁄₈	⅜d. inc.
f	Ebonite Rod	„	3/-	..
f	„ Sheet	„	2/6	..
n	German Silver Wire	„	1/9	..
h	Gutta-percha, fine	„	6/10	..
h	India-rubber, Para fine	„	2/6¾	¼d. dec.
j	Iron Pig (Cleveland warrants) ..	per ton	65/6	2d. inc.
l	„ Wire, galv. No. 8, P.O. qual.	„	£22	..
g	Lead, English Pig	„	£25	£2 5 dec.
m	Manganin Wire No. 28	per lb.	..	..
g	Mercury	per bot.	£15 15 to £16	..
e	Mica (in original cases) small ..	per lb.	4d. to 2/6	..
e	„ „ „ medium	„	3/- to 5/-	..
e	„ „ „ large ..	„	6/6 to 10/6 & up.	..
o	Nickel, sheet, wire, &c.	„	Nom.	..
p	Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p	„ „ rolled bars & rods	„	1/2 to 1/3½	..
p	„ „ rolled strip & sheet	„	1/3½ to 1/5½	..
o	Platinum	per oz.	185/-	..
d	Silicium Bronze Wire	per lb.	1/3	2d. inc.
r	Steel, Magnet, in bars	per ton	£80	..
g	Tin, Block (English)	„	£170	£3 inc.
n	„ Wire, Nos. 1 to 16	per lb.	2/8	..
p	White Anti-friction Metals ..	per ton	£52 to £194	..
k	Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a	G. Boor & Co.	*j*	Bolling & Lowe.
b	The British Aluminium Co., Ltd.	*k*	Morris Ashby, Ltd.
c	Thos. Bolton & Sons, Ltd.	*l*	Richard Johnson & Nephew, Ltd.
d	Frederick Smith & Co.	*m*	W. T. Glover & Co., Ltd.
e	F. Wiggins & Sons.	*n*	P. Ormiston & Sons.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*o*	Johnson, Matthey & Co., Ltd.
g	James & Shakspeare.	*p*	
h	Edward Till & Co.	*r*	W. F. Dennis & Co.

The Russian A.E.G.—It is stated that the accounts of the Russian A.E.G., of Petrograd, show gross profits of £392,000 for 1904, as compared with £342,000 in the previous year. After deducting interest on loans and defraying general expenses amounting to £178,000, as against £159,000 in 1913, there remain net profits of £206,000, as contrasted with £155,000. It is proposed to pay a dividend of 10 per cent. on share capital of £1,200,000, as compared with 9·4 per cent. in 1913, but the payment on shares in German hands is reserved until the conclusion of peace. The report of the directors regards the results as favourable, although the turnover decreased by 10 per cent. over the preceding year, and difficulties were experienced in securing delivery of coal and other raw materials. The orders now on hand already exceed the total turnover obtained in 1914, and with the object of manufacturing articles which have hitherto been imported, it is mentioned that the company has entered into close relations with the General Electric Co., of the United States, and the British Thomson-Houston Co., in London.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MAY, 1915.

THE returns of electrical export and import business for the month of May show, as regards the former, a slight falling-off, and for the latter, a considerable increase on the April totals. Thus the exports for May amounted to £380,159, as compared with £382,610 in the previous month, while the imports reached £268,848, as against £230,752 in April. The re-exports for May amounted to £13,299, as compared with £11,167 in April, showing a slight increase. During the month electrical machinery exports reached a total of nearly £155,000, or a little more than in April, while cable exports showed a considerable advance. Telegraphic and telephonic business fell away, however, and the total result was a decrease of some £2,000 compared with the April export figures.

As regards the imports, it will be noticed that the considerable increase in business in May was due entirely to Continental activity, as American imports reached practically the same value—£184,000—in the last two months.

The bulk of the increased import business represented machinery and telegraphic and telephonic material, and it is interesting to note that Swiss machinery imports into this country reached the high value of over £30,000.

India was, as usual, our best customer for electrical material; our ally, France, made substantial purchases, as also did Holland and Norway, amongst European countries; while the Australian market was a good one during the month.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	2,181	5,991	512	18	3,387	1,765	12,116	920	411	799	2,628	2,573	33,301
German West Africa	...	...	...	...	...	...	...	...	...	...	...	202	202
Netherlands, Java and Dutch Indies ...	494	10,422	468	...	...	...	923	114	230	...	1,729	3.928	18,308
Belgium	...	...	...	...	...	...	...	...	...	...	...	...	...
France	1,622	338	1,077	...	142	37	9,341	2,131	1,288	39	10,525	10,589	37,129
Portugal	...	37	45	190	...	156	101	132	152	...	18	1,668	2,499
Spain, Canary Isles and Spanish N. Africa...	472	117	312	24	29	214	1,997	348	61	35	155	253	4,017
Switzerland, Italy and Austria-Hungary ...	435	...	75	...	39	2,246	1,609	22	10	...	45	1,882	6,363
Greece, Roumania, Turkey and Bulgaria ...	30	322	111	15	...	...	...	...	...	...	2	8	488
Channel Isles, Gibraltar, Malta and Cyprus...	328	73	100	22	...	209	221	...	26	13	6	318	1,316
U.S.A., Philippines and Cuba	466	...	256	10	...	38	489	10	33	...	...	113	1,415
Canada and Newfoundland	99	...	118	159	25	2,930	2,460	413	1,917	...	319	318	8,758
British West Indies and British Guiana ...	3	106	87	81	...	...	139	...	23	10	77	81	607
Mexico and Central America	26	...	...	...	24	...	22	...	...	...	...	414	486
Peru and Uruguay	12	1.696	...	25	...	...	960	...	17	...	196	43	2,949
Chile	97	368	697	37	...	145	81	...	15	...	...	63	1,503
Brazil	250	1.541	420	421	...	170	4,928	537	322	...	49	850	9,488
Argentina	591	939	2,499	285	...	981	1,750	551	395	7	582	3,301	11,881
Colombia, Venezuela, Ecuador and Bolivia...	47	...	94	...	...	...	16	...	...	10	232	6	405
Egypt, Tunis and Morocco	624	172	303	...	29	177	3,022	281	217	37	55	469	5,386
British West Africa	9	110	12	27	133	137	332	6	...	...	118	161	1,048
Rhodesia, O.R.C. and Transvaal	758	380	1,158	751	14	148	1,971	...	76	117	29	38	5,440
Cape of Good Hope	1,502	1,802	747	948	...	180	1,552	12	129	5	148	1,898	8,923
Natal	193	3,087	420	372	...	18	3,139	...	141	40	60	177	7,647
Zanzibar, Brit. E. Africa, Mauritius & Aden	126	64	86	...	...	13	219	21	...	...	514	89	1,132
Azores, Madeira and Portuguese Africa ...	177	162	55	82	...	114	1,270	...	603	15	33	52	2,563
French African Colonies and Madagascar...	...	30	...	...	...	...	561	...	925	...	...	...	1,516
Persia	31	34	10	87	...	...	825	40	...	...	...	...	1,027
China and Siam	788	141	843	306	...	695	811	1,416	234	189	1,042	730	7,195
India	1,250	8,679	4,059	1,705	41	1,510	17,469	1,896	2,231	551	2,423	1,232	43,046
Japan	20	...	291	...	28	87	2,096	...	240	47	...	60	2,869
Ceylon	97	1,073	170	81	...	10	755	27	20	73	3	801	3,110
Straits Settlements, Fed. Malay States and Sarawak	815	296	704	197	...	380	3,360	625	146	128	105	767	7,523
Hong Kong	190	1,373	253	15	...	232	1,370	16,882	49	86	...	5	20,455
West Australia	129	315	161	364	...	265	5,238	314	472	24	...	...	7,282
South Australia	145	3,025	351	56	...	408	379	229	60	...	1,010	...	5,663
Victoria	1,583	8,921	923	1,006	...	399	5,301	7,452	489	80	6,333	111	33,598
New South Wales	1,116	5,749	1,431	1,665	...	678	14 892	75	1,296	65	3,261	618	29,846
Queensland	411	982	533	172	...	54	2,692	...	264	...	566	278	5,952
Tasmania	30	100	83	22	...	...	539	1,901	...	...	248	8	2,931
New Zealand and Fiji Islands	1,649	6,899	1,918	1,415	...	431	9,889	3,767	1,419	...	5,225	2,280	34,892
Total, £	18,896	65,244	21,382	10,558	3,891	14,827	114,838	40,122	13,911	2,370	37,733	36,387	380,159

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	270	38	...	...	975	...	3,610	1,961	1,447	...	5,081		13,382
Germany	...	...	...	...	...	...	...	...	...	...	...		...
Holland...	419	...	12	6,051	331	...	99	...	...	...	...		6,912
Belgium	...	...	...	...	...	...	...	...	...	...	...		...
France	260	116	676	956	875	1,393	645	...	6,941	1,603	255		13,720
Switzerland	3,248	14	29	60	85	675	31,636	...	...	563	229		36,539
Italy	...	8,169	...	...	21	720	890	...	...	253	...		10.053
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...		...
United States	9,158	3,636	1,355	2,547	5,915	230	14,959	127,423	3,557	5,569	9,970		184,319
Total, £	13,355	11,973	2,072	9,614	8.202	3,018	51,839	129,384	11,945	7,988	15,535		264,925

Additional imports.—Spain, goods, £1,794; arc lamps, £32; machinery, £70; battery, £1,734. telegraph and telephone material, £220. Canada, goods, £46; arc lamps, £13; carbons, £14.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above... ...	1,919	129	...	261	925	459	1,907	...	241	705	6,750		13,299

TOTAL EXPORTS: £380,159 TOTAL RE-EXPORTS: £13,299 TOTAL IMPORTS: £268,848

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

IMPORT TRADE OF PERU.

The following statement showing the imports of electrical and similar goods into Peru during the year 1913 is extracted from the recently issued trade statistics. Detailed figures for 1912 are not available, but the total values of the various classes are given for purposes of comparison.

	Machinery other than agricultural or printing machines.	Machinery for arts and trades.	Spare parts for machines of all kinds.	Pumps for irrigation or mining.	Steam boilers.	Transmission belting.	Railway and tramway cars.	Coal.	Rails and accessories.	Scientific Instruments.	Telegraph and telephone instruments and apparatus.	Copper cable.	Incandescent lamps.	Electrical apparatus.
	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Great Britain...	32,000	11,000	14,000	2 000	5,000	12,000	8,000	156,000	9,000	2,000	...	...	...	2,000
Germany... ...	64,000	25 000	5,000	12,000	...	1,000	...	65,000	...	2,000	500	1,000	5,000	15,000
France	7,000	7.000	...	...	...	...	...	...	...	2.000	...	...	...	...
United States...	195,000	43,000	33,000	10,000	5,500	5.000	7,500	23,000	92.000	1,000	1,000	4,000	3,000	25.000
Belgium	...	...	2,000	...	1,000	...	2,500	...	28,000	...	...	...	...	...
Other countries	5,000	1,000	2,000	1,000	500	...	...	‡57 000	1,000	...	500	500	...	4,000
Total, 1913...	303,000	87,000	56.000	25,000	12,000	18,000	18,000	301,000	130,000	7,000	2,000	5,500	8.000	†16.000
Total, 1912...	138,000	63,000	27.000	13,000	18,000	12,000	*	158,000	*	3.500	*	*	*	†25,000

* Not shown separately in 1912. † Includes the items in the three preceding columns. ‡ Largely Australian.

INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

On Thursday and Friday, last week, the members of the above Association foregathered at the Institution of Electrical Engineers, London, where the annual meeting was held instead of at Dundee as previously intended.

Naturally the proceedings were overshadowed by the national crisis through which the country is passing, and many familiar faces were missing, including, of course, that of the President, Major Richardson, of Dundee, whose military duties precluded his attendance, and whose place was ably filled by Mr. A. C. Cramb (Croydon) as Acting President.

Under the circumstances the annual convention, to which we have all become accustomed, was dispensed with, but as it was necessary under the articles of association to have an annual meeting, it was decided to arrange a two-days' programme confined more or less to urgent matters of business.

This included reports on "The practical result of the Point Five tariff," by Messrs. A. S. Blackman (Sunderland) and T. Roles (Bradford), and on "The use of electric vehicles in municipal service," by Mr. F. Ayton (Ipswich), both of which were discussed at some length; also the annual report of the Council and election of officers for the ensuing year.

Other features were a parade of electric vehicles following the afternoon's discussion on the subject, and an unofficial meeting of the Point Five Association in the evening, where, in the congenial atmosphere of Tricity House, the temporarily depressing influence of the morning's discussion on the Point Five tariff was dispelled.

It is a matter for regret that the discussion on Messrs. Roles and Blackman's report should have miscarried, as it certainly did; most of the speakers—even some of the devotees of the Point Five Association, who, however, may have taken the matter for granted—avoided marked reference to the essential feature of this tariff—the offering of a rate not exceeding ½d. per unit for the furthering of domestic heating and cooking—and addressed themselves to discussing the weak points of the rateable value system of assessing the primary charge which, being that with which the authors were best acquainted, was perhaps unduly emphasised in the reports. Thus an excellent opportunity was missed of convincing the sceptics, who still appear to be numerous, of the utility of the ½d. rate.

No one, so far as we are aware, has claimed that the rateable value method of assessing the primary charge is suitable under all conditions — for the matter of that, no tariff ever is—and its irregularities do not appear to be more serious than in the case of other tariffs based on floor area measurements, or watts installed. The tariff maker cannot get away from approximations and there is a good deal to be said for a tariff which, despite its imperfections, attracts the consumer, if it leads to legitimate business.

The electric vehicle discussion revealed considerable interest in the question of municipal use of the "electric," particularly for refuse collection for which purpose it shows an undoubted saving. Several speakers referred to the excessive first cost of the electric vehicle, which, as we pointed out in these columns at the time, attracted a good deal of attention at the annual convention of the Electric Vehicle Association of America last year, and we were glad to hear a seller of these vehicles candidly agree that the price is too heavy and that his firm put much more work into their petrol cars costing less money.

If this statement indicates a disposition to drop prices in order to stimulate the demand, rather than wait for the demand to stimulate the discount, it is so much to the good. The plan adopted by the Hampstead Electricity Committee, of purchasing an electric vehicle and hiring it out to the Works Committee, in order to get over the difficulty of first cost, is worth noting; we believe it is being considered in other directions.

Of the vehicles shown at the parade on the Embankment, those of the business type are mostly familiar to our readers, having been described in our pages from time to time; several excellent examples of passenger-carrying electric were also shown, including an Edison Limousine, of handsome design, having a 50-60 mile range on one charge, which is not included in the tabulated list of vehicles on view.

At the business meeting held on the Friday morning, the annual report of the Council was passed with remarkable celerity; we hope to deal with it at length in our next issue.

Mr. Chattock urged the necessity of giving financial support to the work of the Engineering Standards Committee; Mr. Faraday Proctor mentioned that a representative deputation of engineers had waylaid the Treasury with a view to facilitating municipal loans, but without result; and both report and balance-sheet were adopted, as also were the reports of the Development and Electric Vehicle Committees.

The Officers and Council elected for the year 1915-16 are as follows:—

President: *A. C. Cramb, Croydon. Senior Vice-President: *F. M. Long, Norwich. Junior Vice-President: *A. H. Seabrook, St. Marylebone. Past Presidents: G. Wilkinson, Harrogate; R. A. Chattock, Birmingham; H. Richardson, Dundee. Hon. Solicitor: *Ald. C. Pearson, Bristol. Hon. Sec.:

*H. Faraday Proctor, Bristol. Hon. Treasurer: *J. E. Edgcome, Kingston-upon-Thames.

Members of Council—Engineers: J. W. Beauchamp, West Ham; A. S. Blackman, Sunderland; S. E. Fedden, Sheffield; T. Roles, Bradford; W. A. Vignoles, Grimsby; W. Wyld, Hampstead; *S. E. Britton, Chester; *W. W. Lackie, Glasgow; *S. L. Pearce, Manchester. Committee Representatives: Councillor Crowther, Sheffield; Ald. Ellaway, Birmingham; Ald. J. P. Smith, Barrow-in-Furness; Bailie W. B. Smith, Glasgow; *Councillor H. R. Barge, Poplar; *Ald. Sir J. Beecham, St. Helens.

Some discussion took place as to where the next annual meeting should be held, and it was agreed to leave this matter to the Council, Mr. Faraday Proctor expressing a hope that it would be anywhere but London, as meetings in the metropolis were always rather a failure.

A resolution was carried that the Government should hold itself responsible for damage done to the plant of electric suppliers through the war. It was pointed out that the Government held itself responsible for damage to real property, but not for damage to goods inside belonging to the tenant; Ald. Smith (Liverpool) dissented from the popular view, urging that people should be prepared to take their own risks.

Bailie Smith (Glasgow) gave a brief account of the work of the Parliamentary deputation on coal supplies, from which it appeared that good results are anticipated in the near future, and the proceedings closed with votes of thanks to the Acting President (Mr. Cramb), the Hon. Officers, and the Council of the Institution of Electrical Engineers.

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* Elected.

The Practical Result of the Point Five Tariff.

The report on the above subject by Messrs. A. S. Blackman (Sunderland) and T. Roles (Bradford), of which an abstract appeared in our last issue, was subsequently discussed at length.

Mr. Blackman added as an estimate of supplying a Point Five consumer in Sunderland, with a diversity factor of 5, financial charges of 12s. 11d. per kw. per annum (works plant 1s. 5½d., h.t. feeders, etc. 1s. 2d., l.t. feeders, etc. 10s. 4d.); including working costs, the total came to about ½d. per unit. He felt that although ½d. per unit was satisfactory for cooking purposes, it was no good for heating, which required a rate of about ⅓d. per unit., and the question was how this rate was to be introduced in the future.

Mr. Geo. Wilkinson (Harrogate) said he felt that the authors had not accomplished the object which they set out to do. It was important to find out the real truth. The two examples were instances of towns where the residence revenue was quite small compared with the total revenue, and in both cases it appeared that by comparison a reduced revenue had been obtained with a greatly increased output as a result of the Point Five tariff; the question was what would happen in a purely residential town? Fortunately the statistics showed better results. At Harrogate they analysed 900 accounts, showing a revenue of £5,700 on the 6d. and 2d. rate. Taking the Point Five tariff, they found the revenue increased to £7,500, and allowing £500 deduction for excess rating of grounds, the result was an increase of £1,300. Reduced revenue from a Point Five consumer could be got over by making it a condition that certain apparatus should be installed. Great harm had been done by using small radiators, but the 3-kw. size might be expensive with an extravagant servant. He agreed that people could not be expected to pay ½d. per unit. for water heating, and there was no reason for it, as apparatus was available which would give an adequate supply of hot water all day at small cost. Allowing 12 units a day at ⅓d. per unit (100 per cent. l.f.), the cost came out at 4d. It was necessary to take into account the saving in labour in the electric household; if a servant could be dispensed with a saving of at least £40 a year resulted.

Councillor Dymond (Hereford) said the report conveyed the impression that it was a good thing to cultivate the heating load, and that the Point Five tariff was a good thing to achieve this. Local conditions, however, determined its suitability, and in their case it would be disastrous. At Hereford the larger houses occupied a district of their own; they would be the first to adopt cooking, and it would be necessary to treble the feeders and double the services to supply them, at a cost estimated at some £4,000. Moreover, they were all late diners, and the load might come on the peak. As a corporation department they would have to show a better profit on the work than the existing gas supply gave in order to justify the expenditure. He was satisfied difficulties would arise in pressure regulation. He discussed at some length the tabulated data in the report, and pointed out that the average revenue was in nearly all cases small, the exception being Marylebone, where the fixed charge was based on plant installed, and not on rateable value. He disagreed with the rateable value assessment, as it produced such a discrepancy in accounts for similar sized houses if one had a garden, and this caused trouble in a small town. A charge based on the kw. demand was the most equitable and, in his opinion, could be understood by consumers. Discrimination between domestic and shop use would lead to a residential shop having two tariffs and cause trouble.

Mr. C. H. Wordingham referred to the introduction of the Hopkinson system in 1893, and its re-discovery in later times. Its most modern and worst mutilated forms were due to the "Point Fives." He asked what was a Point Five tariff: only at Luton was ½d. per unit really charged. He disagreed entirely with the rateable value assessment for charging; it was wrong from the supplier's point of view. Directly it was applied in practice it was hedged round by restrictions and conditions. A consumer with a very bad load factor might be charged above the legal rate. The ground area was a difficulty, and the system was wrong which increased consumption and decreased revenue. The rateable value assessment ignored maximum demand, and he thought they must make up their minds to have a fixed charge per kw., plus a charge per unit. He did not believe for one moment they could economically heat water as suggested by Mr. Wilkinson, and disagreed with the authors' remarks on radiators, as the aim should be to keep the air cool and heat the individual.

Mr. W. W. Lackie (Glasgow) said they had a special tariff under which, for instance, a house of £40 rental was charged with 200 units at 3d. each, and all units in excess were charged at ⅜d. a unit. Such a consumer paid on the average of 1.5d. per unit; in his, the speaker's, house the average price worked out at 1.2d. per unit. There were 2,300 such consumers, and they took 500,000 additional units. A large block of tenement buildings had been erected in the city by an enterprising builder, and each had 12 kw. of plant installed for lighting, heating, and cooking. The builder, who occupied one house, used 16,000 units in a year, costing .77d. a unit on the special tariff, and he dispensed with his servant; the other occupiers used about 10,000 units each. The ratio of lamps to maximum demand was 1 to 6 in large Glasgow tenements, without cooking, etc. Personally, he used a separate boiler for water heating, which cost £5 a year, but at ½d. per unit it would have cost him £11.

Mr. Blackman here pointed out that it was a mistake to say that the average revenue had decreased—it had increased, as shown in the report, at both Bradford and Sunderland.

Mr. Bowden (Poplar) agreed that the Point Five tariff was perfectly right, but joined issue as to the assessment and method by which it was arrived at. The Hopkinson system was used at Poplar, and was described fully in his paper at the last convention. It was a weak point in the rateable value assessment that another department fixed the primary charge for electricity supply. In Poplar they sold in 1910 9 million units at 1.2d. per unit, and with a works cost of .65d. per unit; in 1914, 16 million units were sold at .97d. per unit, with works costs amounting to .55d. per unit. The profits of the two years were £6,700 and £8,000 respectively, and this year, on 17 million units, they anticipated a profit of £14,700. The hiring-out of fans, heaters, etc., was a necessity, and his Council had devoted certain money to providing apparatus to be lent to consumers in order to introduce the system. The future would, no doubt, bring small ½-watt lamps, and therefore a fixed charge was essential in order to lessen the possible loss of revenue. They must use a large service for a large cooker and charge for it, as also for management, etc.

Bailie Stevenson (Edinburgh) said that in the cases cited, if the increased units meant more load at one time, it meant more plant in the station, which was the point which appealed to him.

Ald. Smith (Barrow) said he [illegible] that [illegible] on the outskirts would be the first to adopt electric cooking and be the worst to supply. The [illegible] [illegible] were [illegible] as their position and load factor were better, and that type of consumer directly appreciated the advantages, whereas in large houses the owner had nothing to do with the cooking itself.

Mr. R. A. Chattock (Birmingham) said special tariffs were necessary to attract new business. In an industrial town lighting was a by-product, and it would pay them to attract it, while it would be no good in a residential town. This led him to the point he wished to emphasise, viz., that all such supplies should be centralised to get the advantage of the diversity factor over a wide area; in fact to supply on national lines.

Mr. Cooper (Luton) disagreed with the rateable value assessment, which had nothing to do with the electricity consumer. In his town they had a simple flat ½d. rate for heating and cooking, and he did not think it would stand a further charge. The only sound basis for fixing the charge was the Hopkinson method, and it could be adopted anywhere. The rateable value system did not apply to shops, but at Luton they had sold half a million units for heating, etc., to shops and houses, about 155,000 to the latter. Last year 85 per cent. of their increased output was due to units sold at and under ½d. per that, and the gross profit had gone up at the same rate as the gross revenue. It was absolutely essential to hire out apparatus, as the medium-sized houses were going to be the revenue producers.

Councillor **Crowther** (Sheffield) supported the rateable value method of assessment because it was simple and easily understood. For large houses the average cost of energy was higher than for small ones in Sheffield under this tariff. If they had the courage to introduce a 2d. flat rate it would bring more consumers than the rateable value system.

Mr. **Nichols Moore** (Newport) did not agree that progress in cooking supply, etc., was restricted to those towns using a Point Five tariff; towns which charged up to 1d. a unit were making great progress. He thought it was evident the users of the system did not know exactly how it should be applied or modified; a point in its favour was the single service and meter. It was a financial question, and if the gross profit showed a rapid decrease there was something wrong. He asked what was the net effect of such a tariff.

Mr. **Long** (Norwich) asked what were the conditions under which a Point Five tariff could be adopted; some justification for it was required when coal costs were about ½d. per unit, but the financial result was the point to be studied.

Mr. **Roles**, in a brief reply, expressed his regret that both the authors happened to be working with the rateable value system; the "Point Fives" held that no great progress could be made in cooking supply where gas was cheap unless a charge of ½d. per unit or less was made, but he admitted that some load was obtainable at higher prices. He, personally, used 5,000 units a year in his house, and this was an indication of the business they might get later, and were now striving for. He agreed that local conditions must be taken into account, and regretted the sweeping statements made by Mr. Wordingham, which were not borne out by fact.

Mr. **Blackman** added that in his case the effect of the domestic supply on the load was almost negligible.

The Use of Electric Vehicles in Municipal Service.

The following is an abstract of the report of the Electric Vehicle Committee presented by Mr. F. Ayton, M.I.E.E., Hon. Secretary to the Committee:—

There could hardly be conceived a more suitable field for the employment of the electric battery vehicle than that connected with municipal service. This is because the work to be done lies entirely within the proper sphere of this particular type of vehicle, viz., short distance haulage at moderate speeds. The mileage capacity per charge, *i.e.*, 35 to 45 for the heavier vehicles, is sufficient for practically every duty which the municipal vehicle has to perform, but it must not be forgotten that, by a mid-day boosting charge, the daily mileage may be considerably increased. In fact, the only limit to the daily mileage is the time required to charge the battery, and, as the modern types of battery allow of the charging being commenced at a comparatively high rate, the time taken, especially for boosting charges, is very materially reduced from the period which used to be considered necessary. As an instance of the amount of work the electric vehicle is capable of performing, the electric street watering and sewer flushing vehicles belonging to the city of Calgary in Canada are reported to be in use for a 16-hour day at certain periods of the year, the superintendent of street cleaning stating that each vehicle had replaced five horse teams with a resultant saving in expense of no inconsiderable amount.

Naturally the main reason for urging the adoption of electric vehicles by municipalities is the degree of economy which attends their use in substitution for horse haulage. Wherever the "electric" has been employed in its legitimate sphere, the claim of economy has been proved to the hilt. In Glasgow the electricity department found that their first electric van, of 1 ton capacity, did the work of two horses at a saving in expense and with greater efficiency, while, compared with a petrol van, which the department was previously using, the electric did the same work with a saving in expense in the neighbourhood of £240 per annum. Other evidence is afforded by the refuse collection trials at Barnes and at Heston and Isleworth, referred to in detail later, while the instance of Calgary, previously mentioned, provides an additional illustration of the financial advantages accruing from the employment of this type of road motor, the daily saving, as against horses, by the operation of two watering and flushing vans being given as about £5. Outside municipal service we have the case of the electrified delivery service in London of Messrs. Harrod's Stores. This firm now operates no less than 55 delivery vans, and they state to your committee, as their reason for adopting the electric vans: "We find them cheaper than horses."

There is ample evidence, based upon experience, that there is justification for putting the average life of a modern vehicle of good make at not less than ten years, assuming reasonable use and proper upkeep. In the United States electric commercial vehicles built twelve years ago are still in daily service and many seen in the streets are well over six years old. A large American firm of goods carriers, having depôts and delivery vehicles in all the principal cities, wrote to the committee last year in regard to their experience with electric vehicles, stating, among other things, that "the first cars purchased in 1904 and 1905 are still in daily operation without unreasonable expense or unduly high charges." This company operates no less than 375 "electrics."

Experience has shown that this type of automobile can keep the road day by day for more days in the year than any other type—in fact, records show that it is safe to estimate, in the case of a fleet of electric vehicles, that the average working days in a year for each machine will not be less than 97 to 98 per cent. of the maximum possible. The reasons for this are three-fold: first, the simplicity of the mechanism; secondly, the strong construction possible on this account; and, thirdly, the fact that, owing to the simplicity and fewness of the working parts, any repair or replacement can usually be effected during the night, or in such a short time as not to interfere with the use of the vehicle. The net effect of all this is that, where several vehicles are operated, fewer spare ones need be kept than if petrol or steam machines were employed.

A municipality should not lose sight of the influence that the use of any particular type of vehicle may have upon the health of the population and the amenities of the locality; it is the duty of a municipality to set a good example in everything it undertakes. Useful as the horse has been, the principles of modern hygiene dictate that its continued use in congested areas is incompatible with the preservation of the best health among the populace and the maintenance of the lowest possible rate of mortality. The place of the horse has, in future, to be filled by the self-propelled vehicle, and the type which is going to eventually supersede it is that vehicle which will do the same work at the same or lower cost and which, besides, will be characterised by silence in operation, general cleanliness and absence of odour, ease and simplicity of control, rapid acceleration, and safety in regard to the risk of fire. The electric vehicle is the only automobile taking the road to-day which meets fully each and every one of these requirements. The modern electric battery vehicle is no mere experiment; its utility and reliability, as well as its unique economy, are attested by the fact that upwards of 70,000 of the type are in use in the United States where, within the last few years, there has been an enormous growth in the numbers put into service. The advantages which the type possesses from the point of view of public health and civic amenities are alone sufficient to warrant its adoption by municipalities. In the case of those municipalities that own electric supply undertakings, there is a further and very pertinent reason why they should set the example as users, and that is the important new source of revenue which the general use of electric vehicles in any district will open up. The value of this additional source of revenue is emphasised by the fact that the demand in connection with it need never come on during "peak-load" hours; hence it may be dealt with without requiring additional expenditure in plant, buildings or mains. Moreover, as its effect will ever be to even out the load curve and so lead to greater economy in the cost of generation, this will, in time, permit of a lower rate being charged to all other classes of consumer.

The Electric Supply Department.

How can any central station hope to induce the adoption of the electric vehicle in its territory unless it first sets the example? A very short experience of the employment of a suitable "electric" for the outside work of an electric supply department of any size will soon make an enthusiast of any engineer. Apart from its splendid advertising value and its usefulness for giving demonstrations, it has many other advantages of special value in this field of employment. For breakdown work it will soon be found invaluable—it is ready to go out at a moment's notice, and is so simple to drive that several of the mains staff may be taught to operate it, in order that there shall always be a driver available. The permanent driver can be a mere youth. There is an advantage in having one who is just old enough to be eligible to hold a licence because that, in itself, attests to the ease of control and the simplicity which is so valuable a feature of the vehicle. There are few, if any, undertakings of reasonable size that could not make use of a ½-ton or 1-ton van for delivering meters, transporting materials to the service and mains-laying gangs, and in other like duties. In the larger undertakings good use may be made of a small electric car for the business rounds of the engineer, the mains superintendent or the sales manager.

Delivery vans are now in use or on order by the Electric Supply Departments of Glasgow, Edinburgh, Derby, West Ham, Croydon, Blackburn, Bootle, Hereford, Ipswich, Grimsby, Brighton, Wolverhampton, Southampton, Liverpool, and the Borough Councils of St. Marylebone, Stepney and Poplar.

The van used by the Glasgow Electric Supply Department is a covered one of one-ton capacity, fitted with an Edison battery. The vehicle has been in constant use since August 6th, 1913, and up to April 28th, 1915, had covered a total mileage of 22,284 with an energy consumption of 13,752 units, including battery losses, which is equivalent to 0.62 unit per vehicle mile. New tires have recently been fitted in substitution for a set which had done over 11,000 miles.

The results of the use of its one-ton van, in the way of economy and reliability, were so convincing that the department had no hesitation in taking a further step in the general adoption of electric vehicles by placing an order for three more vehicles of half, one and a half, and three tons capacity respectively, which have now been delivered and will shortly be at work. The two lighter vehicles will be used for delivering material from the general store to jobs within the supply area, and to the various sub-stations, while the three-tonner will be principally employed on mains work.

The department has fitted up a garage in which these vehicles will be stabled. The garage is complete with charging plant, and having a floor area of 10,100 sq. ft., it will permit of other vehicles being taken in for charging.

The vehicle at Brighton is a two-seater car used by the engineer and manager of the Electric Supply Department for business purposes, including journeys to the power station, a little over four miles outside Brighton. Its speed is about 16 miles per hour on the level; weight, 22½ cwt.; average daily mileage 25, while the energy consumption is about 0.5 unit per mile input to battery. At 1d. per unit this is only about one halfpenny per mile. The vehicle has run close on 1,000 miles at the time of writing, and, so far, beyond the cost of cleaning, it has cost nothing for maintenance, the tires showing little or no signs of wear. The battery is of Tudor make.

The West Ham Electric Supply Department's vehicle has a carrying capacity of one ton, is fitted with a float body, and is used for the general carrying work of the department. It was put into service on November 21st, 1914, and up to March 31st had covered 1,788 miles with a consumption of electric energy of 0.5 to 0.6 unit per mile of input to battery. Here again we have, at 1d. per unit, a power cost of about one halfpenny per mile. The vehicle has proved of the utmost value to the department. The battery is an A6 Edison.

The St. Marylebone Electric Supply Department van is of the covered type employed in the general delivery work of the business. It is fitted with a Hart battery. The vehicle weighs 34½ cwt., has a speed of about 13 miles per hour, and consumes 0.61 unit per mile. Up to the beginning of April the total mileage had been about 5,000, while the whole expense of operating it, including driver, sundry repairs, licences, insurances, etc., amounted to £68.

The vehicle operated by the Electric Supply Department at Wolverhampton is used for delivering goods, such as cookers, heaters and small motors, as well as to take men and the tools on to jobs. The energy consumption is 0.74 units per mile, input to battery, and the speed about 12 miles per hour. The department has on order a 2½-ton vehicle for the removal of clinker and ash from the power station.

The Ipswich vehicle has a total weight of 34¾ cwt., a speed on the level of about 12 miles per hour, and an energy input to the battery of about 0.7 unit per mile. A Hart battery is used. The vehicle is used for delivering the goods of the installation department, and is also employed by the mains department. It has proved extremely useful.

The vehicle belonging to the Croydon undertaking is a two-seater run-about fitted with an Edison battery. There is a third seat which may be used if required. The car is used by both the distributing engineer and the sales superintendent, and during the five months in which it has been in use it has given no trouble; the expenditure in repairs and general upkeep has been *nil*. The total mileage covered in this period has been 2,156, or an average of 24 miles per day. The Borough Electrical Engineer, Mr. A. C. Cramb, gives the following interesting figures as to the cost of operation, the cost of tires being based upon the assumption that an average of 5,000 miles will be obtained before they require renewal, there being ample justification for this assumption in view of the very small wear so far observable :—

Running Costs.	Total cost.	Pence per mile.
Electric energy at 1d. per unit ...	... £4 11 8 ...	0.510
Oil and grease	... 0 1 5 ...	0.007
Washing, cleaning, etc. ...	... 3 10 0 ...	0.388
Tires (£35 per set for 5,000 miles)	15 0 0 ...	1.660
Total running costs ...		2.565d.
Depreciation.		
Battery (5 years) ...	£11 8 1 ...	1.600
Vehicle (10 years) ...	... 14 15 1	1.620
Total fixed charges		3.220d.

Total cost per mile = 5.785 pence.

The daily mileage is, of course, somewhat low for such a car, being equivalent to a little over 5,000 miles per annum. A total of 10,000 miles per annum is frequently covered by petrol cars used for "about town" work; on such a mileage the total cost per mile would be reduced to 4.175 pence.

Besides their use for delivering goods, answering "breakdown" calls and carrying the supervising officials about from place to place on the outside work, there are other ways in which the electric vehicle may be made use of in the service of electric supply undertakings. They may be fitted with motor-driven winch gear for use in drawing cable into underground conduits; an electrically-operated pump may be fitted for clearing water from manholes, while a telescopic tower ladder can be provided for trimming arc lamps and for overhead work generally. Where a motor winch is provided, the addition of a simple derrick enables the vehicle to be employed in the erection of street lamps and trolley posts.

Where the generating station is not provided with rail or water facilities for the direct delivery of coal, so that the latter has to be carted from the railway depôt or from a wharf, an electric wagon of suitable capacity should soon pay for itself. The same vehicle could be used for carting away ash and clinker. Considerable use is made of electric vehicles for these purposes in the United States.

In demonstration work connected with the obtaining of new business, the electric vehicle promises to be a useful aid because of the supply of electric energy which it carries with it. By the aid of a flexible cable carried through the front window of the house, from the vehicle standing outside in the roadway, the canvasser will be able to demonstrate before the housewife at home the transcendent utility of the electric iron, the labour-saving and, no less, the hygienic value of the vacuum cleaner, the comfort and cleanliness of the electric fire, the refreshing breezes of the electric fan, the convenience of the electric kettle and the smaller pieces of cooking apparatus, while last, but not least, he will be able to show that electric light is next in quality to day-light. It needs no stretch of the imagination to conceive how potent a factor in "new business getting" will be such use of the electric vehicle.

The Collection of House Refuse.

The collection of house refuse is work which is particularly trying for the ordinary steam or petrol-motor vehicle, on account of the many stops and starts. The absence of all gear-changing and clutch work in the electric vehicle, and the uniformly easy drive produced by the electric motor, are features which establish a degree of reliability for this type of vehicle in such work, together with an economy in operation, which are impossible of attainment by any other type.

It possesses the advantage also that, when standing, no waste of power is going on such as takes place with the petrol vehicle, in connection with which it is unreasonable to expect the driver to stop and restart his engine for every short halt.

There is another strong argument in favour of adopting the "electric" when the change is made from horse haulage to motor traction, viz., it is possible, when that type is employed, to utilise the horse-vehicle drivers as the drivers of the new vehicles, because the mechanism is so simple and the operation so easy.

Motor vehicles will show the best results where the refuse destructor is at a distance from the area of collection. It is quite possible, on this account, that, in some towns, the best economy might be obtainable by a combination of ordinary horse-drawn vehicles for the districts in propinquity to the destructor, with the use of electric vans for the districts further away.

In a large Continental city the horse carts are provided with removable box bodies, so that when the cart arrives at the depôt, the body is lifted off by an electric crane, and placed upon the flat platform of a large electric vehicle, which, when it has received its full complement of these full boxes, proceeds on its journey to the destructor. In the meanwhile empty box bodies are placed upon the tumbrils, which once more proceed upon their rounds of collection.

An alternative method is the employment for local house-to-house collection of a special type of small electric vehicle, with tipping-box body. In this machine there is no seat for the driver; the latter stands upon a driving platform a few inches from the ground. The saving of time in getting on and off the vehicle, when compared with the ordinary type of vehicle, is obvious.

Electric vehicles have been employed to a considerable extent on the Continent for refuse collection. The largest installation is in Paris, where the municipality possesses a fleet of 100 electric refuse-collecting vehicles. Each has a capacity of a little over 15 cubic yards, which, since the local refuse averages some 3 cubic yards to the ton, makes the total load of the full vehicle not less than 5 tons. The vehicles perform their work during the night hours, each covering about 25 miles nightly, with an energy consumption per vehicle mile of from 1.5 to 1.7 units. This system of collection was adopted as the result of a very careful trial made by the civic authorities, which showed that considerable economy would be obtainable by the use of electric vehicles.

As the result of a trial of electric vehicles for refuse collection, the Urban District Council of Barnes has placed an order for four vans.

It was found that one electric van would do the same work per week as that now done by sixteen horses and carts employed on refuse collection.

The cost of the type of electric van decided upon, complete with battery and electrically driven tipping gear, is £945. The gear takes from 10 to 15 seconds to tip, and the speed of the van on the level is about 10 miles per hour, with a total mileage capacity upon one charge of 40 to 45. The capacity of the van is 4½ cubic yards, which compares with the 2½ yards of the present cart.

As a result of careful tests the Surveyor, Mr. Tomes, found that the cost of operation [illegible] at [illegible] per van per day, which figure covered interest upon cost of vehicle, as well as its share of the charging equipment, repayment of loan on both of these items, wages, electricity, tires, maintenance of battery and chassis, insurance, lubricants, and sundries. The comparable figure for a horse and cart is 11s. per day.

Basing his estimate upon the figures obtained by the trial of the electric vehicles, Mr. Tomes reported to his Council that the replacing of the existing horses and carts by four electric vans would, notwithstanding a capital expenditure of £4,000 on the vans and charging plant, result in a saving of at least £100 per annum.

A similar trial, made by the surveyor of the Heston and Isleworth Urban District Council, resulted in the Council placing an order for an Edison electric dust van. The trial was specially interesting from the fact that experiments were made with three types of automobile (namely, electric, steam, and petrol in order to determine the one best suited for this work. The electric van's safe load was 2.68 tons; it had a motor tipping body, and was fitted with Edison accumulators. The Garrett steam wagon had a capacity of 3 tons, and the Thornycroft petrol wagon could carry 3.2 tons. It was found that any one of the three motor wagons could do the same work as previously done by four of the Council's horses, but in point of saving in cost over horse haulage, the electric vehicle showed £71, the steam wagon £66, and the petrol wagon only 7s. 7d. per annum. The report of the Works Committee to the Council concludes by stating:—"After careful consideration of the whole matter, the Committee have come to the conclusion that an electrically propelled vehicle would be the best and most suitable for the purposes of house refuse collection." It is interesting to note that the purchase costs of the three types of vehicles were: electric, £840; steam, £617; and petrol, £815; the estimated annual costs of working, including capital charges, being given as £333, £338, and £404 respectively. While the results in working cost for the steam wagon are a near approach to those of the electric, the surveyor notes that the "driver of the electric vehicle does not need any mechanical knowledge, an ordinary intelligent carter being quite able to perform the duties of driver"; while, in regard to the steam wagon, he remarks: "As is well known, a good driver is not always obtainable, *and can only be discounted by the experience gained by the cost of repairs.*"

In December of last year some interesting trials were made of the use of electric vehicles for the collection of house refuse in Birmingham. As a result the Birmingham Corporation have placed an order for two "Orwell" electric refuse-collection vans.

Dover is another place where electric vehicles are about to be used for the collection of house refuse, the Corporation having, as the result of a trial of an Edison vehicle of two tons capacity, decided to order six such vehicles. Each will take the place of three carts and sixteen horses. A considerable annual saving is anticipated by the change in system.

(*To be continued.*)

Discussion.

The discussion was opened by Mr. Lackie (Glasgow), who agreed as to the necessity of interesting the various corporation departments in the electric vehicle. His own department used an electric truck for cable work; it was fitted with a motor generator, by which the cables could be tested before they were connected up. In Glasgow a hired horse and cart cost three or four shillings a day more than formerly, and doing the work of two carts the electric showed a clear saving of £80 a year. A yearly revenue of £20 from the ½-ton and £40 from the 1-ton vehicle (at 1d. per unit) could be obtained. The one drawback to the electric was its first cost, but this would be rectified later; he thought something should be done to standardise the tare weights of such vehicles.

Mr. C. H. Wordingham asked whether it was likely that the electric vehicle on ordinary roads was likely to succeed when the numerous attempts to run battery-driven tramway cars, which operated under ideal road conditions, had been unsuccessful? He agreed that the "electric" was a good advertisement.

Mr. R. A. Chattock said he had come to the conclusion that the electric truck was the thing for industrial work in cities, and the present-day vehicle was an advance on those shown two years ago at Kingston-on-Thames. It was a mistake to think of the electric in comparison with the petrol vehicle. What was wanted now was a light "runabout" passenger car, and if the makers could be induced to turn out such a car at a cheap price, it would supply a want, but it must be light and cheap. Most of the American cars were too big and heavy. It was not fair to make comparisons between trolley and battery-driven cars, and there were some 70,000 electric vehicles in use in the States, where tramway cars were also numerous. He concluded by expressing satisfaction at the progress of standardisation in connection with vehicle parts.

Mr. Beauchamp (West Ham) said he found that the electric truck could haul cable quite well and cheaply. His own department had a vehicle which ran about the area, averaging 17½ miles a day at a cost of 7d. a mile; the actual running time was only 2¼ hours daily.

Mr. Bruce Tomes (Barnes) referred to the satisfactory trials made in his area with an electric dust van, a full report of which appeared in the Electrical Review.

Mr. Ellis (South Shields) said that the two Edison 'buses operated by the South Shields Corporation gave every satisfaction on country roads. The batteries were charged at the car shed between 11 p.m. and 6 a.m. at a cost of ¾d. per unit, and a boost was given at the end of each journey at a small charging station. The cost of the "electric" was a serious matter; inquiries for a 3-ton vehicle showed the Edison truck cost £1,100; the Baker truck £700, while a petrol truck cost about £600 and was a speedier vehicle. Many people wanted speed, and he thought the battery capacity could be increased to provide for this. The electric dust van was preferable to others on account of the numerous stops.

Mr. Hame (York) said his Corporation had four Edison 'buses which had run 13,600 miles, with an overall energy consumption of 1.1 units a mile. Petrol would have cost them £500 a year, but electricity at 1¼d. per unit was costing only £365, showing a saving to the town and providing a consumer of electricity. The 'buses were very satisfactory on level roads.

Other speakers suggested that the design of refuse vans would be improved by making them lower, to avoid climbing up, also that a battery driven road roller was an ideal vehicle for corporation use; and that the Electric Vehicle Committee should confer with the vehicle makers in order to get suitable vehicles made.

Mr. H. Webber (Keighley) referred to the improved results obtained in his area by substituting the trolley 'bus for the petrol 'bus. The former cost about 7d. a 'bus mile, including capital charges to run.

Mr. Brydges (Eastbourne) also took up the question of petrol 'buses which in his town cost 11d. per 'bus mile, all in. They had obtained a £550 4½-ton steam wagon for carrying coal to the generating station; the round trip was 2¼ miles, and 6 loads a day were carried, with 3 men to operate the truck and load. The cost per ton delivered at the works was 11.1d., whereas it formerly cost 1s. 6d. a ton by contract with horse haulage. If the electric truck could do as well as this, he would be glad to consider it, because it would be a good advertisement.

Mr. Christie (Brighton) said station engineers should practice what they preached. He had a "home made" vehicle which he found very useful for "running round the town," and which attracted a great deal of attention. An electric delivery van had proved quite capable of negotiating the hilly roads in Brighton. To provide for vehicle charging they had reconstructed part of the old station and would be able to accommodate 12 vehicles; they also expected to hire out charging equipments.

Mr. Shaw (Ilford) said he had investigated the electric truck for coal haulage, and taking a 4½ ton vehicle, he expected to save from £120 to £160 a year on horse haulage at 10d. a ton. The truck in question was an Edison vehicle costing £440. The accumulator tower wagon, used on the Ilford tramways for 18 months, had given every satisfaction.

Mr. Watson (Edison Co.) said the reason why the electric vehicle was cheaper to run than other types was because they did not attempt to run it above the suitable speed; other vehicles often had high speed qualities which were rarely used. It was a mistake to suppose that first cost was everything, and it was interesting to note that the Midland Railway Co., after trying platform trucks, was now buying 20 electric vehicles, which was a good sign. In the case of a well-known firm of distillers, the bill for energy for their electric truck, for seven weeks, was so low that it was returned under the impression that a mistake had been made. He felt certain that the electric vehicle would practically monopolise refuse collection in a few years' time.

Mr. Wyld (Hampstead) said they had tested an electric van for two weeks and found the cost not more than two-thirds of the horse vehicle. The Works Committee, however, could not see its way to pay £1,000 for the vehicle, and so the Lighting Committee had offered to purchase it and hire it to the former, with driver's and all service charges included, for a period of four years.

Mr. Meakin (Wolseley Motors) said engineers were too keen on speed; the electric had no chance against the petrol vehicle in the matter of speed, but it was the machine for short hauls and many stops. Speed was everything to the petrol car and against the electric, which would depreciate rapidly under such conditions. The electric coupé was quite good for city work. He agreed that the price of the "electric" was much too heavy; his own firm made both types and put much more work into the petrol car for less money. It must be remembered, too, that the electric car could not meet both conditions of speed and short hauls, while the petrol car could.

Mr. F. Ayton (Ipswich), in reply, agreed that each type of vehicle had its own field of use. All would agree that prices would have to come down, but business could be obtained at present prices. If the demand were increased, the price would drop. He thought a front wheel drive vehicle for refuse collection, with a low body, was now on the market. Comparison with rail vehicles or trolley 'buses, did not take into account the mobility of the electric vehicle.

TRADE WITH ITALY.

[Italian Criticism of British Traders.]

The May issue of the *Bulletin of the British Chamber of Commerce for Italy* (*Inc.*), which has just come to hand, contains a good deal of matter of great interest, expressing the urgent desire of our latest Ally that England shall do more to enable Italy to free herself from German commercial domination. The correspondence received by the *Bulletin* consequent upon the publication of an article in its March number, includes a letter from a firm of Birmingham exporters in which he says that credit is the crux of the whole question of trade with Italy. The German export trade, he says, has ruined many markets by long credits; the usual credit terms in Italy run from anything between three and six months, and with small firms the risk is then bound to be great. Bad debts are considered the chief danger of the market, partly due to the smallness of the trade, and partly to the character of the Italian buyers. The writer considers that in this respect business relations can more easily be improved from the Italian end than from the English. The Italian bankruptcy laws also give very little protection to foreign creditors "and are, practically speaking, a premium on dishonesty." The writer goes on to say that such remarks do not of course apply to the many very fine firms with whom anyone would be only too anxious to do business. If German firms were at that time continuing on the same lines as before it was because Germany found it absolutely vital to hang on to any market that she had got, whereas England was free to devote her attention to other markets. Since the letter was written Italy has entered the war and England is increasingly busy making war munitions. The writer says that his remarks apply to hardware trade pure and simple. In the heavier trades such as metals, chemicals, etc., things are much better, and in these he finds Italy to be an excellent market—long credits are not asked for, the business is done usually for cash against documents, and the class of customer is much superior.

Another correspondent, "A British Merchant at Genoa," says:—

"Britishers in Italy had preached to them the 'Trade War on Germany'; it was to be a crusade, and the duty of every patriotic Englishman was to supplant German goods in Italy by British-made goods. We were all fired with enthusiasm: a crusade which incidentally would also improve our incomes was evidently attractive. After nine months' war, however, the 'Crusaders' are much discouraged: German goods continue to arrive and are sold on the old terms: British makers are either too busy with orders for France and Russia, or their works are devoted to war-material, or they will 'think it over when Italy has joined the Allies.' *It would therefore appear to me that the Trade War on Germany in Italy does not interest British manufacturers, and if this is so, the matter had better be dropped.*"

"As regards the past, you cannot get over the hard fact that in 1913 Germany imported into Italy goods to the value of 23 millions sterling and Great Britain only 10 millions, excluding coal in each case. If British manufacturers and shippers do want Italian custom, let them conform to the following hints; but if they do not want the trade, then let us stop this absurd preaching:

1. Adopt metric system of weights and measures for all quotations to Italy.
2. Quote in francs gold. I agree that they cannot be expected to do so in lires.
3. Send out active travellers who can at least speak good French; they would, of course, do much better if they knew Italian. Conduct correspondence in Italian, or at any rate in French.
4. One can generally give three months' credit if an accepted bill is obtainable against delivery of the goods. The law amply protects the holder of an accepted bill; if it is not met at maturity, the bailiffs can be put in at once, but of course ones client must be reasonably sound: a rogue is a rogue in all countries and not a monopoly of Italy."

The writer proceeds to give an instance from personal knowledge of the obstinacy of British firms. "The goods they supply are excellent; this for them is sufficient; they decline to alter their methods of delivery or make-up to suit this market."

An "Italian Agent at Naples" wrote to a number of British firms whose names had been provided by the Chamber, on the advisability of introducing British goods in Italy, and he reports: "The result of my correspondence was very discouraging. Three-fourths of the firms . . . . failed to reply, which only on very rare occasions has ever happened to me in all my commercial career when French or German firms were concerned. The other firms agreed to appoint me their representative, but as a buying agent, ... this method of agency is practically unknown in Italy, where the agent is the connecting link between the manufacturer and the consumer. The failure of my negotiations has greatly pained me, because, apart from commercial relations, I have always felt great sympathy for France and England. . . . . Can one succeed with such methods to destroy German export trade into Italy? I leave you to decide."

The *Bulletin* gives a précis of articles appearing in the Italian press. The criticism is so strong that we think it only right that Britishers should be able to read it in our pages practically in full:—

"Our market offers especially an excellent opening for manufactured goods, which only two countries would be able to supply: Great Britain and Germany. It was therefore clear that, there being obstacles in the latter's way, sales would be easier for the former. German penetration in Italy represents still a masterpiece of ability and patience. The Germans endeavoured to adapt their goods to the needs of the market, and also their prices and terms; they used more especially the efficacious arm of cheapness, to which they united the not less efficacious one of methods of payment, not only for the articles of direct consumption, but also in the larger field of instruments of production. Our manufacturers desirous of widening out or perfecting their plant, found in the Germans not only unusual credit terms, but also practical assistance in the mounting and working of machinery. The German staffs, and Italian staffs in the service of the Germans, insinuated themselves everywhere, assuming leading positions and managing some of the individual works. They even sought to prevent the establishment of certain factories which would have clashed with those in Germany, sooner or later, seeking to induce the Italian works to turn out inferior articles in order to allow of German competition. Germany was already reaping the fruits of her methods; in 1895 she held a modest position among the nations exporting to Italy, whilst in 1913, one year before the war, she had attained absolute pre-eminence with 603 millions of lires' worth of goods sold, leaving behind England with a total of only 591 millions. On the outbreak of war, British merchants at once thought of reconquering the neutral markets and the Board of Trade called attention to Italy, where Germany's hold seemed to be relaxing. The incitement came at the right moment, but will British manufacturers and merchants know how to take advantage of this favourable opportunity? Their attempts so far have not been very successful because they have not been able to get over their spirit of conservatism which leads them to impose their commercial customs which it is difficult to reconcile with the exigencies of the foreign markets in which they wish to operate. Our fellow-countrymen who have sought to get into touch with British producers have found themselves confronted by two obstacles, almost insurmountable, especially at the present moment. Such obstacles are the high prices and the terms of payment. For certain machines produced in Italy at 100 lires, for instance, Germany does not hesitate to quote the same price, while British firms will ask about 250 lires. Such enormous differences exist for hundreds of articles in which the superiority of quality does not always justify the highness of the price. The Germans nearly always allow a certain amount of credit, long or short, while British firms ask for immediate payment, difficult to carry out in times like the present; they would like the Italian buyers to deposit a large sum at a bank in England, to be drawn on against presentation of the documents. This is therefore payment in advance, a thing quite impossible for a country like ours, in which, for certain goods, even the payment on delivery of the goods appears impracticable. It is certainly not with similar systems that the British will be able to get a footing where the Germans were operating with undeniable sucess. Great Britain should adapt herself to the requirements and needs of our market, applying thereto the methods employed by the Germans. We do not thereby wish to deprecate in general the British way of doing business, but only to point out that such system, excellent perhaps in other times and other countries, does not adapt itself to our case; and as commercial exchanges are the fruit of two wills, *i.e.*, of the seller and of the buyer, one must therefore take due account of ours when placing foreign products in Italy. We wished to say this in our own interest and in that of England. It is of interest to Italy to have another market to provide her with goods, and it is also of interest to Great Britain not to lose more ground to German competition, which—it is useless to delude oneself—will get to work again, and with renewed energy as soon as the war is finished.

"Italy needs to shake off, if it is not possible to cast them off entirely, the bonds which hitherto have bound her to Germany, and which, if the war had not supervened, would in the end have suffocated her. Now we have commenced to breathe again, and we now need to substitute, as far as possible, connections which will be done away with or diminished. And this, in a large measure, will have to be done with England, who, on her part, will have every inducement to turn towards Italy part of her great energies. Italy is better prepared for the change than England; we have already connections and sympathies for Great Britain, and the English we willingly state are much more popular and better liked in Italy than Germans have been or ever will be. For many years, almost the only article imported from Great Britain that has shown an important increase is coal, indispensable for our industries; whilst Germany prevailed and imposed herself. Britishers must make a radical change if they want to go ahead in Italy. Germany had conquered Italy commercially not only by money and facilities, but especially by men, whom she has spread broadcast, in the banks, factories, commercial houses and in the very life of the country. Whilst the English form in Italy a notable, beneficent and well-liked colony of a few workers, and a good number of gentlefolks who enjoy in peace our sky and natural beauties, the German colony is far more numerous and not a single individual composing it is extraneous to the action of conquest; they all co-operate like a disciplined army in the work of infiltration. England, therefore, if she wishes to reduce the competition, should send us men, men, and more men, to carry out, openly and [illegible], a whole programme of commercial penetration. Some of the chief obstacles to overcome are the following, viz.: The system of weights and measures used in England, which should be replaced by the metric system without further loss of time, at any rate as far as catalogues intended for Italy are concerned. This is an old question, but the time has come to settle it for ever. The mode of payment insisted on by British firms must be modified. It is too great a handicap to expect to be paid in advance or against documents in England, whilst Germany concedes easy credit terms. This obstacle could in a great measure be removed by the establishment in Italy of a British bank, [illegible] then it would be possible to foster British trade in Italy; without such a financial organisation, which should be really commercial and look after Anglo-Italian trade, progress will [illegible] very difficult, if not impossible, and a start should be made at once, not at the end of the war when German competition will again be rife."

The following figures show some of the imports of Italy from Germany and Austria-Hungary during the year 1914:—

Machine.	From Germany. (In tons).	From Gt. Britain. (In tons).	From Austria-Hungary. (In tons).
Machines driven by steam: fixed (without boiler); semi-fixed (with boiler); air, gas, etc., motors	1,600.6	1,021.3	—
Hydraulic machines	2,314.3	136.1	32.6
Locomobiles	1,219.5	—	741.4
Agricultural machinery	169.2	1,113.0	141.9
Machine-tools for wood and metals	1,529.1	1,490.4	487.0
Electric dynamos and their parts	5,413.2	2,016.8	—
Transformers and converters	3,608.8	206.3	161.1
Incandescent electric lamps	4,826,500 (number)	—	3,337,220 (number)

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

8,409. "Electric [illegible]." L. F. Stephens. June 7th.

8,412. "Electrical safety-fuse devices." C. B. Burdon. June 7th. (Siemens-Schuckertwerke G.m.b.H., Germany.)

8,417. "Casing for the stators of electrical machines." Maschinenfabrik Oerlikon. June 7th. (Convention date, June 30th, 1914, Switzerland.) (Complete.)

8,420. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. June 7th. (General Electric Co., United States.)

8,421. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. June 7th. (General Electric Co., United States.)

8,449. "Electric [illegible]-heaters and the like." E. F. Giraud. June 7th. (Convention date, June 20th, 1914, France.) (Complete.)

8,451. "Printing telegraph systems." A. D. Cardwell. June 7th. (Complete.)

8,458. "Means for joining up the ends of electrical conduits." F. W. Uren and A. Gamble. June 7th. (Convention date, June 18th, 1914, Australia.) (Complete.)

8,466. "Electrical installations, particularly applicable for use in motor vehicles." Soc. Anon. des Etablissements L. Bleriot. June 8th. (Convention date, July 25th, 1914, Belgium.) (Complete.)

8,468. "Electrical hand lamps." W. G. Underwood & Underwood (Manchester), Ltd. June 8th.

8,477. "Electric lamps for bicycles and the like." H. W. H. Warren. June 8th.

8,480. "Telephone transmitters and transmission." W. A. Yewen. June [illegible]

8,485. "Centrifugal compressors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 8th.

8,508. "Electric heaters and electric heating apparatus." E. C. R. Marks. June 8th. (Landers, Frary & Clark, United States.) (Complete.)

8,512. "Electrical heaters." E. C. R. Marks. June 8th. (Landers, Frary & Clark, United States.) (Complete.)

8,518. "Synchronisation of phonographs and kinetographs." C. H. Verity. June 9th.

8,524. "Electric [illegible]." O. C. Dennis. June 9th.

8,537. "Electrical heater." W. J. Kerr. June 9th.

8,543. "Electric welding apparatus." British Thomson-Houston Co., Ltd. June 9th. (General Electric Co., United States.)

8,546. "Electric fuse-carriers." A. C. Robinson. June 9th.

8,561. "Loud-speaking telephone apparatus." H. J. C. Forrester. June 9th. (International Callophone Corporation, United States.) (Divided application on 21,921/14. November 3rd.) (Complete.)

8,572. "Dynamo-electric machines." A. H. Neuland. June 10th. (Complete.)

8,590. "Elastic-fluid turbines." British Thomson-Houston Co., Ltd. June 10th. (General Electric Co., United States.)

8,610. "Electric [illegible]." C. Corbridge. June 10th.

8,622. "Automatic [illegible] for the operation of electric switchgear." H. V. James. June 11th.

8,623. "Automatic switchgear and apparatus for the electric braking of electric motors." H. V. James. June 11th.

8,672. "Alternating-current motors of the commutator type." British Westinghouse Electric & Manufacturing Co., Ltd. June 11th. (Westinghouse & Electric Manufacturing Co., United States.) (Complete.)

8,679. "Transforming electric currents." J. G. Statter. June 12th.

8,686. "Carburettors for internal-combustion engines." Electric Ignition Co. (1913), Ltd., & A. Cox. June 12th.

8,696. "Sparking plugs." H. G. Longford, W. W. Longford & W. A. Clark (trading as Sphinx Manufacturing Co.). June 12th. (Addition to 7,365/13.)

8,702. "Refractory metal tubes." British Thomson-Houston Co. June 12th. (General Electric Co., United States.)

8,712. "Telegraph systems and apparatus therefor." British Insulated and Helsby Cables, Ltd., & H. H. Harrison. June 12th. (Complete.)

8,713. "Thermo-electric pyrometers." H. G. C. Fairweather. June 12th. (Deutsche Gasglühlicht Akt. Ges. Auer., Ges., Germany.) (Complete.)

8,717. "Sparking plugs." V. Joly. June 12th. (Convention date, June 13th, 1914, Belgium.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1914.

9,822. Automatic Telephone Systems. Aktieselskabet Elektrisk Bureau. April 21st. (April 22nd, 1913.)

12,364. Receivers for Wireless Telegraphy and Telephony for diminishing of Atmospheric Influences on such Receivers. P. O. Pedersen. May 19th.

12,720. Light, High-power Electric Accumulator. Marquise des Ligneris. May 23rd.

12,867. Electrical Resistances. C. O. Bastian. May 25th. (Cognate application, 22,872/14.)

12,926. Mercury Motor Meters. W. Hamilton & Ferranti, Ltd. May 26th.

13,147. Series Parallel Control Systems for Electric Motors. British Thomson-Houston Co. (General Electric Co.). May 28th.

13,159. Dynamo-electric Machines. Compagnie de l'Industrie Electrique et Mecanique. May 28th. (May 30th, 1913.)

13,247. Vacuous Tubes used as Magnifiers and Producers of Continuous Electrical Oscillations. Marconi's Wireless Telegraph Co. & H. J. Round. May 29th.

13,248. Production of Continuous Electrical Oscillations and the Utilisation thereof for Wireless Telegraphy and Telephony. Marconi's Wireless Telegraph Co. & H. J. Round. May 29th.

13,362. Telephone Exchanges. C. A. W. Hultzman. May 30th. (June 2nd, 1913.)

14,557. Electrical Measuring Instruments of the Moving Coil Type. T. W. Brogger. June 17th.

15,082. Mechanical Selector for Electro-magnetic Waves applicable to Wireless Telegraphic Receiving Apparatus. R. B. Goldschmidt. June 23rd. (May 2nd, 1914. Addition to 14,595/14.)

16,130. Automatic Electric Switching Mechanism for Controlling Fluid Compressors. O. H. Pieper & A. F. Pieper. July 6th. (February 7th, 1914.)

17,686. Compound for making Water-tight the Joints of Covers of Boxes for Underground Electric Mains and Distributors, and similar Joints of Boxes fixed in exposed positions. W. H. Walker. July 27th.

18,713. Electric Batteries. G. Fuller, G. J. A. Fuller, & L. Fuller. August 15th.

20,156. Sparking-plugs for Internal-combustion Engines and the like. T. McClements. September 25th.

21,538. Printing Telegraphs. C. J. Wiley. October 26th.

22,879. Apparatus for Directed Wireless Telegraphy and Telephony. F. Bellini. November 21st. (June 24th, 1914.)

23,359. Electric Reactance Coils. J. F. Peters. December 1st. (February 5th, 1914.)

1915.

1,328. Electric Switches. H. Lucas & D. H. Edwards. January 27th.

1,870. Vapour Electric Rectifier Systems. S. W. Farnsworth. February 5th. (February 5th, 1914.)

2,728. Electric Smelting Furnaces and the like. F. W. Highfield. February 19th. (Divided application on 4,937/14, February 25th.)

6,476. Cathodes of Vacuous Tubes suitable for use in Wireless Telegraphy. Marconi's Wireless Telegraph Co. & H. J. Round. April 30th. (Divided application on 13,247/14, May 29th.)

Copper.—Mid-monthly returns for June, as set forth in Messrs. H. R. Merton & Co.'s statistical circular, show a further increase in European visible supplies of 1,257 tons, and in English supplies of 2,792 tons. European arrivals from North America are low; from Spain and Portugal to England and France the quantity for the fortnight is considerably in excess of the pre-war average for a month. Other countries (not classified) have supplied England and France with 3,396 tons in the fortnight, a quantity nearly equal to one month's average supply before the war. Chile shipments are below the pre-war average, and Australian the same. Total deliveries are lower, denoting a total for the month about equal to last February, though this may, of course, be increased during the present fortnight.

Municipalities and the Purchase of Tramway Undertakings.—In the House of Commons, Mr. Snowden asked the Prime Minister if he would take steps to relieve municipalities from the position in which some of them had been placed by the restriction of borrowing powers in the following circumstances:—Some municipalities have the option this year of purchasing the local tramway system, the Corporation of Bristol being a case in point; but owing to the refusal of the Treasury to grant public loans, it is impossible to exercise this legal option, with the result that the private tramway company will be reinstated for a long term of years, and the public rights will thus be rendered invalid, and that the loss of the power to exercise the option of purchase will, in the case of Bristol, involve a loss of £20,000 a year for seven years, as well as the advantages of public ownership, and also heavier cost if purchase should be exercised at the expiry of the extended lease. Mr. Snowden asked if the Government would consider the desirability of special legislation entitling the municipalities to exercise the right of purchase now, but to postpone the re-issuing of the loan to, say, six to twelve months after the end of the war. Mr. Asquith said he understood that an application from the Corporation of Bristol had been received by the Treasury relative to the question of the purchase by the Corporation of the local tramway system, and that this application had been referred to the Committee on Fresh Issues of Capital. Pending the receipt of their report, it was premature to consider in this particular case what step, if any, should be taken in the contingency to which the hon. member referred. The general question raised, he thought, was best dealt with in relation to specific cases as they arose.

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